INCH POUND

MIL-I-8846D
8 March 1994
SUPERSEDING
MIL-I-8846C
18 August 1992

MILITARY SPECIFICATION

INSERTS, SCREW-THREAD, HELICAL COIL

This specification is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense

1 SCOPE

1 1 Scope This specification covers helical coil screw-thread inserts made from formed wire, the inner surfaces of which, after assembly, provide threads as specified

1 2 Classification Inserts shall be of the following types and classes, as specified (see 6 2)

a Type I - Coarse thread

(1) Class 1 - Free running.

(2) Class 2 - Screw locking (self-locking)

b. Type II - Fine thread

(1) Class 1 - Free running

(2) Class 2 - Screw locking (self-locking)

c Type III - Taper pipe thread

(1) Class 5 - NPT pipe thread

(2) Class 6 - ANPT pipe thread

Beneficial comments (recommendation, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Technology & Industrial Services Division, SA-ALC/TIRDM, Kelly AFB, TX 78241-5609 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

AMSC N/A FSC 5340

DISTRIBUTION STATEMENT A Approved for public release, distribution is unlimited

d Type IV - Metric spark plug thread

(1) Class 3 - Staking (spark plug thread)

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

PPP-H-1581	Hardware (Fasteners and Related Items), Packaging of

MILITARY

MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT, General Requirements for
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for

STANDARDS

FEDERAL

* FED-STD-H28/2	Screw Thread Standards for Federal Services, Section 2, Unified Inch
* FED-STD-H28/7	Screw Thread Standards for Federal Services, Section 7, Pipe Threads, General Purpose

MILITARY

(See Supplement 1 for list of MS Sheet Form Standards)

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications The following documents 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/ASME B46 1	Surface Texture (Surface Roughness, Waviness, and Lay)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E8	Materials, Metallic, Tension Testing of
ASTM E290	Materials, Metallic, Semi-guided Bend Test for Ductility of
ASTM E1282	Standard Guide for Specifying the Chemical Compositions and Selecting Sampling Practices and Quantitative Analysis Methods for Metals and Alloys

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1137)

NATIONAL AEROSPACE STANDARDS (NAS)

NAS 1130	Insert Screw Thread, Helical Coil, Free Running and Self-Locking, Tangless
* NAS 6603 thru 6620	Bolt, Hex Head, Close Tolerance, Alloy Steel, Long Thread, Self-Locking and Nonlocking

(Application for copies should be addressed to Aerospace Industries Association of American, Inc., 1250 Eye Street, N W , Washington, D C 20005)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AS 7245	Inserts, Screw Thread, Helical Coil 19Cr-9 2Ni, Corrosion Resistant Steel, Procurement for

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

(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 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 and NAS 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 Associated specifications and standards The individual item requirements shall * be as specified herein and in accordance with the applicable standard In the event of * any conflict between the requirements of this specification and the MS sheets and NAS * standard, the latter shall govern

* 3 2 Material Unless otherwise specified on the drawing, the wire shall be
* manufactured from induction furnace or electric arc furnace steel, cold drawn, and shaped by rolling to conform to this specification and the applicable MS and NAS standards

* 3 2 1 Chemical composition The chemical composition of the wire shall conform to
* Table I (AS 7245)

Table I Chemical Composition

Element	Analysis (Percent)
Carbon	0 15 Max
Manganese	2 00 Max
Silicon	1 00 Max
Phosphorus	0 045 Max
Sulfur	0 035 Max
Chromium	17 00 to 20 00
* Nickel	8 00 to 10 50
Molybdenum	0 75 Max
Copper	0 75 Max
* Iron	Remainder

* 3 2 2 Tensile Strength Before coiling into parts, the wire shall have a tensile
* strength not lower than 150,000 pounds per square inch (psi) (see 4 4.2)

* 3 2 3 Cold-bending Wire from which the inserts are made shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to twice the cross-sectional dimension of the wire in the plane of bend (see 4 4 3)

* 3 3 Design The detail design and dimensions of the inserts shall conform to the
* applicable MS sheets and NAS standards (see 3 1)

* 3 3 1 Surface texture The surface roughness of thread flanks shall be 32 microinches AA or as specified in the detail specification or the product drawing Roughness shall be specified in accordance with the method outlined in ANSI/ASME B46 1

* 3 4 Threads Class 1 inserts, (NAS1130, MS122076 thru MS122275, and NAS1130,
* MS124651 thru MS124850) and Class 2 inserts (NAS1130, MS21209), when assembled in
* accordance with MS33537, shall produce a finished thread meeting the requirements of
* FED-STD-H28/2 and accept external threads which conform to MIL-S-8879 After assembly, Class 1 and Class 2 inserts shall conform to the minimum and maximum lengths specified on MS33537 Class 3 inserts (MS9018), when assembled, shall form threads in accordance with MS9071 Class 5 and Class 6 inserts, when assembled in accordance with the applicable
* design standard or drawing, shall form threads conforming to FED-STD-H28/7 and MIL-P-7105, respectively

3 5 Screw-locking-torque The class 2 insert, when assembled in accordance with MS33537 and tested in accordance with 4 4 5 shall produce torque in accordance with the * values specified in Table II

Table II Pound-Inches Torque at Room Temperature

Fine Thread Series			Coarse Thread Series		
* Bolt Size	Maximum Locking Torque, Installation or Removal	Minimum Breakaway Torque	Bolt Size	Maximum Locking Torque, Installation or Removal	Minimum Breakaway Torque
0 099-56	2	7 1/	0 086-56	1 25	3 1/
0 112-48	3	10 1/	0 099-48	2	7 1/
0 138-40	6	1 0	0 112-40	3	10 1/
0 164-36	9	1 5	0 125-40	4 7	13 1/
0 190-32	13	2 0	0 138-32	6	1 0
0 250-28	30	3 5	0 164-32	9	1 5
0 3125-24	60	6 5	0 190-24	13	2 0
0 375-24	80	9 5	0 250-20	30	4 5
0 4375-20	100	14 0	0 3125-18	60	7 5
0 500-20	150	18 0	0 375-16	80	12 0
0 5625-18	200	24 0	0 4375-14	100	16 5
0 625-18	300	32 0	0 500-13	150	24 0
0 750-16	400	50 0	0 5625-12	200	30 0
0 875-14	600	70 0	0 625-11	300	40 0
1 00-12	800	90 0	0 750-10	400	60 0
1 125-12	900	117 0	0 875-9	600	82 0
1 250-12	1,000	143 0	1 000-8	800	110 0
1 375-12	1,150	165 0	1 125-7	900	137 0
1 500-12	1,350	190 0	1 250-7	1,000	165 0
			1 375-6	1,150	185 0
			1 500-6	1,350	210 0

1/ Ounce-inches

* 3 6 Identification of product Unplated class 1 inserts shall be furnished in bright stainless steel finish Cadmium plated class 1 inserts shall be gold to yellow iridescent * in color Unplated class 2 inserts shall be coated with a red dye which may completely or * partially cover insert Cadmium plated class 2 inserts shall be olive drab to dark brown in color Class 1 and 2 inserts coated with a dry film lubricant shall be dark gray to black in color On inserts that are cadmium plated the cadmium shall be 0 0001 inch * nominal thickness Plating shall be in accordance with the applicable MS and NAS * standards

* 3 7 Workmanship The formed wire shall be of uniform quality and temper, smooth, clean, and free from kinks, waviness, splits, cracks, laps, seams, scale, segregation, and * other imperfections which may impair the serviceability of the insert

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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements

4 1 2 Responsibility for compliance The manufacturer's system for parts production should be based on preventing product imperfections, rather that detecting the imperfections at final inspection and then requiring corrective action to be invoked An effective manufacturing in process control system shall be established, subject to the approval of the purchaser, and used during production of parts

4 1 2 Inspection requirements 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 imperfect material, either indicated or actual, nor does it commit the Government to accept imperfect material

4 2 Classification of inspection The examination and testing of inserts shall be classified as quality conformance inspection

4 3 Quality conformance inspection Quality conformance inspection shall consist of the sampling tests and examinations

4 3 1 Inspection lot An inspection lot shall consist of inserts which are of the same type, class, thread size and length, fabricated by the same process, from the same heat of material, and produced as one continuous run or order, or part thereof, and submitted for acceptance inspection at the same time

4 3 2 Sampling tests and examinations

4 3 2 1 Sampling for tests Sampling for the material composition test (4 4 1), tensile strength test (4 4 2) and cold-bending test (4 4 3) shall be in accordance with the applicable test paragraph Any one failure shall be cause for rejection of the represented lot

4 3 2 2 Nondestructive tests - visual and dimensional A random sample shall be selected from each production inspection lot, the size for the sample to be as specified in Table III All dimensional characteristics are considered imperfect when out of tolerance

4 3 2 3 Destructive tests - screw locking torque A random sample shall be selected from each production inspection lot, the size of the sample shall be as specified in Table III

4 3 2 4 Acceptance Quality Of random samples tested, acceptance quality shall be based on zero imperfections

4 3 2 5 Disposition of sample units Sample units which have been subjected to test 4 4 5 shall not be delivered on the contract or order

4 4 Methods of inspection

4 4 1 Material composition It shall be ascertained that the material complies with 3 2 1 The manufacturer's certificate of chemical composition may be accepted At the discretion of the procuring activity, the material shall be tested in accordance with ASTM E1282 If the material does not pass these tests the entire lot shall be rejected

4 4 2 Tensile strength Two samples of each lot representative of the insert material shall be tested in accordance with test method ASTM E8 for compliance with 3 2 2

4 4 3 Cold-bending Two samples of each lot representative of the insert material shall be tested in accordance with test method ASTM E290 for compliance with 3 2 3

4 4 4 Visual and mechanical examination Samples of all insert lots shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements

* Table III Sample Sizes

Nondestructive Tests Visual and Dimensional Characteristics		Destructive Tests Screw-Locking Torque	
Production Inspection Lot Size	Sample Size	Production Inspection Lot Size	Sample Size
90 & under	8	50 & under	2
91 to 150	12	51 to 500	3
151 to 280	19	501 to 35000	5
281 to 500	21	35001 & over	8
501 to 1200	27		
1201 to 3200	35		
3201 to 10000	38		
10001 to 35000	46		
35001 to 150000	56		
15001 & over	64		

4 4 5 Screw-locking torque (Class 2 inserts) The torque test shall consist of a 15-cycle, room-temperature torque test, using cadmium-plated bolts or screws in accordance with Table IV, and with thread lengths greater than the nut thicknesses of Table IV The * bolt or screw pitch diameter, after plating, shall be class 3A The bolts selected for * this test shall be of sufficient length so the thread runout does not enter the insert and * that a minimum of one full thread extends past the end of the insert A new bolt or screw and a new tapped hole shall be used for each complete 15-cycle test The insert shall be assembled in a nut in accordance with Table IV Bolts and screws must assemble freely, * with the fingers, up to the locking coil or coils The bolt or screw shall be engaged and * disengaged from the assembled insert for 15 full 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 avoid heating of the bolt A bolt shall be considered fully installed when three threads extend past the end of the locking coils of the insert, the removal cycle shall be considered complete when the locking coils are disengaged

4 4 5 1 Maximum locking torque Maximum locking torque shall be the maximum torque value encountered on any installation or removal cycle and shall not exceed the values specified in Table II Maximum locking torque readings shall be taken on the first and seventh installation cycles and on the fifteenth removal cycle

* 4 4 5 2 Minimum breakaway torque Minimum breakaway torque shall be the minimum torque required to start removal of the screw or bolt from the installed position and shall be recorded at the start of the fifteenth removal cycle The torque value for any cycle shall not be less than the applicable value shown on Table II

Table IV Dimensions of Insert Nuts and Bolts Required for Torque Test

	Bolt Size	Test Nuts 1/ 4/ Across Flats (Maximum)	Test Nuts 1/ 4/ Thickness 2/ +0 010 -0 000	Bolts for Torque Tests Basic MS and NAS Part Number 3/
	0 099-56 UNF-3B	0 250	0 170	
F	0 112-48 UNF-3B	0 312	0 190	
I	0 138-40 UNF-3B	0 344	0 240	
N	0 164-36 UNF-3B	0 375	0 280	
* E	0 190-32 UNJF-3B	0 437	0 320	NAS6603
*	0 250-28 UNJF-3B	0 500	0 410	NAS6604
* T	0 3125-24 UNJF-3B	0 562	0 510	NAS6605
* H	0 375-24 UNJF-3B	0 688	0 600	NAS6606
* R	0 4375-20 UNJF-3B	0 750	0 710	NAS6607
* E	0 500-20 UNJF-3B	0 875	0 800	NAS6608
* A	0 5625-18 UNJF-3B	0 937	0 900	NAS6609
* D	0 625-18 UNJF-3B	1 062	0 990	NAS6610
*	0 750-16 UNJF-3B	1 250	1 190	NAS6612
* S	0 875-14 UNJF-3B	1 437	1 380	NAS6614
* E	1 000 12 UNJF 3B	1 625	1 625	NAS6616
* R	1 125-12 UNJF-3B	1 812	1 770	NAS6618
* I	1 250-12 UNJF-3B	2 000	1 960	NAS6620
E	1 375-12 UNJF-3B	2 187	2 150	-------
S	1 500-12 UNJF-3B	2 187	2 330	-------
C	0 086-56 UNC-3B	0 188	0 150	MS16997
* O	0 099-48 UNC-3B	0 250	0 170	
A	0 112-40 UNC-3B	0 312	0 190	MS16997
R	0 125-40 UNC-3B	0 344	0 210	
S	0 138-32 UNC-3B	0 344	0 240	MS16997
E	0 164-32 UNC-3B	0 375	0 280	MS16997
	0 190-24 UNC-3B	0 437	0 320	MS16997
T	0 250-20 UNC-3B	0 500	0 410	MS16997
H	0 3125-18 UNC-3B	0 562	0 510	MS16997
R	0 375-16 UNC-3B	0 688	0 600	MS16997
E	0 4375-14 UNC-3B	0 750	0 710	MS16997
A	0 500-13 UNC-3B	0 875	0 800	MS16997
D	0 5625-12 UNC-3B	0 937	0 900	MS16997
	0 625-11 UNC-3B	1 062	0 990	MS16997
S	0 750-10 UNC-3B	1 250	1 190	MS16997
E	0 875-9 UNC-3B	1 437	1 380	MS16997
R	1 000-8 UNC-3B	1 625	1 625	
I	1 125-7 UNC-3B	1 812	1 770	
E	1 250-7 UNC-3B	2 000	1 960	
S	1 375-6 UNC-3B	2 187	2 150	
	1 500-6 UNC-3B	2 187	2 330	

1/ Material Aluminum alloy 2024-T4 or T351

2/ Nut thickness is equal to dimension "H" minimum of MS 33537

3/ Equivalent class 3A cadmium plated socket head cap screws may be substituted for the NAS and MS bolts

4/ For locking torque testing a plate or block of the same material and hole dimensions may be used in lieu of the nut configurations

4 4 6 Inspection of Packaging The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of PP-H-1581

5 PACKAGING

5 1 Packaging requirements Preservation, packaging, packing, and marking shall conform to PPP-H-1581, packaging standards, or packaging data sheets

6 NOTES

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

6 1 Intended use The inserts covered by this specification are intended for use in original design application, especially in soft materials, to provide protection against thread failures caused by stripping, fatigue, wear, corrosion, and seizing They are also intended for use in the repair of damaged or worn threads not originally protected The class 2 insert which has prevailing torque capabilities provides protection to the joint against loosening caused by vibration and impact loading, thus obviating the use of lock washers, lock wires, or other means of locking

6 2 Acquisition requirements Acquisition documents should specify the following

a Title, number, and date of this specification

* b Part number in accordance with the applicable MS sheet or NAS standard (see 3 1)

c Type, class, nominal length, thread size, and series (see 1 2)

d Applicable levels of preservation, packaging, and packing (see 5 1)

e Package quantities, if other than standard

6 3 Design and installation guidance.

* 6 3 1 Design Tanged inserts and tangless inserts require different installation
* tooling and shall not be supplied interchangeably The decision to select tanged inserts
* or tangless inserts shall be made by the design activity

* 6 3 2 Inserts lengths Type I and type II inserts are available in five standard lengths, 1, 1-1/2, 2, 2-1/2 and 3 times the nominal thread diameter For specific sizes and part numbers see section 2

* 6 3 3 Installation Inserts are installed in accordance with the dimensional requirements contained in MS33537

* 6 3 4 Insert length selection The standard engineering practice of balancing the tensile strength of the bolt material against the shear strength of the parent or boss material also applies to helical coil inserts Table V will aid the designer in developing the full load value of the bolt rather than stripping the parent or tapped material

In using this table these factors must be considered

6 3 4 1 Actual bolt tensile strength, particularly in the lower bolt tensile ranges may be significantly higher than the nominal values This should be considered in insert length selection

6 3 4 2 The parent material shear strengths are for room temperature Elevated temperatures call for significant shear value reductions, compensation should be made when required Shear values are appropriate because the parent material is subject to shearing stress at the major diameter of the tapped threads

6 3 4 3 When parent material shear strength falls between two tabulated values, use the lower of the two

6 3 4 4 Bolt thread length, overall length, insert length, and full tapped thread depth must be adequate to insure full thread engagement when assembled in order to comply with its design function Refer to MS33537

Table V Length of Thread Engagement in Bolt Nominal Diameters

Shear Strength of Parent Material (psi Fsu)	Bolt Tensile Strength Rating (psi Ftu)					
	80,000	100,000	125,000	160,0000	180,000	220,000
10,000	2-1/2	3	-	-	-	-
15,000	1-1/2	2	2-1/2	3	-	-
20,000	1-1/2	1-1/2	2	2-1/2	3	3
25,000	1	1-1/2	1-1/2	2	2-1/2	2-1/2
30,000	1	1	1-1/2	2	2	2-1/2
40,000	1	1	1	1-1/2	1-1/2	2
50,000	1	1	1	1	1-1/2	1-1/2

6 4 Tools Helical coil wire screw thread taps and plug gages are defined in MIL-T-21309 Included in MIL-T-21309 are tools for inserting and extracting helical coil wire screw thread inserts with tangs only Tools for tangless inserts are specified by the manufacturer

6 5 Subject term (Keyword) listing

Free Running
Screw Locking
Tanged Inserts
Tangless Inserts

6 6 Changes from previous issue The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue

Custodians
Air Force - 99
Army - AV
Navy - AS

Review activities
Army - AR, MI, EA
DLA-IS

User activities
Army - AT, CR, GL, ME
Navy - SH

Preparing activity
Air Force - 82

(Project No 5340-2155)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1 The preparing activity must complete blocks 1, 2 3, and 8 In block 1, both the document number and revision letter should be given

2 The submitter of this form must complete blocks 4, 5, 6, and 7

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I RECOMMEND A CHANGE:	1 DOCUMENT NUMBER	2 DOCUMENT DATE (YYMMDD)
	MIL-I-8846D	8 March 1994

3 DOCUMENT TITLE

INSERTS, SCREW-THREAD, HELICAL-COIL

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

8 PREPARING ACTIVITY

a NAME	b TELEPHONE *(Include Area Code)*	
SAN ANTONIO AIR LOGISTICS CWNTER	(1) Commercial (512) 925-6314	(2) AUTOVON 945-6314
c ADDRESS *(Include Zip Code)* ATTN SA-ALC/TILDM 485 QUENTIN-ROOSEVELT ROAD KELLY AFB TX 78241-6425	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT Defense Quality and Standardization Office 5203 Leesburg Pike Suite 1403 Falls Church VA 22041 3466 Telephone (703) 756-2340 AUTOVON 289 2340	