

INSERTS, SCREW THREAD, HELICAL COIL METRIC SERIES  
PROCUREMENT SPECIFICATION FOR

1. SCOPE

1.1 Scope: This specification defines the requirements for corrosion resistant steel helical coil metric series screw thread inserts made from formed wire, the inner surfaces of which, after assembly, provide internal threads of the diameter and pitch specified on the drawing.

1.2 Classification: Inserts shall be of the following types:

MA1565-1	Free Running
MA1565-2	Screw Locking (Self-Locking)

2. APPLICABLE DOCUMENTS

2.1 Government Publications: The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified hereon.

Military Standards

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

Federal Specifications

PPP-H-1581	Hardware (Fasteners and Related Items), Packaging of
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2.2 Other Publications: The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

American National Standards Institute

ANSI B1.13M-1979	Metric Screw Threads - M Profile
ANSI B1.21M-1978	Metric Screw Threads - MJ Profile

Society of Automotive Engineers, Inc.

AS 1310	Fastener Torque for Threaded Applications, Definitions of
AS 1370	Screw Threads, Controlled Root Radius (J Threads) - Metric Series
MA 1567	Insert, Screw Thread, Helical Coil Metric Series, Standard Assembly Dimensions for
AMS 2400	Plating - Cadmium
AMS 7245	Inserts, Thread Form, Corrosion Resistant Steel - 18.5Cr-9.2Ni

3. REQUIREMENTS

3.1 Material

3.1.1 Composition: The chemical composition of the wire shall conform to material composition requirements AMS 7245.

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or their use by governmental agencies is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 3.1.2 Properties
- 3.1.2.1 Tensile Strength: Wire tensile strength shall be in accordance with AMS 7245.
- 3.1.2.2 Bending: Wire shall withstand, without cracking, bending when tested in accordance with AMS 7245.
- 3.2 Design: The insert shall conform to the requirements of the applicable drawing and of this specification.
- 3.2.1 Removal Notch: The tang removal notch shall be located as shown on the drawing and shall be of such depth that the part may be installed without failure of the tang and that the tang may be removed, after assembly, without affecting the function of the installed insert.
- 3.2.2 Threads: The inserts, when assembled in threaded holes conforming to MA 1567, shall form threads conforming to ANSI B1.13M, except for the locking feature of MA1565-2 inserts which shall conform to the applicable insert drawing. The assembled insert (both types) shall accept and function with parts externally threaded to AS 1370, ANSI B1.13M and ANSI B1.21M.
- 3.3 Self-Locking Torque: MA1565-2 insert, when assembled in threaded holes conforming to MA 1567 and tested in accordance with para. 4.3.4, shall provide a frictional lock to retain the bolt threads within the torque limits specified in Table I.

TABLE I  
SELF-LOCKING TORQUE AT ROOM TEMPERATURE

Nominal Insert Size	Max Locking Torque Installation or Removal N.m	Minimum Breakaway Torque N.m	Nominal Insert Size	Max Locking Torque Installation or Removal N.m	Minimum Breakaway Torque N.m
M2.2X0.45	0.14	0.02	M18X1.5	42	5.5
M2.5X0.45	0.22	0.06	M18X2	42	5.5
			M18X2.5	42	5.5
M3X0.5	0.44	0.1			
M3.5X0.6	0.68	0.12	M20X1.5	54	7
M4X0.7	0.9	0.16	M20X2	54	7
			M20X2.5	54	7
M5X0.8	1.6	0.3			
M6X1	3	0.4	M22X1.5	70	9
M7X1	4.4	0.6	M22X2	70	9
			M22X2.5	70	9
M8X1	6	0.8			
M8X1.25	6	0.8	M24X2	80	11
			M24X3	80	11
M10X1.25	10	1.4			
M10X1.5	10	1.4	M27X2	95	12
			M27X3	95	12
M12X1.25	15	2.2			
M12X1.5	15	2.2	M30X2	110	14
M12X1.75	15	2.2	M30X3	110	14
M14X1.5	23	3	M33X2	125	16
M14X2	23	3	M33X3	125	16
M16X1.5	32	4.2	M36X2	140	18
M16X2	32	4.2	M36X3	140	18
			M39X2	150	20
			M39X3	150	20

3.4 Vibration: The screw locking insert, when installed into a hole threaded to the requirements of MA 1567, shall perform satisfactorily when subjected to a vibration test per para. 4.3.5.

3.5 Workmanship: The formed wire shall be of uniform quality and temper; smooth, clean, free from kinks, waviness, splits, cracks, laps, seams, scale, segregation, and other defects which may impair the serviceability of the insert.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection: The vendor of inserts shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by para. 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the inserts conform to the requirements of this specification.

4.2 Classification of Tests: The inspection and testing of inserts shall be classified as either qualification tests or acceptance tests.

4.2.1 Qualification Tests: Qualification tests shall be performed on inserts selected from the first lot of inserts of each size produced by a supplier and shall be repeated whenever a significant change is made in the manufacturing process. The qualification test shall consist of the tests and inspections defined in Table II. The Vibration and Removal Notch tests shall be performed on five (5) samples each. All other qualification tests shall be conducted in accordance with acceptance test requirements.

4.2.2 Acceptance Tests: Acceptance tests shall be performed on a sampling basis. Sampling shall be in accordance with Table III. Acceptance tests shall consist of the tests and inspection defined in Table II.

TABLE II  
QUALIFICATION AND ACCEPTANCE TEST REQUIREMENTS

Characteristics	Req't. Para.	Test Method Per Paragraph	
		Qualification	Acceptance
Material Composition	3.1.1	4.3.2	4.3.2
Material Tensile Strength	3.1.2.1	4.3.2	4.3.2
Material Bending	3.1.2.2	4.3.2	4.3.2
Design	3.2	4.3.1	4.3.1
Removal Notch	3.2.1	4.3.3	4.3.3
Threads	3.2.2	4.3.1	4.3.1
Self-Locking Torque <u>2</u> /	3.3	4.3.4	4.3.4
Vibration <u>1</u> / <u>2</u> /	3.4	4.3.5	---
Workmanship	3.5	4.3.1	4.3.1

1 / The vibration test is waived for insert sizes below 5 mm nominal diameter and sizes larger than 12 mm nominal diameter, provided the 12 mm nominal diameter insert with the same type and design locking element has satisfactorily passed the vibration test. The vibration test is also waived for inserts of nominal lengths other than 1.5 diameters, provided the 1.5 diameter length inserts of the same nominal diameter, thread pitch and type and design of locking elements have satisfactorily passed.

2 / Self-Locking Torque and Vibration Tests are applicable to MA1565-2 inserts only.

TABLE III  
 SAMPLING PLAN FOR ACCEPTANCE TESTS 1 /

Lot Size	Self-Locking Torque & Removal Notch (4.0% AQL)			All Other Acceptance Tests (1.5% AQL)		
	Sample Size	Ac	Re	Sample Size	Ac	Re
Under 26	2	0	1	5	0	1
26 thru 50	2	0	1	8	0	1
51 thru 90	3	0	1	13	0	1
91 thru 150	3	0	1	20	1	2
151 thru 280	3	0	1	32	1	2
281 thru 500	3	0	1	50	2	3
501 thru 1200	5	0	1	80	3	4
1201 thru 3200	5	0	1	125	5	6
3201 thru 10000	5	0	1	200	7	8
10001 thru 35000	5	0	1	315	10	11
35001 and up	8	1	2	500	14	15

1 / Sample sizes listed above are based on single sampling plans for normal inspection in MIL-STD-105. It is permissible to use other sampling plans, per MIL-STD-105, which provide the same quality protection. When sample size equals or exceeds the lot size, 100% inspection is required.

4.3 Test Methods

- 4.3.1 Examination of the Product: Inserts shall be visually examined for conformance with drawing and workmanship requirements using conventional inspection methods and instruments.
- 4.3.2 Material: The supplier shall certify that material complies with the composition, tensile strength and bending requirements of AMS 7245.
- 4.3.3 Installed Inserts: Inserts shall be installed in a threaded hole conforming to MA 1567 and the tang removed. Insert a test bolt conforming to paragraph 4.3.4.1 so that one full thread extends beyond the end of the insert to determine if the tang has broken off at the notch cleanly enough so that the tang end of the installed insert does not interfere with the installation of a test bolt.
- 4.3.4 Self-Locking Torque
  - 4.3.4.1 Torque Test Bolts: Assembled screw locking inserts shall be torque tested with bolts having metric threads in accordance with ANSI B1.13M, ANSI B1.21M, or AS 1370, cadmium plated per AMS 2400, and a hardness of 36-44 HRC. 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 when the bolt is fully seated.

4.3.4.2 Torque Test Block and Spacer: The insert to be tested shall be installed in a threaded hole conforming to MA 1567 in a test block meeting the requirements of Figure 1 and made from 2024-T4 aluminum alloy. After installation the tang shall be removed. The surface of the test block from which the insert is assembled shall be marked "TOP" and shall be marked to indicate the radial location where the assembled insert begins. A steel spacer meeting the requirements of Figure 2 shall be used for developing the bolt load.

4.3.4.3 Torque Test Method: The torque test shall consist of a 15-cycle, room temperature test. A new bolt or screw and a new tapped hole shall be used for each complete 15-cycle test. For each of the 15 cycles, bolts shall be assembled and seated to the assembly torque specified in Table IV. Bolts shall be completely disengaged from the insert at the end of each cycle. The self-locking and breakaway torques shall be observed while the bolt is being assembled and disassembled to determine compliance with requirements of para. 3.3. The test shall be run at a rate slow enough to yield a dependable measure of torque and avoid heating of the bolt.

TABLE IV  
ASSEMBLY TORQUE

Nominal Insert Size	Assembly Torque N.m	Nominal Insert Size	Assembly Torque N.m
M2.2X0.45	0.38	M18X1.5	260
M2.5X0.45	0.58	M18X2	240
M3X0.5	1.0	M18X2.5	220
M3.5X0.6	1.6		
M4X0.7	2.4	M20X1.5	360
		M20X2	340
M5X0.8	5	M20X2.5	320
M6X1	8		
M7X1	14	M22X1.5	480
		M22X2	460
M8X1	21	M22X2.5	440
M8X1.25	20		
		M24X2	600
M10X1.25	42	M24X3	550
M10X1.5	40		
		M27X2	850
M12X1.25	75	M27X3	800
M12X1.5	70		
M12X1.75	70	M30X2	1200
		M30X3	1100
M14X1.5	115		
M14X2	110	M33X2	1600
		M33X3	1500
M16X1.5	180		
M16X2	170	M36X2	2100
		M36X3	2000
		M39X2	2600
		M39X3	2500

4.3.5 Vibration

4.3.5.1 Vibration Test Bolts: Assembled inserts shall be tested with bolts of the same type used in para. 4.3.4.

4.3.5.2 Vibration Test Nuts: The inserts to be tested shall be installed in threaded holes conforming to MA 1567 in hex nuts made from 2024-T4 aluminum alloy, having dimensions in accordance with Table V. After installation, the tangs shall be removed.

4.3.5.3 Vibration Test Set-up: On the fixture shown in MIL-STD-1312, Test No. 7, Metric, the insert-nut assembly shall be screwed onto the test bolt and tightened to the assembly torque specified in Table IV.

4.3.5.4 Vibration Test: The fixture shall be vibrated with an essentially sinusoidal waveform at a frequency of 29 to 30 Hz and a double amplitude of 11.0 - 11.8 mm. The test run shall be for 30,000 cycles. If, prior to the completion of 30,000 cycles, an insert-nut assembly rotates completely off a bolt, the test shall be stopped. At the completion of the test, breakaway torque shall be measured after the insert-nut assembly has been unseated 90 Deg. from the clamped position.

TABLE V  
VIBRATION TEST  
NUT DIMENSIONS

Nominal Insert Size	Nut Across Flats		Nut Thickness	
	Min	Max	Min	Max
5	10.92	11.19	8.3	8.8
6	11.92	12.78	10	10.5
7	12.92	14.37	11.5	12
8	14.21	15.08	13	13.5
10	18.97	20.08	16.25	16.75
12	20.08	21.92	19.25	19.75

4.4 Quality: The inserts shall be considered to have failed if, at the conclusion of any of the tests and inspections, any of the following conditions exist:

4.4.1 Any break or crack in the insert.

4.4.2 Installation or removal torque exceeds the maximum locking torque value in Table I.

4.4.3 Breakaway torque less than the values in Table I.

4.4.4 Movement of the insert beyond  $\pm 90$  Deg. relative to the TOP surface when installing or removing the test bolt.

4.4.5 Movement of the insert-nut assembly beyond 360 Deg. relative to the test bolt during the vibration test.

4.4.6 Seizure or galling of the insert or test bolt.

4.4.7 Tang not broken off cleanly, leaving a fin or burr which interferes with the test bolt at installation.

4.4.8 Tang breaks off during installation.

4.5 Rejection: Parts not conforming to the requirements of this specification or to authorized modifications will be subject to rejection.

4.6 Reports: On request, the vendor of inserts shall furnish with each shipment two copies of a report stating that the wire conforms to the chemical composition and tensile strength requirements of this specification and has been tested for conformance with all the other requirements of this specification. This report shall include the purchase order number, this specification number and its revision letter, control number, part number, and quantity. The control number shall be a designation indicating round wire acceptance testing and batch processing of inserts.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Identification

5.1.1 Inserts of each different part number shall be packaged in separate containers.

5.1.2 Each container shall be permanently and legibly marked to show the following information:

INSERTS, THREAD FORM, CORROSION RESISTANT STEEL  
 MA1565  
 PART NUMBER \_\_\_\_\_  
 CONTROL NUMBER \_\_\_\_\_  
 QUANTITY \_\_\_\_\_  
 MANUFACTURER'S IDENTIFICATION \_\_\_\_\_

5.1.3 Containers shall be prepared for shipment in accordance with commercial practice to ensure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 For direct U.S. Military procurement, packaging shall be in accordance with PPP-H-1581, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.3 will be acceptable if it meets the requirements of Level C.

6. NOTES

6.1 For direct U.S. Military procurement, purchase documents should specify the following:

Title, number and date of this specification.  
 Size or part number of inserts desired  
 Quantity of inserts desired  
 Applicable level of packaging (see 5.1.4)

6.2 For definitions of torque terms, see AS 1310.