IFI-524
1996

TEST PROCEDURE FOR THE PERFORMANCE OF METRIC NONMETALLIC RESISTANT ELEMENT PREVAILING-TORQUE SCREWS

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IFI NOTES:

1. *IFI-524 is a standard developed through the procedures of the Industrial Fasteners Institute. IFI-524 is under the jurisdiction of IFI Divisions I and III and is the direct responsibility of the IFI Standards and Technical Practices Committee.*

2. *IFI-524 defines the testing of lock screws to determine their conformance with specified prevailing-torque requirements.*

3. *IFI-524 was first issued in 1982 and was extensively reviewed and revised in 1996.*

1. Scope

1.1 This standard establishes a conformance test procedure for the performance of metric Nonmetallic Resistant Element Type Prevailing-Torque Screws (hereinafter called REPT screw), in nominal thread diameters M1.6 thru M36.

The prevailing-torque values given in this standard are conformance requirements 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 differ. 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 other mechanical or performance capabilities such as strength properties, 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 nonmetallic 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 While the requirements of this standard apply to REPT screws, it is not the intent to preclude alternate types of screws which totally satisfy the requirements of this standard.

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. Property Classes

2.1 Property Classes. This standard covers only steel REPT screws produced to meet the mechanical strength requirements of one of four basic Property Classes, 8.8, 9.8, 10.9 and 12.9 as specified in ASTM F568M, page B–56.

The standard sizes of REPT screws for each of the four property classes are given in Table 1.

3. Requirements

3.1 Finish. REPT screws shall be furnished plain or with a protective coating as specified by the purchaser. If tolerancing differs, see "Scope" Para. 2.

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 tolerance Class 6g as specified in ASME B1.13M, except that the portion of the threaded length containing the nonmetallic element need not conform. If tolerancing differs, see "Scope" Para. 2.

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 has threads acceptable to Gaging System 21 of ASME B1.3M, page A–46.

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 removal 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 screws to meet dimensional or performance requirements traceable to the alteration.

4. Performance Test

4.1 Test Procedure. The 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 restrain-

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Table 1 Prevailing-Torques for Nonmetallic Resistant Element Screws

Nom Screw Size and Thread Pitch	Clamp Load (1) kN				Prevailing-Torque	First Removal Prevailing-Torque	Fifth Removal Prevailing-Torque
	Property Class of Screw				Max	Min	Min
	8.8	9.8	10.9	12.9	N·m	N·m	N·m
M1.6 × 0.35	—	0.6	—	0.9	0.10	0.01	0.004
M2 × 0.4	—	1.0	—	1.5	0.20	0.02	0.01
M2.5 × 0.45	—	1.6	—	2.5	0.40	0.05	0.03
M3 × 0.5	—	2.4	—	3.7	0.60	0.14	0.06
M3.5 × 0.6	—	3.3	—	4.9	0.90	0.22	0.11
M4 × 0.7	—	4.3	—	6.4	1.2	0.26	0.16
M5 × 0.8	—	6.9	8.8	10	2.3	0.36	0.23
M6 × 1	—	9.8	12	15	3.0	0.45	0.30
M8 × 1.25	—	18	23	27	10	0.90	0.58
M10 × 1.5	—	28	36	42	14	1.8	1.1
M12 × 1.75	—	41	52	61	21	2.6	1.5
M14 × 2	—	56	72	84	30	3.6	2.3
M16 × 2	—	76	98	110	40	5.0	3.4
M20 × 2.5	110	—	150	180	60	8.0	5.5
M24 × 3	160	—	220	260	90	13	8.5
M30 × 3.5	250	—	350	410	120	19	13
M36 × 4	370	—	510	590	150	28	18

NOTE:
1. Clamp loads equal 75 percent of the proof loads specified for the property class in ASTM F568M.

ing 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 REPT 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 screw size and property class is developed.

The axial tensile clamp load in the REPT screw shall be reduced to zero by backing the turned member off until the test washer is free to move 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 deg of rotation shall be measured and recorded. The REPT screw and test nut shall be disassembled and then reassembled and

Table 2 Dimensions of Test Nuts

Nominal Size	Width Across Flats		Width Across Corners		Nut Thickness		90° - 120° Countersink Dia	
	Max	Min	Max	Min	Max	Min	Max	Min
M1.6	3.20	3.02	3.70	3.41	1.30	1.05	1.84	1.60
M2.0	4.00	3.82	4.62	4.32	1.60	1.35	2.30	2.00
M2.5	5.00	4.82	5.77	5.45	2.00	1.75	2.875	2.50
M3.0	5.50	5.32	6.35	6.01	2.90	2.65	3.45	3.00
M3.5	6.00	5.82	6.93	6.58	3.30	3.00	4.025	3.50
M4.0	7.00	6.78	8.08	7.66	3.80	3.50	4.60	4.00
M5.0	8.00	7.78	9.24	8.79	5.10	4.80	5.75	5.00
M6.0	10.00	9.78	11.55	11.05	5.70	5.40	6.75	6.00
M8.0	13.00	12.73	15.01	14.38	7.50	7.14	8.75	8.00
M10.0	16.00	15.73	18.48	17.77	9.30	8.94	10.80	10.00
M12.0	18.00	17.73	20.78	20.03	12.00	11.57	12.96	12.00
M14.0	21.00	20.67	24.25	23.35	14.10	13.40	15.12	14.00
M16.0	24.00	23.67	27.71	26.75	16.40	15.70	17.28	16.00
M20.0	30.00	29.16	34.64	32.95	20.30	19.00	21.60	20.00
M24.0	36.00	35.00	41.57	39.55	23.90	22.60	25.92	24.00
M30.0	46.00	45.00	53.12	50.85	28.60	27.30	32.40	30.00
M36.0	55.00	53.80	63.51	60.79	34.70	33.10	38.88	36.00

* Nut sizes M1.6 thru M2.5 are based on ASME B18.2.4.1M Style 1.
(1) Nut sizes M3.0 thru M36 are based on ANSI B18.2.4.2M Style 2.

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 deg of rotation shall be measured and recorded. At no time during this 360 deg 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 speci-

fied 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 REPT screw nominal size plus 0.4 mm for screw sizes M5 and smaller, plus 0.8 mm for sizes M6 to M24 incl., and plus 1.6 mm for sizes M30 and M36.

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.

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 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.

4.1.4 **Thread Tolerance.** All test nuts shall be Class 6H when testing screws with Class 6g or Class 4g6g. Test nuts shall be free of rust and dirt and shall have a plain finish with light oil coating. The screw shall be assembled into the countersunk side of the nut. Alternate testing using a gage block shall be used only by agreement of purchaser and supplier. Gage blocks must meet the same thread tolerance and physical requirements of 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 gage block shall require gaging prior to usage and gaging after each screw test to the requirements of Gaging System 21 of ASME B1.3M, page A–46.

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

5. Inspection

5.1 **Inspection Procedure.** REPT 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

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