

FED. SUPPLY CLASS

5306

1. SCOPE

1.1 Scope. This specification covers positive locking self-retaining bolts.

1.2 Classification. Bolts will be of the following types and classes, as specified (see 6.2):

Types:

- Type I Head end actuated.
- Type II Thread end actuated (solid shank).

Classes:

- Class 1 CRES bolts, magnetic (PH13-8Mo).
- Class 2 CRES bolts, nonmagnetic (A286).
- Class 3 Titanium bolts (6Al-4V).
- Class 4 Nickel Alloy (718).

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

Federal

- ~~QQ-W-390 Wire, Nickel-Chromium-Iron Alloy~~
- ~~QQ-S-763 Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting~~

Military

- MIL-PRF-121 Barrier Material, Greaseproofed, Waterproofed, Flexible

STANDARDS

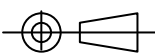
Military

- MIL-STD-129 Marking for Shipment and Storage
- MIL-STD-810 Environmental Test Methods
- MS17825 Nut, Self-Locking, Castellated, Hexagon, 250 °F, Non-Metallic Insert
- MS17826 Nut, Self-Locking, Castellated, Hexagon, 250 °F, Thin Non-Metallic Insert
- MIL-STD-2073/1 Standard Practice for Military Packaging

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks can be obtained from the Department of Defense Single Stock Point (DODSSP) <http://dodssp.daps.dla.mil>.)

① COMPLETELY REVISED

THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MIL-B-23964, REVISION D, AMENDMENT 5.

THIRD ANGLE PROJECTION 	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE	TITLE BOLT, SELF-RETAINING, POSITIVE LOCKING	CLASSIFICATION SPECIFICATION NASM23964 SHEET 1 OF 20

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 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.

SAE International

AMS-QQ-S-763	Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting
AMS2700	Passivation Treatments for CRES
AMS2759	Heat Treatment of Steels (Aircraft Practice) Process for
AMS4928	Titanium Alloy Bars and Forgings (6Al-4V)
AMS4967	Titanium Alloy Bars and Forgings (6Al-4V) Annealed, Heat Treatable
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
AMS5629	Steel Bars, Forgings, Tubing, and Rings, Corrosion Resistant 13CR - 8Ni - 2.3Mo - 1.1 Al Vacuum Induction Plus Consumable Electrode Melted
AMS5662	Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant 52.5Ni - 19Cr - 3.0 Mo - 5.1(Cb+Ta) - .90 Ti - .50 Al - 18Fe Consumable Electrode or Vacuum Induction Melted 1775 °F (970 °C) Solution Heat Treated
AMS5663	Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant 52.5Ni - 19Cr - 3.0Mo - 5.1(Cb+Ta) - .90 Ti - .50 Al - 19Fe Consumable Electrode or Vacuum Induction Melted 1750 °F (955 °C) Solution and Precipitation Heat Treated
AMS5678	Steel Wire, Corrosion Resistant 17Cr - 7.1Ni - 1.1 Al, Precipitation Hardenable, Spring Temper
AMS5699	Alloy Wire, Corrosion and Heat Resistant, Nickel Base 15.5Cr - 7Fe - 2.3Ti - 1 (Cb-Ta) - .7Al
AMS5737	Steel Bars, Forgings and Tubing, Corrosion and Heat Resistant 15Cr - 26Ni - 1.3Mo - 2.1 Ti - .30V Consumable Electrode Melted 1650 °F (898.9 °C) Solution Treated and Precipitation Heat Treated
AMS5833	Alloy Wire, Corrosion and Heat Resistant 20Cr - 15Ni - 40Co - 7.0Mo - .06Be - 16Fe Solution Heat Treated and Cold Drawn
AMS5834	Wire, Corrosion and Heat Resistant 40Co - 20Cr - 15Ni - 7.0Mo - .06Be - 16Fe Solution Heat Treated, Cold Drawn, and Aged
AS8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification for
AMS-H-81200	Heat Treatment of Titanium and Titanium Alloys

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001 www.sae.org

ASME

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

Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990 www.asme.org

American Society for Quality (ASQ)

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203 www.asq.org

ASTM International

ASTM E8/E8M	Standard Test Methods of Tension Testing of Metallic Materials
ASTM B166	Wire, Nickel-Chromium-Iron Alloy of
ASTM D3951	Standard Practice for Commercial Packaging
ASTM E1444	Inspection, Magnetic Particle
ASTM E1417	Inspection, Liquid Penetrant

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA www.astm.org

REVISION

1

ASME B46.1

SHEET 2

① COMPLETELY REVISED

Aerospace Industries Association (AIA/NAS)

NASM310	Nut, Plain, Castellated, Airframe
NASM320	Nut, Plain, Castellated, Shear
NAS618	Fastener - Recommended Shank, Hole and Head-to-Shank Fillet Radius Limits for
NASM1312	Fasteners, Test Methods
NASM3369	Bolts, Self-Retaining, Positive Locking, CRES 90 KSI Fsu, 63 KSI FtU, Hexagon Slotted Head, 450 °F and 650 °F
NASM20002	Washer, Countersunk and Plain, High Strength
NASM21125	Bolts, Self-Retaining, Positive Locking, CRES 90 KSI Fsu, 63 KSI FtU, Pan Head, 450 °F and 650 °F
NASM21130	Bolts, Self-Retaining, Positive Locking, CRES 90 KSI Fsu, 63 KSI FtU, 100° Flush Head, 450 °F and 650 °F
NASM21133	Nut, Self Locking, Steel, 180 KSI FtU, 450 °F, Flanged, MS33787 Wrenching Element
NASM21224	Nut, Self-Locking, Castellated, Hexagon, Counter-bored, Assembled Washer, 250 °F, Non-Metallic Insert (for Self-Retaining Bolts)
NASM21244	Nut, Castellated, Hexagon, Counterbored Assembled Washer, 450 °F (for Self - Retaining Bolts)

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209 www.aia-aerospace.org

- 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 NASM 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 Part standards. The individual item requirements shall be as specified herein and in accordance with the applicable part standards. In the event of any conflict between the requirements of this specification and the part standards, the latter shall govern.
- 3.2 Qualification. The bolts furnished under this specification shall be produced using the same manufacturing methods as used to produce bolts that have passed qualification tests. The purchaser may apply any or all tests specified herein to any product represented as meeting this specification, at any time, to verify conformance.
- 3.3 Materials
- 3.3.1 Identification. The manufacturer shall make material identification tests of the metal stock used to fabricate the bolts. A test report indicating that the identification tests were made shall be made available upon the request of the acquiring activity or as directed by the contracting officer (see 4.3.2).
- 3.3.2 Class 1 bolts. Bolt bodies and plungers shall be fabricated from CRES conforming to the chemistry of AMS5629 (PH13-8Mo).
- 3.3.2.1 Class 1 locking balls or elements. Locking balls or elements shall be fabricated from material as specified in QQ-S-763 AMS-QQ-S-763 Class 440C, AMS5629 (PH13-8Mo) or AMS5663 (718).
- 3.3.2.2 Class 1 springs. Springs shall be fabricated from 17-7PH as specified in AMS5678; or from Elgiloy wire in accordance with AMS5833 or AMS5834.
- 3.3.3 Class 2 bolts. Bolt bodies and plungers shall be fabricated from CRES conforming to the chemistry of AMS5737 (A286).
- 3.3.3.1 Class 2 locking balls or elements. Locking balls or elements shall be fabricated from material as specified in AMS5737 (A286) or AMS5663 (718).

① COMPLETELY REVISED

REVISION

1

NASM23964

SHEET 3



Document Sharing Hub

- 3.3.3.2 Class 2 springs. Springs shall be fabricated from material as specified in ~~QQ-W-399~~ ASTM B166, Cold Drawn, Spring Temper or AMS5699, or from Elgiloy wire in accordance with AMS5833 or AMS5834.
- 3.3.4 Class 3 bolts. Bolt bodies shall be fabricated from titanium conforming to AMS4928 (6Al-4V) or AMS4967 (6Al-4V).
- 3.3.4.1 Class 3 plungers. Plungers shall be fabricated from titanium conforming to AMS4928 (6Al-4V) or AMS4967 (6Al-4V), AMS5629 (PH13-8Mo) or AMS5663 (718).
- 3.3.4.1 Class 3 plungers. Plungers shall be fabricated from titanium conforming to AMS4928 (6Al-4V) or AMS4967 (6Al-4V), AMS5629 (PH13-8Mo) or AMS5663 (718).
- 3.3.4.2 Class 3 locking balls or elements. Locking balls or elements shall be fabricated from titanium alloy material as specified in AMS4928, from magnetic material as specified in ~~QQ-S-763~~ AMS-QQ-S-763 Class 440C, AMS5663 (718) or AMS5629 (PH13-8Mo).
- 3.3.4.3 Class 3 springs. Springs shall be fabricated from 17-7PH as specified in AMS5678; or from Elgiloy wire in accordance with AMS5833 or AMS5834.
- 3.3.5 Class 4 bolts. Bolt bodies shall be fabricated from nickel alloy 718 per AMS5662 or AMS5663.
- 3.3.5.1 Class 4 plunger. Plungers shall be fabricated from nickel alloy AMS5662, AMS5663 (718) or AMS5629 (PH13-8Mo).
- 3.3.5.2 Class 4 locking balls or elements. Locking balls or elements shall be fabricated from material specified in ~~QQ-S-763~~ AMS-QQ-S-763 Class 440C, AMS5629 (PH13-8Mo) or AMS5663 (718).
- 3.3.5.3 Class 4 springs. Springs shall be fabricated from 17-7PH as specified in AMS5678; or from Elgiloy wire in accordance with AMS5833 or AMS5834.
- 3.3.6 Spring retaining plug. The spring retaining plug, if used, shall be manufactured from the same material as the bolt. Heat treatment is optional.
- 3.4 Passivation. CRES shall be passivated in accordance with AMS2700.
- 3.4.1 Heat treat. Heat treatment of CRES shall be in accordance with AMS2759. Heat treatment of titanium shall be in accordance with AMS-H-81200. Heat treatment of nickel alloy 718 shall be in accordance with AMS5662.
- 3.5 Design and construction. The design and construction of the bolt shall be as specified herein and on the applicable part standards.
- 3.5.1 Visual and dimensional requirements. Bolts manufactured to this specification shall meet the visual and dimensional requirements when tested in accordance with 4.5.1.
- 3.5.2 Shank straightness. The shank straightness shall be within the values specified in Table I when measured as specified in 4.5.2.

TABLE I – SHANK STRAIGHTNESS

Shank Diameter (inch)	Maximum deviation of bolt shank from surface plate (inch per inch grip length)
.1900	.0040
.2500, .3125	.0030
.3750, .4375	.0025
.5000 and up	.0020

- 3.5.3 Locking device. All bolts shall be of such design as to be retained in position by the locking balls or elements until the release mechanism is manually actuated.

① COMPLETELY REVISED

REVISION
1
NASM23964
SHEET 4



- 3.5.3.1 Locking device actuating plunger. An axial pushing force shall release the locking mechanism. The force shall be applied to the actuating plunger located either in the center of the bolt head or the center of the thread end of the bolt. The locking mechanism shall automatically return to the locked position when the actuating force is removed.
- 3.5.3.2 Lubrication. Plungers and locking element, with the exception of the balls, shall be lubricated with solid film lubricant in accordance with MIL-PRF-46010 AS5272. For plungers requiring passivation, lubrication shall be subsequent to passivation.
- 3.5.4 Release mechanism. The release mechanism shall be of such design as to remain in the locked position unless actuating force is applied.
- 3.5.4.1 Release mechanism actuating force. The actuating force required to release the locking device shall be within the range specified for the applicable size bolt shown in Table II.
- 3.5.4.2 Endurance. The release mechanism shall, after 5,000 cycles of operation, meet the values specified in Table II (see 4.5.4.1).
- 3.5.5 Locking ball or element push-out force. Balls or elements used as a locking device shall be so retained in the shank as to withstand the minimum push-out force specified in Table II (see 4.5.5). This requirement does not apply to bolts with locking elements that are fully retained by the plungers.
- 3.5.6 Operability. The release mechanism shall be operable when the bolt is loaded in shear to the following percentages of the minimum shear strength as shown in Table II (see 4.5.6).
- Ø.1900 shank diameter – 35 percent.
 - Ø.2500 shank diameter and larger – 50 percent.

TABLE II – PERFORMANCE CHARACTERISTICS

Nominal size	Body double shear strength LBF Min			Bolt tensile strength LBF Min PH13-8Mo, 718 A286 and Ti /b/	Retaining device tensile strength LBF Min PH13-8Mo, 718 A286 and Ti	Release mechanism actuating LBF		Bolt removal LBF Max	Locking balls push-out LBF Min
	A286 /a/	A286 Ti	PH13-8Mo 718			Min	Max		
.1900	5,150	4,250	5,150	1,110	110	.5	5	6	10
.2500	9,200	7,360	9,200	2,040	230	1	9	10	20
.3125	14,400	11,500	14,400	3,250	510	2	9	10	20
.3750	20,600	16,500	20,600	5,050	575	2	10	11	20
.4375	28,200	22,500	28,200	6,800	710	3	11	12	40
.5000	36,800	29,400	36,800	9,250	1,160	3	12	13	60
.5625	46,500	37,400	46,500	11,800	1,420	3	12	13	60
.6250	58,600	44,800	58,600	14,400	2,070	4	12	13	80
.7500	82,400	62,800	82,400	20,900	2,950	5	14	15	80
.8750	117,000	89,400	117,000	28,600	3,980	5	14	15	80
1.0000	154,000	113,000	154,000	37,600	5,200	5	14	15	80

/a/ Inactive for new design after 31 December 1990.

/b/ Tensile loads are based on the strength of the companion nut: AN310 NASM310, AN320 NASM320, MS17825, MS17826, MS21224 NASM21224 and MS21244 NASM21244.

① COMPLETELY REVISED

REVISION

1

NASM23964

SHEET 5



Document Sharing Hub

USE OF OR RELIANCE UPON THIS DOCUMENT OR ANY NATIONAL AEROSPACE STANDARD IS ENTIRELY VOLUNTARY. AIA DOES NOT QUALIFY SUPPLIERS OR CERTIFY

Copyright Aerospace Industries Association of America Inc. THIS DOCUMENT IS PRODUCED UNDER NATIONAL AEROSPACE STANDARD: AIA MAKES NO REPRESENTATION OR CLAIM RESPECTING (1) THE SUITABILITY OF
Provided by IHS under license with AIA/NAS. Licensee= www.sepana.ir/5991803002, User=sam, albert
No reproduction or networking permitted without license from IHS. Not for Resale, 01/04/2016 22:35:06 MST TRADEMARK RIGHTS.

Full document details: AIA NASM23964 2011

- 3.5.6.1 Locking ball or element retraction. For head actuated bolts, the locking ball or element shall retract or release when the release mechanism actuating force is applied. This release allows removal of the bolt from a bushing when the bolt removal force is applied along the bolt axis opposing the release mechanism actuating force (see Table II). For thread end actuated bolts, the locking ball or element shall retract or release when the bolt removal force of Table II is applied to the release mechanism. This release allows removal of the bolt from a bushing when the release mechanism force is applied along the bolt axis in the same direction as the bolt removal force (see 4.5.6.1).
- 3.5.7 Cotter pin hole. A cotter pin hole shall be drilled in accordance with the applicable part standards. This hole shall not interfere with the operation of the retaining mechanism, and all burrs shall be removed. Countersinking of cotter pin hole is optional.
- 3.5.8 Double shear strength. The bolt shall conform to the minimum double shear strength as specified in Table II (see 4.5.7).
- 3.5.9 Retaining device tensile loads. The retaining device tensile loads shall be as specified in Table II (see 4.5.8).
- 3.5.10 Bolt tensile test. The bolt tensile loads shall be as specified in Table II (see 4.5.9).
- 3.5.11 Surface roughness. The surface roughness of the bolts shall not exceed the values shown in Table III (see 4.5.10).

TABLE III – ROUGHNESS HEIGHT RATING

Area	Maximum surface roughness microinches
Shank and underside of head	63
Other surfaces	125

- 3.5.12 Threads
- 3.5.12.1 Form and dimensions. Unless otherwise specified, the threads shall be right-handed and the dimensions, form and contour shall conform to AS8879 and the applicable part standards.
- 3.5.12.2 Rolling. Threads shall be fully formed by a single rolling process.
- 3.5.12.3 Runout. Thread runout, consisting of a maximum of 1.500 incomplete thread pitches, shall fair onto the shank, thereby eliminating any abrupt changes in cross-sectional area. There shall be a minimum thread runout of .5 pitch. Bottom and sides of runout thread pitches may deviate from true thread form but shall be smooth.
- 3.5.12.4 Concentricity of shank to threads. The concentricity of shank diameter "ØD" and thread pitch diameters shall be within "Y" values FIM (see Figure 1).
- 3.5.13 Head. The bolt heads shall be upset or forged.
- 3.5.13.1 Bearing surface. The bearing surface of bolt protruding heads shall be at right angles to the shank within the limits shown on Figure 1. The angular variations of the underside of the head shall be uniform around the shank within a tolerance of ± 10 minutes, as measured between the bearing surface of the head and shank, at a length along the shank from the head equal to the diameter of the bolt (see 4.5.1).
- 3.5.13.2 Concentricity of head to shank. For flush-headed fasteners, the conical surface of the head and the shank diameter "ØD" shall be within .005 FIM. Head driving recess to the shank shall be within .016 FIM for sizes .2500 and smaller and within .024 FIM above .2500. Concentricity of the head and shank of the protruding headed fasteners shall be within "X" values FIM (see Figure 1).

① COMPLETELY REVISED

REVISION

1

NAS Documents

SHEET 6



Document Sharing Hub

USE OF OR RELIANCE UPON THIS DOCUMENT OR ANY NATIONAL AEROSPACE STANDARD IS ENTIRELY VOLUNTARY. AIA DOES NOT QUALIFY SUPPLIERS OR CERTIFY

Copyright Aerospace Industries Association of America, Inc. MS PRODUCED UNDER NATIONAL AEROSPACE STANDARD: AIA MAKES NO REPRESENTATION OR CLAIM RESPECTING (1) THE SUITABILITY OF
Provided by IHS under license with AIA/NAS Licensee: www.sepana.ir/5991803002, User=sam, albert
No reproduction or networking permitted without license from IHS Not for Resale, 01/04/2016 22:35:06 MST TRADEMARK RIGHTS.

Full document details: AIA NASM23964 2011