

**TEST PROCEDURE FOR THE PERFORMANCE
OF NONMETALLIC RESISTANT ELEMENT
PREVAILING-TORQUE SCREWS**IFI-124
2002**IFI NOTES:**

1. *IFI-124 is a standard developed through the procedures of the Industrial Fasteners Institute under the jurisdiction of its Standards and Technical Practices Committee.*
2. *IFI-124 defines the testing of Nonmetallic Resistant Element Prevailing-Torque Screws to determine their conformance with specified prevailing-torque requirements. While the standard was originally established for nonmetallic insert type screws, it does not preclude other types of prevailing-torque screws, e.g., all-metal screws with a "designed-in" distortion of their threads, providing such screws meet the inherent test requirements.*
3. *IFI-124 was first published in 1973. It was revised in 1982, 1987, 1995, 1996, and again prior to the issuance of this 2002 edition.*

1.0 Introduction.

1.1 Scope. This standard establishes a conformance test procedure for the performance of Nonmetallic Resistant Element Prevailing-Torque Screws (hereinafter called "REPT screw"), in nominal screw sizes No. 0 thru 1-1/2 in. While the requirements of this standard apply to Nonmetallic Resistant Element Screws, it is not the intent to preclude alternate types of screws which totally satisfy the requirements of this standard.

The prevailing-torque values given in this standard are conformance requirements for REPT screws and apply only to the combination of test conditions described in the performance test procedure (4.1). If the conditions of the actual service application differ from those of 4.1 (e.g., internally threaded hole in a different material, length of thread engagement, class of internal thread tolerance, speed of driving, different plating or coating on screw or mating part), the prevailing-torque values may vary. Such values can only be determined through testing the REPT screw in its specific application.

This standard is not concerned with dimensional features such as head styles, or with performance capabilities such as corrosion resistance, sealing, suitability for use in high or low temperatures, and/or consistency of torque-to-tension relationships during assembly. Such features and properties are covered in other standards and specifications and must be referenced when specifying a REPT screw to assure that all of the service conditions of the particular engineering application are properly met.

(Note: The application of some non-metallic elements requires heating of an isolated area in the screw thread to approximately 600°F which may have an adverse effect on the mechanical properties of some products.)

1.2 Strength Grades.

1.2.1 Strength Grades. This standard covers only steel REPT screws produced to meet the mechanical strength requirements of one of three basic strength grades, SAE J429 Grades 5 and 8, ASTM A449, ASTM A354, and ASTM A574.

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1.3 Definitions.

1.3.1 A prevailing-torque REPT screw is an externally threaded fastener which is frictionally resistant to rotation due to a self-contained prevailing-torque feature, and not because of a compressive load developed against the underhead bearing surface of the screw or a tensile load developed in the shank of the screw.

1.3.2 REPT screws are metallic screws to which have been added a nonmetallic insert or fused nonmetallic substance in their threaded length. The design of the prevailing-torque feature shall be in accordance with the practice of the manufacturer. Depending upon the amount of friction present because of surface finish and lubricants, the dimensional characteristics of the nonmetallic element may vary to achieve the performance requirements stated in Table 1.

1.3.3 For purposes of this standard, "lot" means a quantity of fasteners of one part number fabricated by the same production process from the same coil or heat number of metal as provided by the fastener manufacturer and submitted for inspection and testing at one time.

2.0 Referenced Standards.

(IFI Note: Titles and sources of availability of ASME, ASTM and SAE standards referenced in this standard are given on page N-38.)

3.0 Requirements.

3.1 Finish. REPT screws shall be furnished plain or with a protective coating as specified by the purchaser. At the option of the manufacturer, screws may be provided with a supplementary lubricant.

3.2 Threads.

3.2.1 Thread Tolerances. Threads of REPT screws shall be Unified coarse or fine series, as

specified in ASME B1.1, except that the portion of the threaded length containing the nonmetallic element need not conform. Unless otherwise specified, threads of REPT screws shall have Class 2A tolerances prior to plating, except that REPT screws of strength grade ASTM A574 of nominal sizes 1 in. and smaller shall have Class 3A tolerances.

3.2.2 Thread Start. REPT screws, except those covered in 3.3.2, shall assemble a minimum of one full turn by the fingers into any mating internally threaded component that is acceptable to Gaging System 21 of ASME B1.3M.

3.3 Performance.

3.3.1 The prevailing-torque of REPT screws occurring during any installation or removal shall not exceed the maximum prevailing-torque specified in Table 1, when tested as specified in 4.1. In addition, the highest prevailing-torques developed by REPT screws during first and fifth removals shall not be less than the minimum first and fifth removal torques, respectively, specified in Table 1 when tested in accordance with 4.1. In addition, the lowest prevailing-torque developed by REPT screws during the fifth removal shall not be zero, when tested in accordance with 4.1.

3.3.2 REPT screws which are too short or which have thread lengths too short to permit testing in accordance with 4.1 shall have their prevailing-torque requirements and test procedure established by agreement between the purchaser and manufacturer.

3.4 When REPT screws are altered in any manner by any source following shipment by the manufacturer to a purchaser, the screw manufacturer shall not be held responsible for failures of the REPT screw to meet dimensional or performance requirements traceable to the alteration.

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**Table 1 Prevailing-Torques for Nonmetallic Resistant Element Screws –
Unified Coarse and Fine Thread Series**

Nom Size of Screw and Threads per Inch	Clamp Load (1) lbs.			First On Prevailing- Torque lb. in.	First Removal Prevailing- Torque lb. in.	Fifth Removal Prevailing- Torque lb. in.
	Strength Grade of Screw					
	SAE Grade 5 or ASTM A449	SAE Grade 8 or ASTM A354	ASTM A574	Max	Min	Min
#0 – 80	115	160	190	0.75	1.5*	0.5*
#2 – 56	234	330	390	2	3*	1.5*
#2 – 64	250	355	410	2	3*	1.5*
#4 – 40	385	540	635	5	1	0.5
#4 – 48	420	595	690	5	1	0.5
#6 – 32	580	820	950	8	2	1
#6 – 40	650	910	1,060	8	2	1
#8 – 32	900	1,260	1,470	12	2.5	1.5
#8 – 36	940	1,330	1,540	12	2.5	1.5
#10 – 24	1,120	1,580	1,840	18	3	2
#10 – 32	1,280	1,800	2,100	18	3	2
1/4 – 20	2,020	2,850	3,220	40	5	3
1/4 – 28	2,320	3,260	3,680	40	5	3
5/16 – 18	3,340	4,720	5,300	85	8	5
5/16 – 24	3,680	5,210	5,870	85	8	5
3/8 – 16	4,950	6,980	7,880	110	14	9
3/8 – 24	5,590	7,880	8,900	110	14	9
7/16 – 14	6,790	9,600	10,800	150	20	12
7/16 – 20	7,580	10,600	12,000	150	20	12
1/2 – 13	9,080	12,800	14,400	220	26	16
1/2 – 20	10,200	14,400	16,200	220	26	16
9/16 – 12	11,600	16,400	18,400	270	35	22
9/16 – 18	13,000	18,300	20,600	270	35	22
5/8 – 11	14,400	20,300	22,900	350	45	30
5/8 – 18	16,400	23,000	26,000	350	45	30
3/4 – 10	21,300	30,100	33,800	460	60	45
3/4 – 16	23,800	33,600	37,800	460	60	45
7/8 – 9	29,500	41,600	46,800	700	95	65
7/8 – 14	32,500	45,800	51,500	700	95	65
1 – 8	38,600	54,500	61,400	900	130	85
1 – 12	42,300	59,700	67,100	900	130	85
1-1/8 – 7	42,400	68,700	77,200	1,050	150	110
1-1/8 – 12	47,500	77,000	87,000	1,050	150	110
1-1/4 – 7	53,800	87,200	98,200	1,150	200	140
1-1/4 – 12	59,600	96,600	109,000	1,150	200	140
1-3/8 – 6	64,400	104,000	117,000	1,300	240	150
1-3/8 – 12	73,000	118,000	134,000	1,300	240	150
1-1/2 – 6	78,000	126,000	142,000	1,500	280	185
1-1/2 – 12	87,800	142,000	160,000	1,500	280	185

* Torque values are in inch ounce.

1. Clamp loads equal 75 percent of the proof loads specified for the respective strength grade of screw material.

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4.0 Performance Test.

4.1 Test Procedure. A sample REPT screw shall be assembled with a test washer (4.1.6) and a test nut (4.1.3) in a load measuring device (4.1.1) with the test washer located adjacent to the component to be turned. During the complete performance of the test, either the REPT screw or the test nut shall be turned. When the REPT screw is turned, the restraining mechanism shall be such that it imparts no radial distortion to the test nut. The REPT screw or test nut shall be advanced until its bearing surface is seated against the test washer. The total thickness of spacer material in the test assembly shall be selected so that at seating, the mid-length of the nonmetallic element of the screw shall coincide as closely as practical with the mid-thickness of the test nut, and a minimum length of REPT screw equivalent to two thread pitches shall project through the top of the test nut. During this first installation, the highest prevailing-torque (first on torque) occurring while the screw or test nut is in motion and prior to development of any axial load shall be measured and recorded.

Tightening shall be continued until an axial tensile clamp load equal to the load as specified in Table 1 for the applicable thread series and grade of screw is developed.

The axial tensile clamp load in the REPT screw shall be reduced to zero by backing the screw or test nut off until the test washer is free to turn by the fingers. Following a pause (it is generally necessary to change the wrench to one of a lower torque capacity), removal shall be continued and the highest torque (first removal torque) occurring while the REPT screw or test nut is being backed off throughout the next 360 degree of rotation shall be measured and recorded. The REPT screw and test nut shall be disassembled and then reassembled and disassembled four more times. On each reassembly the REPT screw shall be assembled with the test nut until the turned element is seated against

the test washer, but no tensile load shall be induced in the REPT screw. During the fifth removal, the highest torque (fifth removal torque) occurring while the REPT screw or test nut is being backed off throughout the first 360 degree of rotation shall be measured and recorded. At no time during this 360 degree of rotation shall the torque be zero.

At no time during the four additional installations and removals should the prevailing-torque exceed the maximum prevailing-torque as specified in Table 1.

(Note: The intent of this preceding requirement is to demonstrate that galling between the sample REPT screw and test nut has not occurred. With certain designs of REPT screws there may be an increase in the prevailing-torque during the five assembly cycles and, in rare instances, the specified maximum prevailing-torque may be exceeded. In such instances the manufacturer, when requested, shall give evidence that galling was not a contributing factor.)

Sufficient time shall elapse between torquing cycles to prevent overheating of the test assembly.

Speed of driving shall not exceed 30 RPM.

4.1.1 Tensile Load Measuring Device. The tensile load measuring device shall be an instrument capable of measuring the actual tension induced in the REPT screw as it is being tightened. The device shall be accurate within plus or minus 5 percent of the tensile clamp load to be induced. Diameter of the REPT screw clearance hole in the backing plate shall be the screw nominal diameter plus 0.016 in. for screw sizes No. 10 and smaller, plus 0.031 in. for screw sizes 1/4 to 1 in., incl., and plus 0.062 in. for screw sizes 1-1/8 in. and larger.

4.1.2 Torque wrenches shall be accurate within plus or minus 2 percent of the maximum of the specified torque range of the wrench.

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Table 2 Dimensions of Test Nuts

Nominal Size	Width Across Flats		Width Across Corners		Nut Thickness		90° Countersink Dia $\pm 5^\circ$	
	Max	Min	Max	Min	Max	Min	Max	Min
*No. 0		0.150	0.180	0.171		0.117	0.090	0.070
*No. 2		0.180	0.217	0.205		0.146	0.115	0.095
*No. 4		0.241	0.289	0.275		0.203	0.142	0.102
*No. 6		0.302	0.361	0.344		0.250	0.179	0.128
*No. 8		0.332	0.456	0.397		0.250	0.205	0.154
*No. 10		0.362	0.497	0.433		0.306	0.231	0.180
(1) 1/4	0.438	0.428	0.505	0.488	0.288	0.274	0.280	0.250
5/16	0.500	0.489	0.577	0.557	0.366	0.320	0.343	0.313
3/8	0.562	0.551	0.650	0.628	0.415	0.398	0.405	0.375
7/16	0.688	0.675	0.794	0.768	0.463	0.444	0.473	0.436
1/2	0.750	0.736	0.866	0.840	0.573	0.552	0.540	0.500
9/16	0.875	0.861	1.010	0.892	0.621	0.598	0.608	0.563
5/8	0.938	0.922	1.083	1.051	0.731	0.706	0.675	0.625
3/4	1.125	1.088	1.299	1.240	0.827	0.798	0.810	0.750
7/8	1.312	1.269	1.516	1.447	0.922	0.890	0.945	0.875
1	1.500	1.450	1.732	1.653	1.018	0.982	1.080	1.000
1-1/8	1.688	1.631	1.949	1.859	1.176	1.136	1.215	1.125
1-1/4	1.875	1.812	2.165	2.066	1.272	1.228	1.350	1.250
1-3/8	2.062	1.994	2.382	2.273	1.399	1.351	1.485	1.375
1-1/2	2.250	2.175	2.598	2.480	1.526	1.474	1.620	1.500

* Thickness of test nut product was based on availability of test nut in limited quantities and consistency in torque values.

(1) Nut sizes 1/4 in. and larger are based on ASME B18.2.2 Hex Thick Nut.

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4.1.3 Test Nut. The test nut shall conform to dimensions given in Table 2. Alternately, a test block may be used as long as its thickness and countersink comply with Table 2. Nuts or test blocks shall be made of carbon steel, and shall have proof load strengths equal to or greater than the minimum specified ultimate strength of the screw being tested. Test blocks shall meet the same mechanical requirements as test nuts.

4.1.4 Thread Tolerance. All test nuts shall be Class 2B when testing screws having Class 2A thread tolerance, and Class 3B when testing screws having Class 3A thread tolerance. Test nuts shall be free of rust and dirt and shall have a plain finish with oil coating. The screw shall be assembled into the countersunk side of the nut. Alternate testing using a test block shall be used only by agreement of purchaser and supplier. Test blocks shall meet the same thread tolerance as test nuts.

4.1.5 Usage. A new test nut shall be used for testing each screw. Prior to the usage of a test nut, its threads shall be gaged and shall be acceptable to the requirements of Gaging System 21 of ASME B1.3M. Alternate testing with test block shall require gaging prior to usage and

gaging after each screw test to the requirements of Gaging System 21 of ASME B1.3M.

4.1.6 Test Washer. Washers shall be steel with dimensions, hardness and finish at option of testing agency.

5.0 Inspection.

5.1 Inspection Procedure. Screws shall be inspected to determine conformance with the requirements of this standard.

Unless otherwise specified, from each lot of REPT screws the following number of tests shall be conducted to determine the acceptability to each of the requirements:

Lot Size (pieces)	No. of Tests
to 50	2
51 to 500	3
501 to 35,000	5
over 35,000	8

Acceptance is based on all samples meeting the requirements of the test.

Alternate inspection procedures may be specified by the purchaser on the purchase order or engineering drawing.