

METRIC

DOD-I-63276A
 21 October 1983
 SUPERSEDING
 DOD-I-63276
 26 September 1977

MILITARY SPECIFICATION

INSERT, SCREW THREAD, LOCKED IN, RING LOCKED, SERRATED, METRIC,
 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 metric locked in, screw thread inserts with and without metallic internal thread locking feature. The method of locking in the insert is by means of a serrated collar and an accessory lockring with matching serrations installed within the parent material to prevent rotation. The accessory lockring is also covered herein.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- QQ-A-225/6 - Aluminum Alloy Bar, Rod and Wire; Rolled, Drawn or Cold Finished, 2024
- QQ-A-250/6 - Aluminum Alloy 5083, Plate and Sheet
- 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, Armament Research and Development Center, US Army Armament, Munitions and Chemical Command, ATTN: DRSMC-TST-S(D), Dover, New Jersey 07801 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

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- MIL-I-6866 - Inspection, Penetrant Method of
- MIL-I-6868 - Inspection Process, Magnetic Particle
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys
- MIL-C-8837 - Coating, Cadmium (Vacuum Deposited)
- DOD-I-63276/1 - Insert, Screw Thread, Locked In, Ring Locked, Serrated, Metric
- DOD-I-63276/2 - Ring, Lock, Serrated, Metric
- MIL-L-81329 - Lubricant, Solid Film, Extreme Environment

STANDARDS

FEDERAL

- FED-STD-H28/20 - Inspection Methods for Acceptability of UN, UNR, UNJ, M and MJ Screw - Threads
- FED-STD-H28/21 - Screw Thread Standards for Federal Services, Section 21, Metric Screw Threads

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-1312 - Fasteners Test Methods

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 - Surface Texture

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

NATIONAL AEROSPACE STANDARDS (NAS)

NAS 672 - Plating - High Strength Steels - Cadmium

(Application for copies should be addressed to Aerospace Industries Association of America, Inc., 1725 DeSales Street, NW, Washington, DC 20036.)

AEROSPACE MATERIAL SPECIFICATIONS (AMS)

- AMS 2411 - Silver Plating For High Temperature Applications
- AMS 5643 - Steel Bars, Forgings, Tubing and Rings, Corrosion Resistant
- AMS 5731 - Steel Bars, Forgings, Tubing & Rings, Corrosion and Heat Resistant

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AMS 5734 - Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant
AMS 6322 - Steel Bars, Forgings, and Rings

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108 - Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A 380 - Cleaning and Descaling Stainless Steel Parts, Equipment and Systems

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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.

3.2 Material. Recycled and reclaimed materials (See 3.1) shall be used to the maximum extent practicable. The insert and lockring shall each be a one piece all metal unit made from the following materials as specified.

3.2.1 Alloy steel. Alloy steel shall be composition 8740 (UNS G87400) in accordance with AMS 6322.

3.2.2 Corrosion resistant steel. Corrosion resistant steel shall be composition A-286 (UNS K66286) in accordance with AMS 5731 or AMS 5734 or composition 17-4PH (UNS S17400) in accordance with AMS 5643.

3.2.3 Carbon steel. Carbon steel shall be composition 1117 (UNS G11170) in accordance with ASTM A108.

3.3 Treatment and finish.

3.3.1 Protective finish. The insert and lockring shall be furnished with a protective finish or surface treatment as specified.

3.3.1.1 Alloy steel inserts. Alloy steel inserts shall be cadmium plated in accordance with QQ-P-416, Type II, Class 3. The plating thickness shall be 5.1 μm (micrometers). The entire insert including threads shall be plated.

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3.3.1.2 Corrosion resistant steel inserts. Corrosion resistant steel inserts without internal thread locking feature shall be cleaned, descaled and passivated in accordance with ASTM A380. Inserts made from 17-4PH steel with internal thread locking feature shall be coated with a solid film lubricant in accordance with MIL-L-81329. Inserts made from A-286 steel with internal thread locking feature shall be silver plated in accordance with AMS 2411, 5 μm thick minimum.

3.3.1.3 Carbon steel lockrings. Carbon steel lockrings shall be cadmium plated in accordance with QQ-P-416, Type II, Class 3 (5.1 μm plating thickness).

3.3.1.4 Corrosion resistant steel lockrings. Corrosion resistant steel lockrings shall be cleaned, descaled and passivated in accordance with ASTM A380 as specified on the applicable specification sheet.

3.4 Design, dimensions and tolerances. Design, dimensions, and tolerances shall conform to the requirements of the applicable specification sheet and shall apply after application of the protective plating or cleaning, descaling and passivation surface treatment.

3.4.1 Threads. Threads shall be right hand, M or MJ profile in accordance with FED-STD-H28/21 and the applicable specification sheet.

3.4.1.1 External threads. External threads shall be M profile tolerance class 4h. Thread gaging shall be performed after plating and prior to the application of solid film lubricant.

3.4.1.2 Internal threads. Internal threads shall be MJ profile tolerance class 4H6H for thread size MJ5x0 and tolerance class 4H5H for thread sizes greater than MJ5x0.8. Thread gaging shall be performed after plating and prior to the application of solid film lubricant. For insert internal thread locking feature, the "GO" plug gage shall enter a minimum of 3/4 turn before engagement of the locking feature.

3.4.1.3 Thread forming. Threads shall be produced either by machining, grinding or fully formed by a single rolling process prior to protective plating or surface treatment.

3.4.1.4 Thread concentricity. The internal thread pitch diameter shall be concentric with the external thread pitch diameter within 0.15mm Full Indicator Movement (FIM).

3.4.2 Internal thread locking feature. The internal thread of the insert shall be distorted to impose friction between the insert and the inserted item. The self-locking insert shall be characterized by a slot in the external thread. The feature shall not operate by means of separate movement from the installation, nor depend upon axial load on the insert wall.

3.4.2.1 Self-locking torque. When the insert is properly installed in the parent material, the locking feature shall provide a locking torque with a mating screw or bolt that is within the limits specified in Table I when tested in accordance with 4.7.2. Inserts shall not be subjected to self-locking tests after testing as specified in 4.7.3, 4.7.4 or 4.7.5.

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TABLE I. Self-locking torque

Internal Thread Size	Maximum Locking Torque N·m	Minimum Breakaway Torque N·m
MJ5X0.8	1.6	0.23
MJ6X1	2.8	0.36
MJ7X1	4.3	0.54
MJ8X1 & MJ8X1.25	5.8	0.71
MJ10X1.25 & MJ10X1.5	9.6	1.16
MJ12X1.25 & MJ12X1.5	14.8	1.77
MJ14X1.5	22.6	2.71

3.4.3 Locking serrations.

3.4.3.1 Insert locking serrations. Insert locking serrations shall conform in size with the dash number specified in the applicable specification sheet and shall be of full form and free from burrs or other flaws.

3.4.3.2 Lockring serrations. Lockring internal and external serrations dimensions shall conform in size with the respective dash number and basic lockring part number specified in the applicable specification sheet and shall be of full form and free from burrs or other flaws.

3.4.3.3 Serrations concentricity. The internal serrations shall be concentric with the external serrations within 0.15 mm Full Indicator Movement (FIM).

3.4.4 Surface texture. The surface texture of the insert and lockring prior to plating shall not exceed the values specified in the applicable specification sheet and shall be in accordance with ANSI B46.1.

3.5 Mechanical properties. The insert conforming to the design and dimensions specified in the applicable specification sheet and having a load rating as specified in table II shall be capable of developing a minimum tensile strength and have shear engagement areas in accordance with table II.

TABLE II. Mechanical properties

Load Rating MPa	Minimum Tensile Strength MPa	Shear Engagement Area (External Threads)		
		-100 Numbers	-200 Numbers	-300 Numbers
1550	1550	Table IV COL 1	Table IV COL 2	Table IV COL 3

3.5.1 Tensile strength. The properly installed insert shall be capable of developing the minimum axial load as specified in table III when tested in accordance with 4.7.3.

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TABLE III. Axial load for insert internal threads

Internal Thread Size	Tensile Stress Area		Minimum Axial Load	
	mm ²	1/	kN	2/
MJ5x0.8	14.0		21.7	
MJ6x1	19.8		30.7	
MJ7x1	28.5		44.2	
MJ8x1	38.8		60.1	
MJ8x1.25	36.1		56.0	
MJ10x1.25	60.6		94.0	
MJ10x1.5	57.3		88.8	
MJ12x1.25	91.3		141.0	
MJ12x1.5	87.2		135.0	
MJ14x1.5	123.5		191.0	

1/ The tensile stress areas used for the calculation of the axial load values are based on the stress area per formula

$$A_S = \pi \left(\frac{E}{2} - \frac{3H}{16} \right)^2 \quad \text{as shown in FED-STD-H28, Appendix A5, 3. strength factor}$$

2/ The minimum applied axial loads shown are the applicable tensile stress areas multiplied by 1550 MPa.

3.5.2 Resistance to pullout. The insert shall demonstrate minimum shear engagement areas as specified in table IV. The installed insert with locking in place as specified in 4.1.3 shall be capable of developing a minimum resistance to pullout in accordance with table V. Values specified in table V are based on the minimum shear engagement areas of the insert (table IV) when installed in a test block of 170 MPa shear strength and tested in accordance with 4.7.4.

TABLE IV. Shear engagement area of insert external thread

Internal Thread Size	Minimum Shear Engagement Area (mm ²) 1/		
	COL 1	COL 2	COL 3
	-100 Numbers	-200 Numbers	-300 Numbers
MJ5x0.8	104.1	131.8	164.9
MJ6x1	142.2	180.1	227.0
MJ7x1	213.1	269.0	335.4
MJ8x1 & MJ8x1.25	275.4	352.1	442.0
MJ10x1.25 & MJ10x1.5	420.6	540.5	681.2
MJ12x1.25 & MJ12x1.5	622.6	803.6	1014.9
MJ14x1.5	840.4	1085.5	1372.3

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

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TABLE V. Resistance to pull-out, insert external thread

Internal Thread Size	Minimum Resistance to Pull-out (kN) 1/		
	COL 1	COL 2	COL 3
	-100 Numbers	-200 Numbers	-300 Numbers
MJ5x0.8	17.7	22.4	28.0
MJ6x1	24.2	30.6	38.6
MJ7x1	36.2	45.7	57.0
MJ8x1 & MJ8x1.25	46.8	59.9	75.1
MJ10x1.25 & MJ10x1.5	71.5	91.9	116.0
MJ12x1.25 & MJ12x1.5	106.0	136.0	172.0
MJ14x1.5	143.0	184.0	233.0

1/ Pull-out load = (Shear Engagement Area) X (170 MPa). To compute minimum pull-out load in other materials, multiply Shear Engagement Area by applicable ultimate shear strength of material.

3.5.3 Rotational resistance. The insert shall produce a minimum torque resistance value not less than that specified in table VI when installed in conformance with the applicable specification sheet and tested in accordance with 4.7.5.

3.5.3.1 Removal and replacement. The insert and lockring shall meet the requirements of 3.5.3 when replacing an identical insert and lockring in an existing hole in accordance with the applicable specification sheet provided the hole is undamaged by the insert removal operation.

TABLE VI. Rotational resistance strength

Internal Thread Size	Minimum Rotational Resistance (Torque-out) N·m
MJ5x0.8	7.0
MJ6x1	10.0
MJ7x1	17.5
MJ8x1 & MJ8x1.25	28.0
MJ10x1.25 & MJ10x1.5	54.0
MJ12x1.25 & MJ12x1.5	90.0
MJ14x1.5	155.0

3.5.4 Hardness.

3.5.4.1 Insert hardness. The insert shall meet the hardness as specified in the applicable specification sheet when tested in accordance with 4.7.1.

3.5.4.2 Lockring hardness. The carbon steel lockring shall be case hardened to a depth of 0.025 to 0.10 mm and develop a hardness as specified in the applicable specification sheet when tested in accordance with 4.7.1 Corrosion resistant steel lockrings are not case hardened.

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3.6 Metallurgical properties.

3.6.1 Discontinuities.

3.6.1.1 Cracks. (See 6.3.1) The insert and lockring shall be free of cracks in any direction or location.

3.6.1.2 Laps and seams. (See 6.3.2 and 6.3.3) The insert and lockring may show evidence of laps and seams except in locations specified in 3.6.2. The allowable depth shall not exceed 20 percent of the thread height (sharp V thread) for the insert and mating lockring.

3.6.1.3 Inclusions. (See 6.3.4) The insert shall show no evidence of surface or subsurface inclusions at the thread root. Small inclusions in other parts of the insert or lockring, not indicative of unsatisfactory quality shall be permissible.

3.6.2 Thread discontinuities. (Laps, seams and surface irregularities in rolled threads). The insert shall show no evidence of laps at the root or along the flanks of the thread as shown in figure 1. Multiple laps on the sides of threads are not permissible regardless of location. A single lap is permissible along the side of the thread above the pitch diameter on either the pressure or non-pressure side (one lap per thread) provided it extends toward the crest and generally parallel to the side as shown in figure 2a. Crest craters, crest laps, or a crest lap in combination with a crest crater are permissible, provided the imperfection does not extend deeper than 20 percent of the basic thread height (See table VII) as measured from the thread crest when the thread major diameter is at a minimum size (See figure 2a). Slight deviation from the thread contour is permissible at the crest of the thread within the major diameter limits as shown in Figure 2b. The incomplete thread at each end of the thread may also deviate slightly from contour.

TABLE VII. Basic thread height, metric thread

PITCH mm	BASIC THREAD HEIGHT (.750H)	20% BASIC THREAD HEIGHT
0.8	0.600	0.120
1.0	0.750	0.150
1.25	0.938	0.188
1.5	1.125	0.225

3.6.3 Grinding burns. The insert and lockring shall show no evidence of grinding burns.

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3.7 Workmanship. Workmanship shall be consistent with the type of product, finish, and class of thread fit specified. Inserts and lockrings shall be of uniform quality free from laps, cracks, seams, inclusions, splits, or other defects or irregularities which would be detrimental to the performance of the insert in service use.

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 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 assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. The manufacturer shall insure that test and inspection facilities of sufficient accuracy, quality and quantity are established and maintained to permit performance of required inspections.

4.1.2 Test block fabrication. The test block shall be fabricated in accordance with figure 3. The test block may exceed dimensions specified in figure 3 to accommodate multiple testing of inserts and lockrings except for tests of 4.7.3 and 4.7.4.

4.1.3 Test specimen installation. Sample inserts and lockrings shall be installed in accordance with the applicable specification sheet in test block specified in 4.1.2.

4.1.3.1 Inspection of installed inserts and lockrings. The inserts and lockrings installed as specified in 4.1.3 shall be visually inspected under 10 diameters magnification. The presence of cracks in either test block, insert or lockring as a result of installation shall be cause for rejection. When visual inspection discloses a condition which shows cause for further examination, the test specimen shall be penetrant inspected in accordance with MIL-I-6866.

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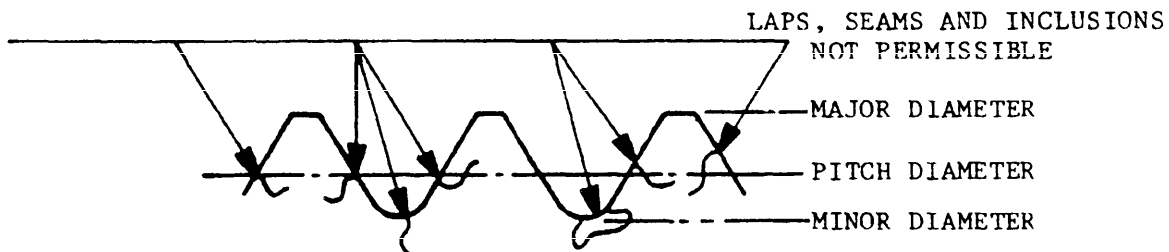


FIGURE 1. Laps, seams, and surface thread

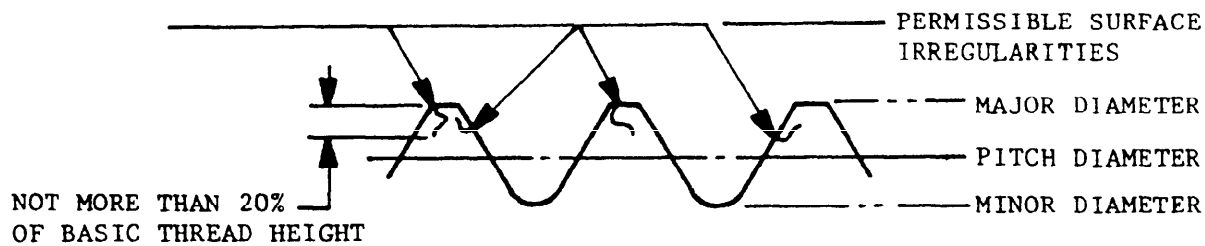


FIGURE 2a. Laps, seams, and surface thread

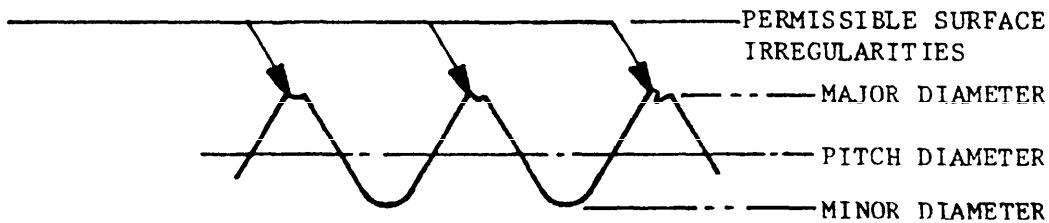
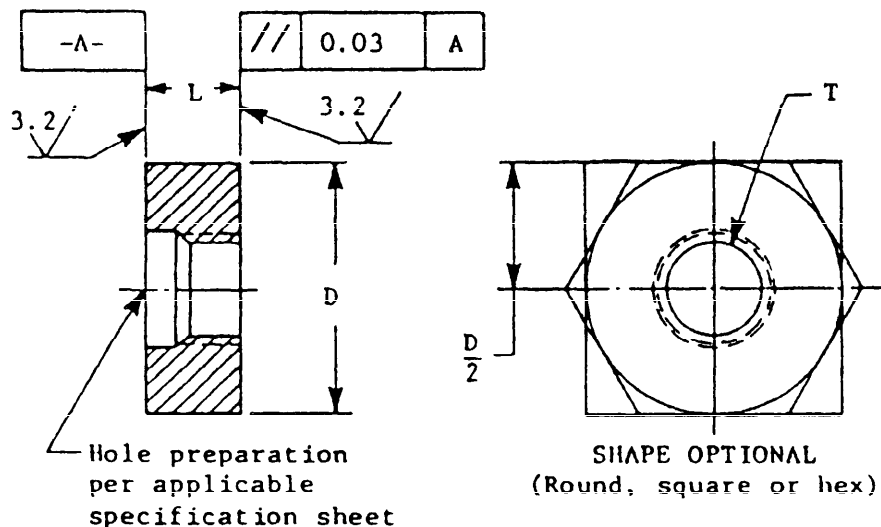


FIGURE 2b. Laps, seams, and surface thread

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NOTES:

1. DIMENSIONS:

T = Nominal diameter of insert external thread.

D = 4 x T

- (a) L = Insert length minus 1.6mm for rotational resistance test (4.7.5).
 (b) L = Insert length plus 1.6mm for self-locking torque (4.7.2) tensile strength (4.7.3) and resistance to pullout (4.7.4) tests.

2. MATERIAL:

- (a) Self-locking torque (4.7.2), tensile strength (4.7.3) and rotational resistance (4.7.5) tests - Aluminum alloy, 2024-T4 in accordance with QQ-A-225/6.
 (b) Resistance to pullout test (4.7.4) - Aluminum alloy, 5083-H321 in accordance with QQ-A-250/6.

3. Anodize in accordance with MIL-A-8625, Type I, Class 1 or 2.

4. Penetrant inspect in accordance with MIL-I-6866. Discontinuities or cracks shall not be acceptable.

FIGURE 3. Test block

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4.1.3.2 Test bolts and screws. Bolts and screws for use in all tests shall have M profile tolerance, class 4h threads in accordance with FED-STD-H28/21.

4.1.3.2.1 Bolts and screws used for testing as specified in 4.7.3, 4.7.4, and 4.7.5 shall be heat treated to 1800 MPa minimum ultimate tensile strength and shall be cadmium plated in accordance with MIL-C-8837, Type I, Class 2 (7.6 μm plating thickness) or NAS 672.

4.1.3.2.2 Bolts and screws used for internal thread self-locking tests of inserts as specified in 4.7.2 shall be heat treated as follows:

a. Alloy steel inserts: Test bolts and screws shall be heat treated to 1100 MPa minimum tensile strength and cadmium plated in accordance with QQ-P-416, Type II, Class 3 (5.1 μm plating thickness).

b. Corrosion resistant steel inserts with solid film lubricant or silver plated: Corrosion resistant steel bolts and screws shall be heat treated to 900 MPa minimum tensile strength and cleaned, descaled and passivated in accordance with ASTM A380.

4.2 Quality conformance inspection. Quality conformance inspection shall be as specified in Table VIII.

4.2.1 Inspection lot. An inspection lot shall consist of all inserts or lockrings covered by a single specification sheet produced under essentially the same conditions and offered for inspections at one time.

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 re-inspection. A resubmitted lot shall be inspected using tightened inspection. Such lots shall be separate from new lots and clearly identified as reinspected lots.

4.3 Classification of defects. Classification of defects shall be in accordance with MIL-STD-105 and table IX.

4.3.1 Defect non-compliance. An insert or lockring exhibiting one or more defects shall be considered defective.

4.4 Inspection sampling. Inspection sampling shall be in accordance with MIL-STD-105 and the applicable inspection level and Acceptable Quality Level (AQL) specified in table IX.

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

4.6 Method of inspection.

4.6.1 Visual and dimensional. The insert and lockring shall be examined to verify that physical dimensions, surface texture, and workmanship are in accordance with the applicable requirements of 3.4, 3.4.4 and 3.7.

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4.6.2 Material inspection. Material inspection shall consist of certification supporting verifying data that the materials used in fabricating the insert and lockring are in accordance with the applicable requirements of 3.2.

4.6.3 Treatment and finish inspection.

4.6.3.1 Heat treatment inspection. Heat treatment verification of the insert and the lockring shall be in accordance with the applicable specification sheet.

4.6.3.2 Protective finish inspection. Sample inserts and lockrings shall be inspected for minimum thickness and continuity of plating in accordance with QQ-P-416 and 3.3.1.1 or in accordance with AMS 2411 and 3.3.1.2.

4.6.3.3 Cleaning, descaling and passivation inspection. Sample inserts and lockrings shall be inspected for cleaning, descaling and passivation in accordance with ASTM A380 and 3.3.1.2.

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TABLE VIII. Quality conformance inspection

Inspection	Requirement Paragraph	Test Method Paragraph
<u>Group A</u>		
Visual and dimensional	3.1	4.6.1
Material	3.2	4.6.2
Treatment and finish	3.3 (as applicable)	4.6.3 (as applicable)
Grinding burns	3.6.3	4.6.1
Workmanship	3.7	4.6.1
Packaging	5.1	4.5
<u>Group B</u>		
Threads	3.4.1	4.6.4
Thread concentricity	3.4.1.4	4.6.4.3
Internal thread locking feature	3.4.2	4.7.2
Locking serrations	3.4.3	4.6.5
Surface texture	3.4.4	4.6.6
<u>Group C</u>		
Self-locking torque	3.4.2.1	4.7.2.1
Minimum breakaway torque	3.4.2.1	4.7.2.2
Tensile strength	3.5.1	4.7.3
Resistance to pull-out	3.5.2	4.7.4
Rotational resistance	3.5.3	4.7.5
Hardness	3.5.4	4.7.1
Cracks	3.6.1.1	4.6.7
Laps and seams	3.6.1.2	4.6.7
Inclusions	3.6.1.3	4.6.7
Thread discontinuities	3.6.2	4.6.7

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TABLE IX. Classification of defects & inspection sampling for insert

Category	Defect	Inspection Method
<u>Critical</u>	<u>None defined</u>	
<u>Major</u>	AQL = 1.5 percent defective, Level II	
101	Design and dimensions incorrect (3.4)	Standard Inspection Equipment (SIE)
102	Threads not as specified (3.4.1)	SIE
103	Internal threads not concentric with external threads (3.4.1.4)	SIE
104	Self-locking feature missing, when required (3.4.2)	Visual
105	Surface texture (3.4.4)	SIE
106	Cracks (3.6.1.1) and thread discontinuities (3.6.2)	SIE
107	Imperfect insert serrations (3.4.3.1)	Visual
108	Treatment and finish (3.3 as applicable)	Visual
109	Mechanical properties (3.5 as applicable to inserts)	SIE
<u>Minor</u>	AQL = 2.5 percent defective, Level S1	
201	Overall length (3.4)	SIE
202	Workmanship (3.7)	Visual

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TABLE X. Classification of defects & inspection sampling for lockring

Category	Defect	Inspection Method
<u>Critical</u>	<u>None defined</u>	
<u>Major</u>	AQL = 1.5 percent defective, Level II	
101	Design and dimensions incorrect (3.4)	SIE
102	Imperfect lockring serrations (3.4.3.2)	Visual
103	Concentricity between lockring internal and external serrations (3.4.3.3)	SIE
104	Surface texture (3.4.4)	SIE
105	Mechanical properties (3.5 as applicable to lockring)	SIE
<u>Minor</u>	AQL = 4.0 percent defective	
201	Treatment and finish (3.3 as applicable)	Visual
202	Workmanship (3.7)	Visual

4.6.4 Thread inspection.

4.6.4.1 External threads inspection. Sample inserts shall have their external threads inspected in accordance with System 21, FED-STD-H28/20, 3.4.1.1 and 3.4.1.3 as applicable.

4.6.4.2 Internal threads inspection. Sample inserts shall have their internal threads inspected in accordance with System 21, FED-STD-H28/20, 3.4.1.2 and 3.4.1.3 as applicable.

4.6.4.3 Thread concentricity inspection. Sample inserts shall have their internal thread pitch diameter concentric with the external thread pitch diameter in accordance with 3.4.1.4.

4.6.5 Locking serrations inspection. Sample insert and lockring locking serrations, both internal and external of lockring and external of insert shall conform with 3.4.3 as applicable.

4.6.6 Surface texture inspection. Sample inserts and lockrings shall be inspected for surface texture with any of the surface examination and measurement methods specified in ANSI B46.1 in accordance with the requirements of 3.4.4.

4.6.7 Metallurgical properties inspection. Sample inserts and lockrings shall be inspected for discontinuities in accordance with 3.6. Any crack detected during visual examination shall be cause for rejection of the lot. When visual evidence of discontinuities shows cause for further inspection, sample inserts and lockrings shall be subjected to magnetic particle inspection in accordance with MIL-I-6868 for alloy steel and penetrant inspection in accordance with MIL-I-6866 for corrosion resistant steel. Magnetic particle or penetrant inspection alone shall not be cause for rejection. If indications are considered cause for rejection, representative samples shall be taken from those inserts and lockrings showing indications and these samples shall be further examined. Samples shall be sectioned and discontinuities measured under 10X magnification. The inspection shall be performed on finished inserts and lockrings free of lubrication and subsequent to any processing operation which could adversely affect the inserts and lockrings. Requirements for dye as an indication of particle inspection may be waived.

4.7 Mechanical properties inspection. In lieu of the mechanical properties sampling inspection of 4.7, mechanical properties inspection may consist of certification supporting verifying data that the insert and lockring has met the requirements of 3.5.

4.7.1 Hardness test. Sample inserts and lockrings shall be tested for hardness to meet the requirements of 3.5.4 in accordance with MIL-STD-1312, Test 6.

4.7.2 Self-locking torque test. Sample inserts shall be installed in test blocks in accordance with figure 3 and 4.1.3 to meet the requirements of 3.4.2.1. Bolts and screws shall be in accordance with 4.1.3.2 and shall have sufficient thread length to extend beyond the locking feature a minimum of two pitches (including thread chamfer). A new bolt or screw and a new sample insert shall be used for each complete fifteen cycle test. Bolts and screws shall assemble freely, with the fingers, up to the locking feature. The bolt or screw shall be engaged or disengaged from the assembled insert self-locking area for fifteen full

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installation and removal cycles without axial load on the insert. The test shall be run at a rate slow enough to yield a dependable measure of torque and to avoid heating of the bolt or screw. A bolt or screw shall be considered fully installed when two threads extend past the end of the insert locking feature; the removal cycle shall be considered complete when the locking feature is disengaged.

4.7.2.1 Maximum locking torque test. Maximum locking torque shall be the maximum torque value encountered on any installation or removal cycle and shall not exceed the applicable values specified in Table I in accordance with the requirement of 3.4.2.1. Maximum locking torque readings shall be recorded on the first, seventh and fifteenth installation cycle.

4.7.2.2 Minimum breakaway torque test. Minimum breakaway torque shall be the minimum torque required to start removal of the bolt or screw from a fixed position located between the first 1/4 turn to 1 turn of the removal cycle. Minimum breakaway torque readings shall be recorded at the start of the first, seventh, and fifteenth removal cycles. The torque for any cycle shall not be less than the applicable values specified in Table I in accordance with the requirements of 3.4.2.1.

4.7.3 Tensile strength test. Sample inserts shall be installed in test blocks in accordance with figure 3 and 4.1.3. The test bolt or screw shall assemble freely into the insert with finger torque prior to engaging the locking feature. The bolt or screw thread shall be of sufficient length to fully engage the entire length of the insert internal thread when the sample inserts are installed in test fixture in accordance with figure 4. The bushing and test block clearance holes in the upper and lower yokes (see figure 4) shall have a free fit not in excess of 1.5 mm greater than the bushing and test block diameters. The test bolt or screw clearance hole in the upper bushing (see figure 4) shall be 0.13 to 0.4 mm diameter larger than the nominal diameter of the test bolt or screw. The bolt clearance hole in lower yoke shall have a diameter of 1 1/2 x the nominal insert external thread diameter ± 0.4 . The applicable axial tensile load value specified in table III shall be applied to the assembly and sample inserts shall meet the requirements of 3.5.1. In the event of bolt failure below specified axial load value, the test shall be repeated until the axial load value of the insert is reached or exceeded. Rate of loading shall not exceed 700 MPa per minute based on the shank diameter area of the bolt.

4.7.4 Resistance to pull-out test. Sample inserts shall be installed in test blocks in accordance with figure 3 and 4.1.3 to meet the requirements of 3.5.2. The minimum single shear strength of the test block material, shall be determined by means of double shear tests of coupons taken from the material from which the test blocks are fabricated. The procedure shall be the same as 4.7.3 except, to demonstrate the average shear engagement area, an axial load of sufficient magnitude to produce failure (pull-out) shall be applied to the assembly. The axial load test result shall be adjusted for test block shear strength as follows: The product of the load test results (N) and the ratio of the 170 MPa to the actual minimum shear strength shall be used as the resistance to pull-out (N). The mean (arithmetical average) value, as determined by five or more tests, shall meet or exceed the values specified in table V in accordance with 3.5.2. In the event of bolt failure below the applicable strength rating, the test shall be repeated until the pull-out strength of the insert is reached or exceeded. Rate of loading

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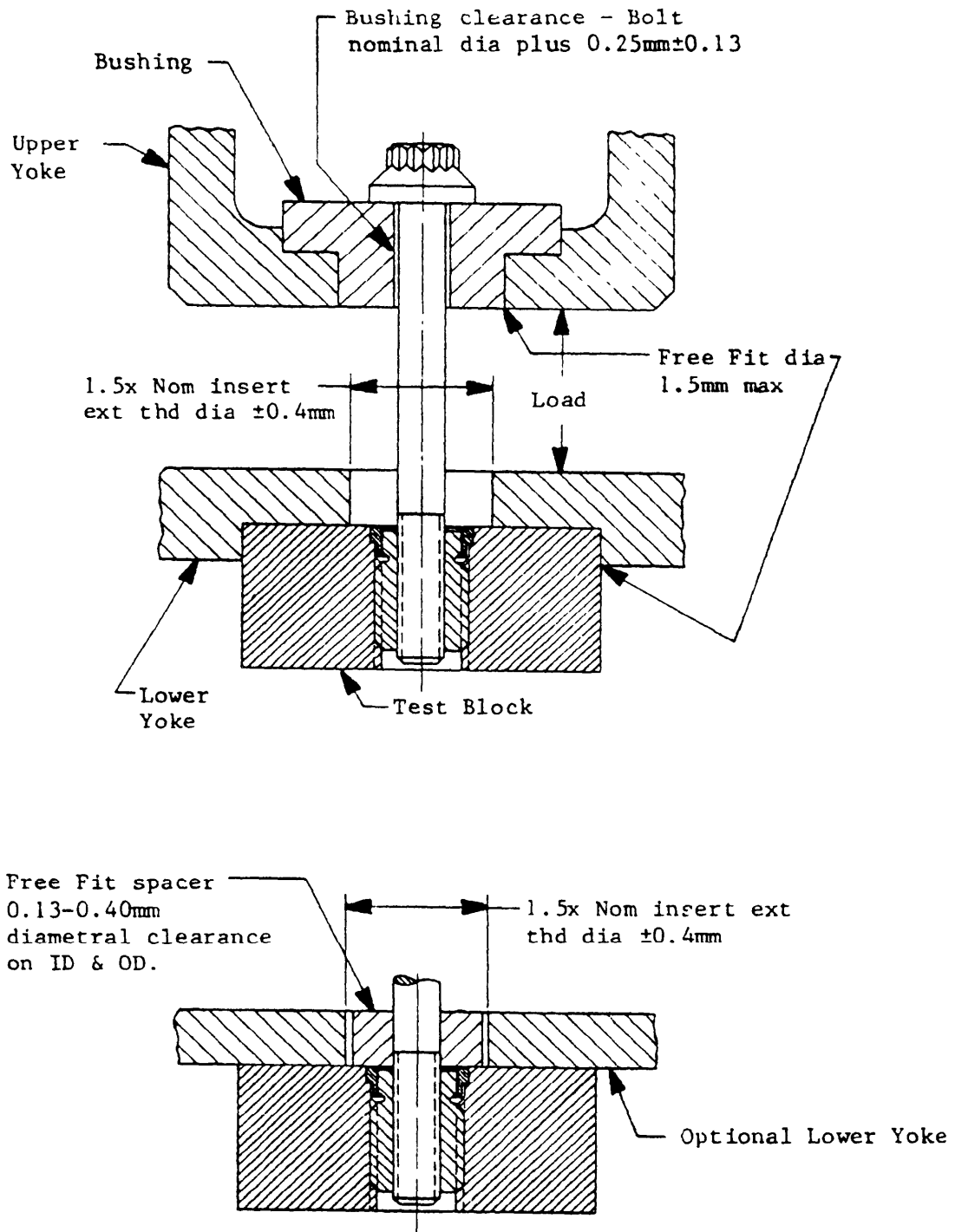
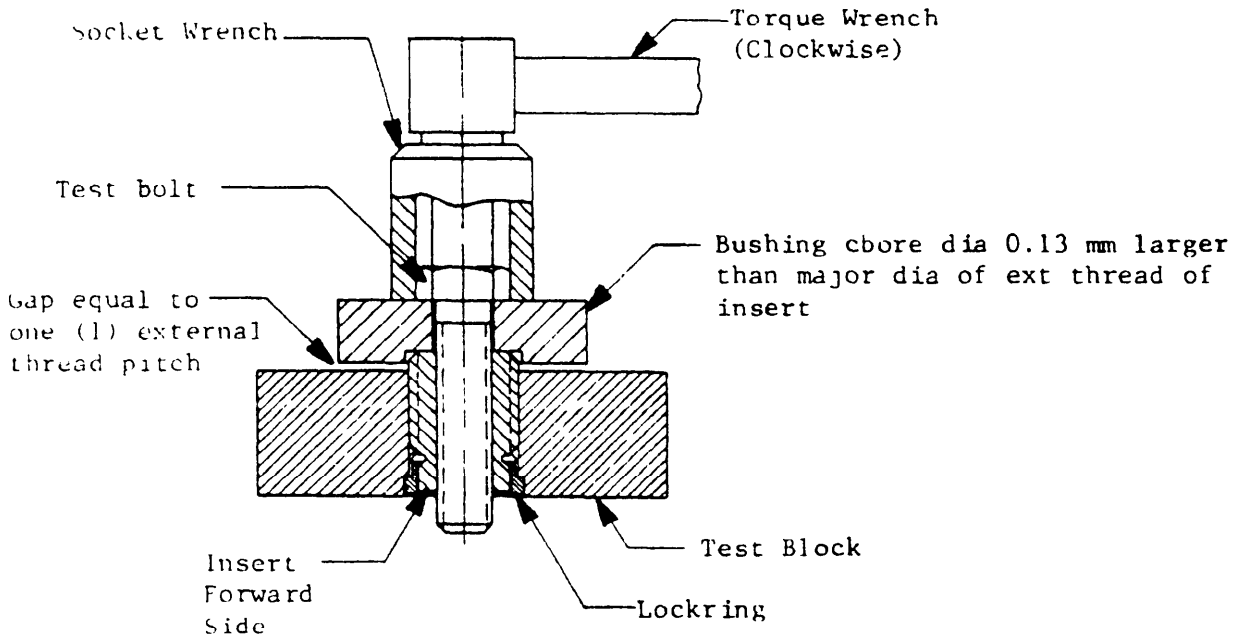
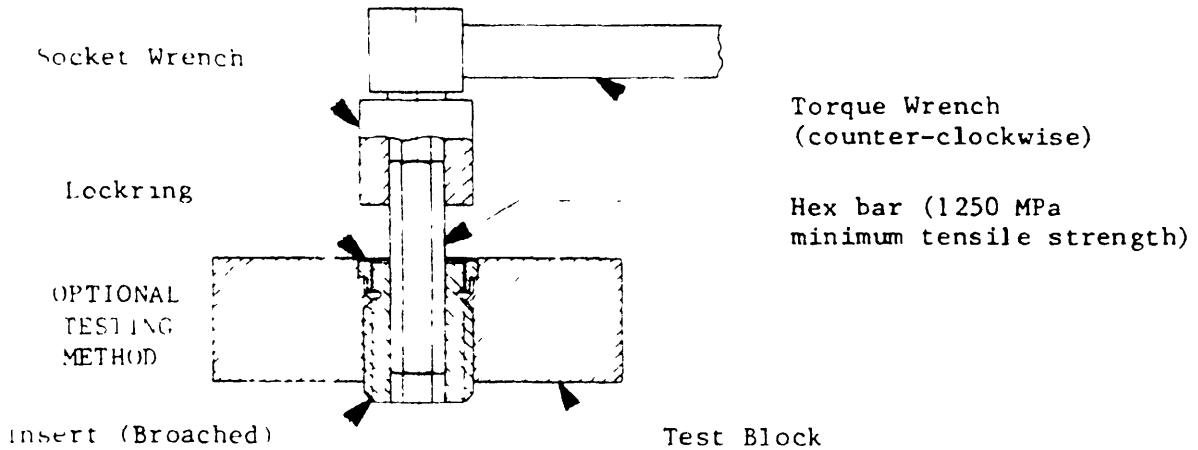


FIGURE 4. Tensile strength and resistance to pullout test fixtures

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NOTE: Above test fixture used with insert in the as received condition.



NOTE: Above test fixture used when product is internally broached with a hexagon whose cross point dimension does not exceed the major diameter of the insert internal thread. More accurate results are obtainable with this method as the insert will not tend to collapse or transmit friction into final values.

FIGURE 5. Rotational resistance test fixture

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shall not exceed 700 MPa per minute based on the shank diameter area of the bolt. Whenever the pull-out values exceed the tensile strength of the test bolt, or the test equipment, it is permissible to use lower shear strength materials (100 MPa approx.) in lieu of specified test block materials. Double shear tests on coupons taken from the lower shear strength test blocks shall be performed and the resultant shear strength used to adjust the test results as stated above.

4.7.5 Rotational resistance test. Sample inserts shall be installed in test blocks in accordance with figure 3 and 4.1.3 and utilizing a test assembly as illustrated in figure 5. With the forward side face of the insert installed in accordance with 4.1.3, the far side of the insert shall extend a distance approximately equal to one (1) external thread pitch past the far side of the test block allowing it to fit into the counterbore of the bushing. The insert shall fit into the bushing counterbore sufficiently close to prevent it from expanding under pressure. A test bolt or screw of 1800 MPa minimum tensile strength as specified in 4.1.3.2.1 shall enter the insert from the back side (opposite normal entry). The test bolt or screw shall be torqued in a clockwise direction. Failure at applicable values below those specified in table VI in accordance with the requirements of 3.5.3 shall be cause for rejection.

5. PACKAGING

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

6. NOTES

6.1 Intended use. Inserts covered by this specification are intended primarily in equipments to protect and strengthen internal threads in materials with low shear strength, especially in areas where repeated assembly and disassembly is required. Lockrings covered by this specification are designed with external and internal serrations which are used as a locking device to prevent rotation of DOD-I-63276 metric inserts as well as DOD-S-63275 metric studs when required.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number and date of this specification and the 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 defined as a clean crystalline break passing through the grain or grain boundary without the inclusion of foreign elements.

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

6.3.3 Seam. An elongated discontinuity caused by a defect, which has been closed by rolling or forging mechanically, but not united.

6.3.4 Inclusions. Particles of non-metallic impurities such as oxides, sulfides and silicates, which are mechanically held in the steel during solidification.

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

Custodians:

Army - AR
Navy - OS
Air Force - 99

Preparing activity:

Army - AR

(Project 5340-1463)

Review activities:

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Air Force - 11
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