

TAPPING SCREW PERFORMANCE SPECIFICATIONS F.I.P. - 1000.1 THROUGH F.I.P. - 1000.7

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TAPPING SCREW PERFORMANCE SPECIFICATIONS

F.I.P. - 1000.1 THROUGH F.I.P. - 1000.7

TAPPING SCREWS: Case Hardened Carbon Steel; Inch and Metric

Types:

- A
- AB, B, BT(25)
- F,T(23)
- Thread Rolling Screws
- Self Drilling Screws

The purpose of this specification is to provide fastener users, distributors, importers and manufacturers with a series of simple to understand and perform tests which will help to detect fastener problems before they cause productivity losses and/or product damage.

Unlike other standards, F.I.P. has made an effort to explain within each test description the purpose of the test, indicating what production problems may arise from a particular screw failure. It further explains and illustrates all apparatus required to perform the test, the step-by-step procedure, the description of a failure and the possible causes of that failure. Every effort has been made to present this valuable information in an easy to understand way so that inexperienced personnel can successfully perform these tests by simply using the suggested equipment and following the procedures step by step.

Potential fastener failure problems should be caught prior to actual use in assembly. Hopefully this document will aid American industry in accomplishing just that, thus improving overall production efficiency which is crucial to the future of our economy.

The Tapping Screw performance tests in the following pages are described in the sequence in which they should be performed when testing each, lot. The charts covering each type of tapping screw also list the test requirements in this same preferred order, left to right. Also in the back of this standard are two (2) recommended test forms which list the tests in order to help fastener inspectors to conduct the tests on each lot of parts systematically and efficiently. The first test form is to be used for all types of tapping screws. The second is an additional sheet which should be used for the Drill-Drive Test for Self-Drilling Screws. These forms should be filled out and kept for future reference as a record of performance on each lot. Since the charts and forms are created in the recommended order for testing, if the parts fail any one test they may be rejected at that point without conducting further tests.

This document is based on an analysis and comparison of the tapping screw specifications published by General Motors Corporation and Ford Motor Company. These were selected because they are the most comprehensive on this subject and, in general, the most practical. This is probably because between these two firms they use more tapping screws each year than any other firms in the world. Complete copies of their standards are available for a fee upon request.



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This standard only covers the performance of tapping screws. For dimensional guidelines we recommend the A.N.S.I. B18.6.4, 1981. Ordering information for this document is available upon request.

The sample size recommendations are based on the proposal of A.N.S.I. 818.18.1 M dated 1982 for general purpose fasteners. Ordering information for this complete document is available upon request.

References;

The following standards were used in the compilation of this standard:

Ford Motor Product Engineering Standards General

ESS-M1A160-A August 1973
ES-20002-S100 August 1973
ES-20003-S1000 December 1970
ES-20002-S100 August 1973

Motors Engineering Standards

GM6010M December 1984 GM6170M April 1970
GM6171 M April 1985 GM6172M April 1986

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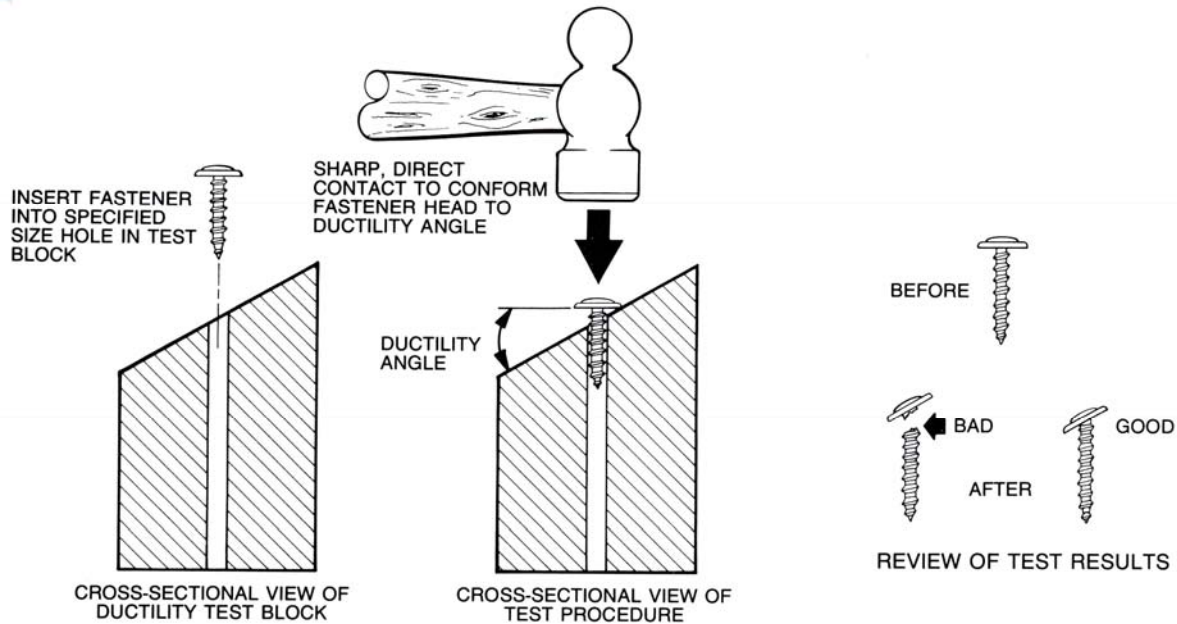
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TAPPING SCREW PERFORMANCE SPECIFICATIONS



DUCTILITY TEST

1. DUCTILITY TEST

Applicable To:

All Tapping Screws.

Test Purpose:

To detect detrimental brittleness which may cause heads to break off during driving or seating or when impact stresses occur in the application.

Specification:

10 Degree bend for all Tapping Screws except 5 degrees for Self Drilling Screws.

Apparatus required:

A. Ductility Block (DB-010 or DB-005).
B. Small Hammer (DH-100).

Minimum Recommended

Sample Size:

8 pieces per lot; lot size not to exceed 250,000.

Procedure:

A. Place screw in the appropriately marked hole on the block.
B. Strike on top of the head with a hammer so that the bearing surface of the part conforms to ductility block angle.
C. Inspect.

Failure:

The part has failed if the head separates completely from the shank.

Possible Failure Causes:

A. Core Hardness too high.
B. Case Hardness too deep.
C. Recess in head too deep.
D. Underhead radius too small.



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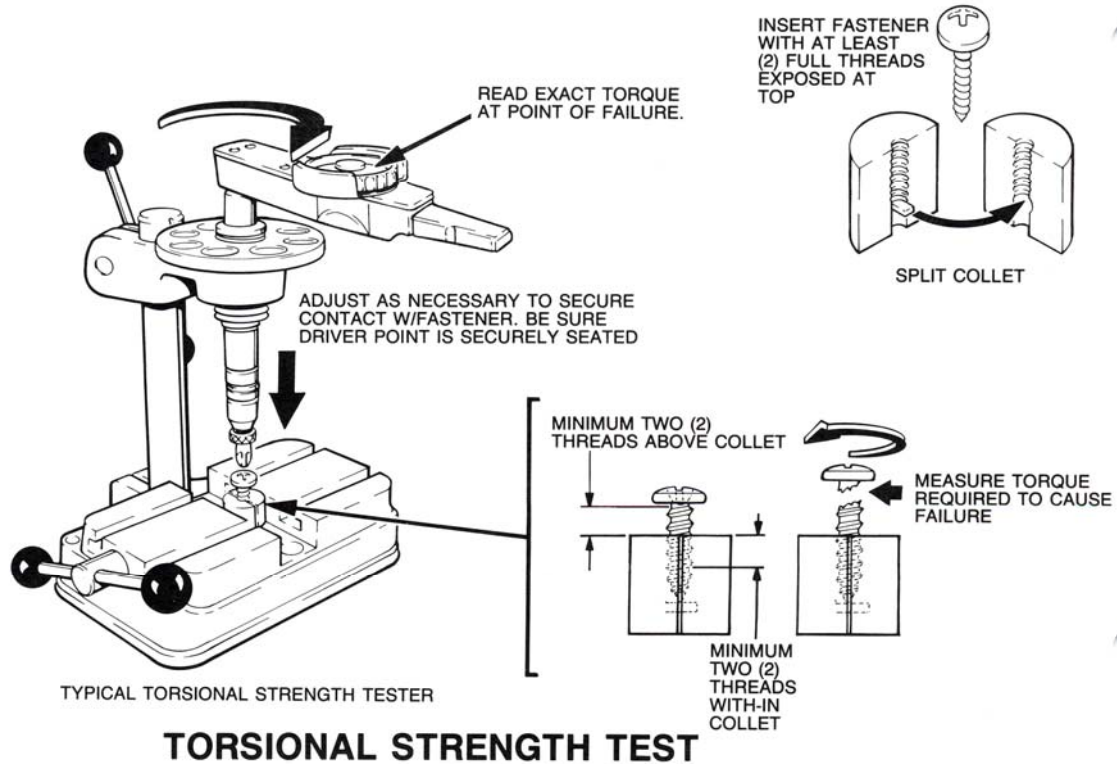
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TAPPING SCREW PERFORMANCE SPECIFICATIONS



TORSIONAL STRENGTH TEST

2. TORSIONAL STRENGTH TEST

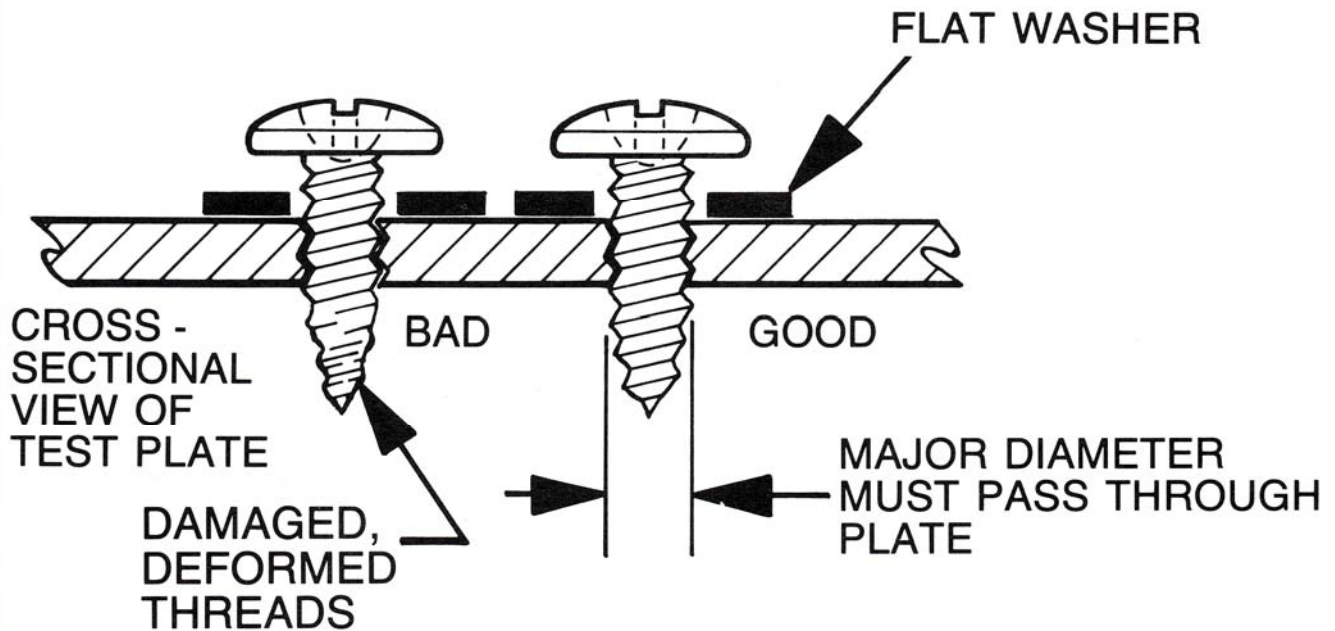
- Applicable To: All Tapping Screws.
- Test Purpose: To detect parts having low strength which might twist off during driving or seating.
- Specification: See charts that follow.
- Apparatus required:
- A. Appropriate Split Collet (SCxx-xx).
 - B. Collet Holder (SCH-250).
 - C. Screw Testing Fixture (STF-250).
 - D. Torque Wrench; accurate with +/-2% (TW-xxx).
- Minimum Recommended Sample Size: 4 pieces per lot; lot size not to exceed 250,000.
- Procedure:
- A. Place the split collet into the collet holder and screw the fastener into the collet such that a minimum of 2 full threads are in the collet and a minimum of 2 threads are above the collet.
 - B. Place the collet holder in the screw testing fixture and clamp into place.
 - C. Apply torque with a torque wrench until the part twists off.
 - D. Record failure value and compare to the required specification.
- Failure: Part twists in two at less than specified minimum.
- Possible Failure Causes:
- A. Core Hardness too low.
 - B. Case Hardness too low.
 - C. Case Hardness too shallow.
 - D. Minor diameter too small.



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DRIVE TEST

3. DRIVE TEST

Applicable To:

Test Purpose:

Specification:

Apparatus required:

Minimum Recommended

Sample Size:

Procedure:

Failure:

Possible Failure Cause:

All Tapping Screws except BT(25).

To detect parts whose threads may collapse during installation, causing parts to drive improperly or not at all.

See charts that follow.

A. Appropriate test plates (TP-xx-xx).

B. Driving tools (power driver optional; do not exceed 500 RPM).

4 pieces per lot; lot size not to exceed 250,000

A. Drive parts into test plates until a full major diameter thread is formed completely through the plate. Lightly oil plain finished screws.

B. Inspect the threads which have penetrated the plate.

Note: This test can be performed in conjunction with the "Drive Torque Test" and the "Hydrogen Embrittlement Test."

The parts have failed if the threads which penetrated the plate have deformed to any extent at all.

A. Case Hardness too shallow.

B. Case Hardness too low.

C. Test Plate too hard.

D. Test Plate hole too small.



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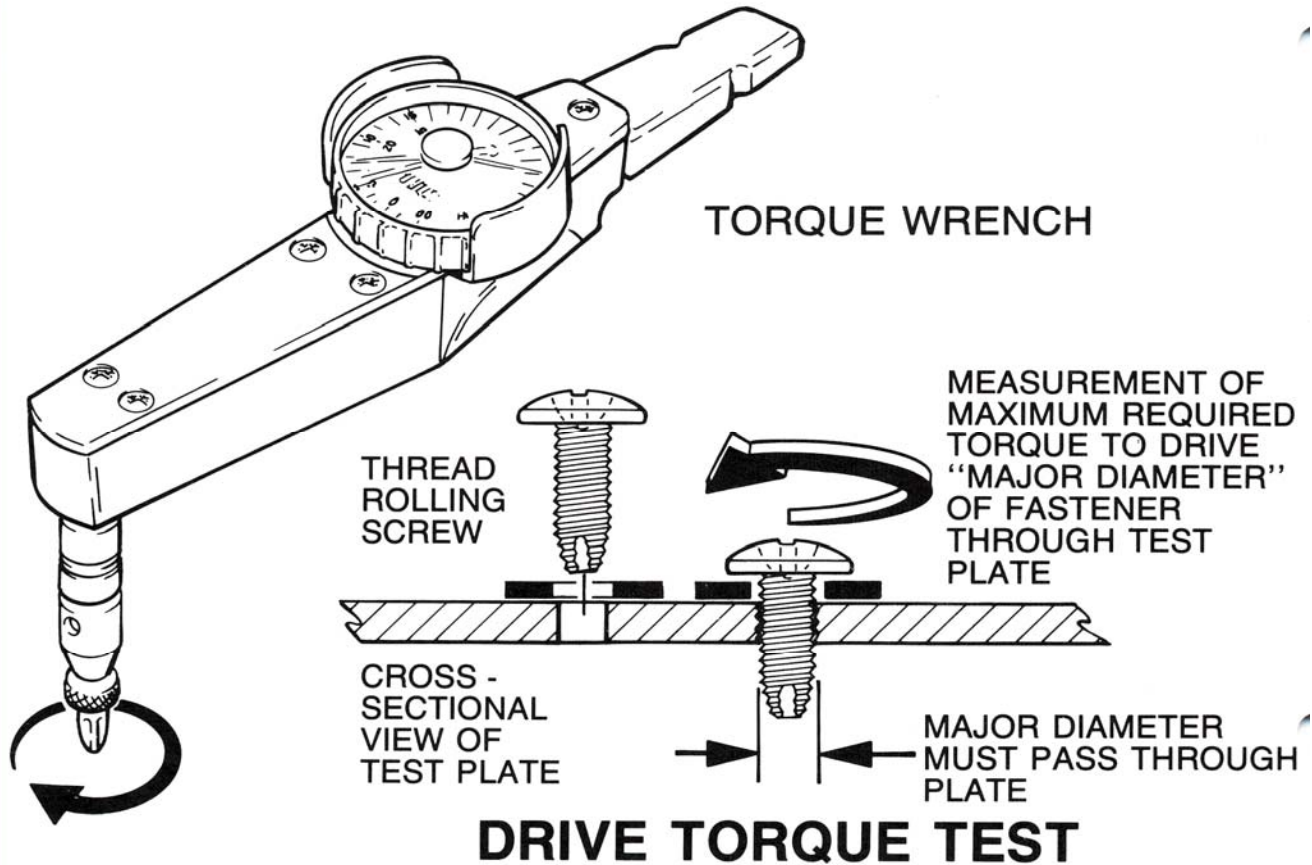
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TAPPING SCREW PERFORMANCE SPECIFICATIONS



4. DRIVE TORQUE TEST

Applicable To:

Test Purpose:

Specification:

Apparatus required:

Minimum Recommended

Sample Size

Procedure:

Failure:

Possible Failure Causes:

Thread Rolling Screws only.

To detect parts which have excessive driving torque requirements which will make driving and assembly difficult and may prevent components from being properly clamped together.

See charts that follow.

A. Specified test plates (same as those for "Drive Test").

B. Torque Wrench, accurate within $\pm 2\%$ (TW-xxx).

4 pieces per lot; lot size not to exceed 250,000.

A. Drive screws into the specified test plate with a torque wrench until a full major diameter thread completely penetrates the plate. Lightly oil plain finish parts.

B. Record the highest torque value.

Note: This test can be done in conjunction with the "Drive Test" and "Hydrogen Embrittlement Test."

The parts have failed if value recorded exceeds the maximum specified in the following chart.

A. Forming feature of screw not properly formed.

B. Case Hardness too low.

C. Case Hardness too thin.

D. Test Plate hardness too high.

E. Test Plate hole size too small.

F. Parts may need to be oiled or waxed.



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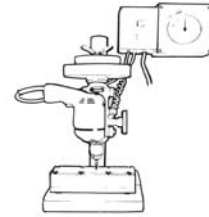
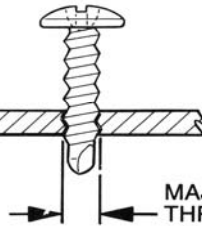
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TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFIED AXIAL LOAD
AND DRILLING SPEED



LIMIT SWITCH STOPS
AXIAL LOAD & ROTATION



CROSS - SECTIONAL VIEW
OF DRILL TEST PLATE

.060 - .064 THICK
RB60 - 85

MAJOR DIAMETER
THROUGH PLATE, THREADS
COMPLETELY FORMED



TIMER - SECONDS



TIMER - SECONDS

DRILL DRIVE TEST

5. DRILL-DRIVE TEST

Applicable To:
Test Purpose:

Self-Drilling Screws only.

To detect parts which drill too slowly, requiring too much manual effort to drive, or which will not drill at all, causing production problems.

Specification:
Apparatus Required:

See charts that follow.

- A. Drill Testing Equipment (DST-201).
- B. Test Plates .060-.064 thick, RB 60-85.

Minimum Recommended
Sample Size:

- A. up to 5,000 pc 6 pieces
 - B. 5,001 to 15,000 pc 12 pieces
 - C. 15,001 to 50,000 pc 18 pieces
 - D. 50,001 to 250,000 pc 25 pieces
- Note: 250,000 is maximum lot size

E. If 1 piece of the above sample size exceeds the minimum drill time, double the sample size and retest to the sampling plan below.

Sample Size	Slow Drill ¹	Excessive Drill ²
12	1	0
24	1	0
36	2	1
50	3	1

Note: (1) "Slow Drill" means parts exceeded maximum drill time by less than twice.

(2) "Excessive Drill" means parts exceeded maximum drill time by greater than twice.

Procedure:

- A. Load screws in tester.
- B. Adjust tester so that it stops and records the time elapsed as soon as the screw drills its hole and forms 1 full thread beyond the test plate.
- C. Record the timed results.

Failure:

Screws fail when they exceed the "Drill-Drive" times specified in the performance chart based on the sampling plan above.

Possible Failure Causes:

- A. Burrs on drill point.
- B. Case Hardness too low.
- C. Case Hardness too thin.
- D. Test Plate too hard.
- E. Test Plate too thick.
- F. Axial load too light.
- G. Driver too slow.
- H. Excessive Plating Buildup.



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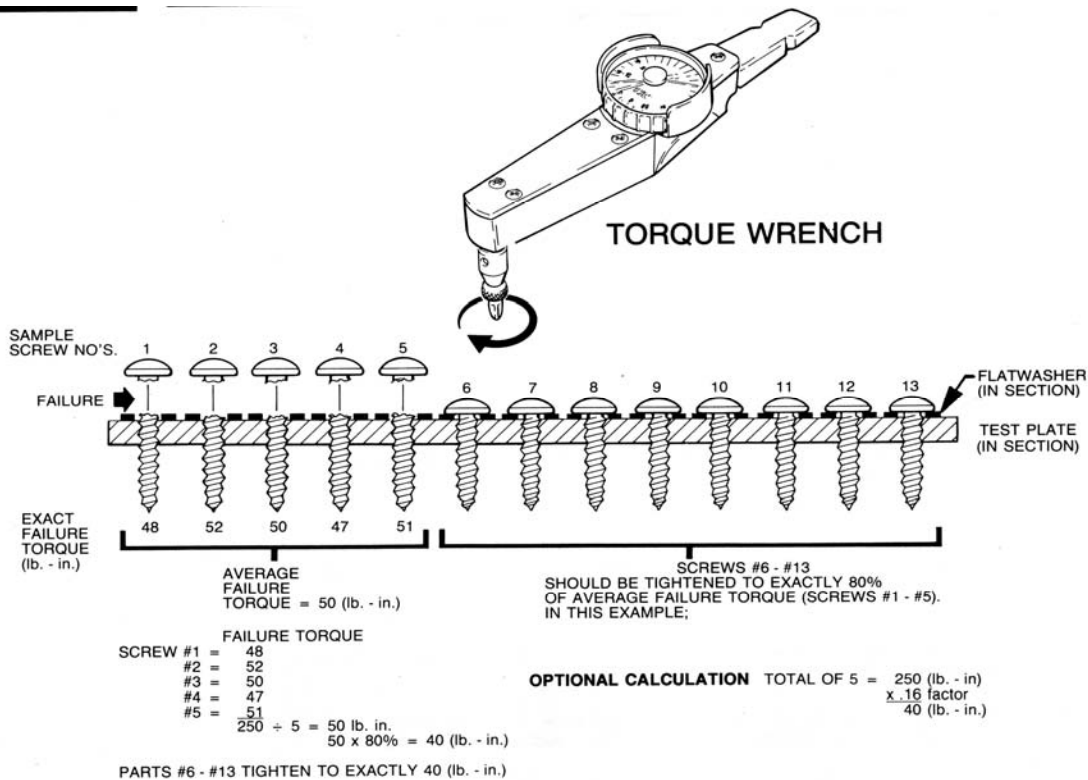
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TAPPING SCREW PERFORMANCE SPECIFICATIONS



HYDROGEN EMBRITTLEMENT TEST

6. HYDROGEN EMBRITTLEMENT TEST

Applicable to:
Test Purpose:

Warning:

Specifications:

Apparatus required:

Minimum Recommended Sample Size:

Procedure:

Failure:

Possible Failure Causes:

All electroplated Tapping Screws.

To detect parts which may have a delayed failure up to 24 hours after installation in the assembly resulting from hydrogen induced during cleaning or plating. This is a particularly damaging failure because, unlike other types of failures, it does not occur at the time of assembly but only hours after the assembly is made. Its detection and correction after assembly can be costly, involving extensive disassembly, rework and reassembly, or in some cases, complete scrap.

As a precaution all electroplated tapping screws should be baked after plating a minimum of 4 hours at temperature at 400 degrees Fahrenheit. This should be specified on all purchase orders.

Parts must not fracture within 24 hours after being seated at 80% of the average failure torque of 5 parts from the same lot.

- A. Specified Test Plates
- B. Flat Washers
- C. Torque Wrench; accurate within +/-2% (TW-xxx).

8 pieces per lot; lot size not to exceed 250,000. (8 pcs. is minimum. Since Hydrogen Embrittlement frequently occurs in a small percentage of a lot, a better practice is to test at least 50 pcs. per lot.)

A. Place washers on 13 screws to ensure that the parts are seated completely on the underside of the head and not on a shoulder or underhead radius. Total thickness of washers should be .080 minimum.
B. Drive all 13 screws into the correct test plate but do not seat. **Note:** Self-Drilling Screws are required to drill their own hole in the correct test plate.

C. Tighten 5 pieces until screw twists into 2 or more pieces or strips out. Record the 5 values and calculate the average. Multiply that average by .80 (80%) to determine the "Test Tightening Torque."

Note: An optional calculation is to multiply the sum of the 5 failure values by .16 (16%).

D. Seat the 8 remaining pieces to the "Test Tightening Torque."

E. Allow parts to sit 24 hours and retighten to the "Test Tightening Torque."

The entire lot fails if any head separates from its shank during the 24 hour period or when retightened.

- A. Parts were not baked after electroplating.
- B. Parts were tightened to too high a value.
- C. Washers were not used under the head so that the clamp force was not properly distributed or the underhead radius was damaged in tightening.
- D. Recess is too deep.



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TAPPING SCREW PERFORMANCE SPECIFICATIONS

7. COMBINATION TEST RECOMMENDATIONS

Purpose of Recommendation: The following 3 or at least 2 of the 3 tests should be done on all tapping screws to determine their acceptability. This combined test will help you to do all 3 in the least amount of time.

Tests: Drive Test.
Drive Torque Test (Thread Rolling Screws only).
Hydrogen Embrittlement Test.

Procedure (per lot):

- A. Place flat washers on 13 screws to insure tension underhead upon seating.
- B. Drive all screws into the specified test plate so that the major diameter of the screw thread protrudes completely through the plate but do not seat the parts.
- C. If testing Thread Rolling Screws, record the maximum driving torque and compare to the specification to determine acceptability (Drive Torque Test, Test #4.)
- D. Examine all of the screw threads protruding through the plate. If any of the threads are deformed the lot is rejectable (Drive Test, Test #3).
- E. Tighten 5 of the 13 parts to failure (screws broken into 2 or more pieces). Record the failure values and calculate the sum. Multiply the sum by .16 (16%) to determine the "Test Tightening Torque." Tighten the next 8 or more screws (**8 pcs. is minimum. Since Hydrogen Embrittlement frequently occurs in a small percentage of a lot, a better practice is to test at least 50 pcs. per lot**) to that value and allow to sit for 24 hours. Retighten the parts to the "Test Tightening Torque" after 24 hours. If any parts break before or while retightening the lot is rejectable.

8. HARDNESS TESTING

Applicable To: All Tapping Screws.
Test Purpose: To analyze parts which have failed one or more of the previously described performance tests.
Apparatus:

- A. Core hardness
 - 1. Belt sander (S-100).
 - 2. Standard Hardness Tester (HTR-100).
- B. Case Hardness: Micro-Hardness Tester (MHP-500).

Specification:

	All except Self-Drilling Screws	Self-Drilling Screws
Core Hardness:	RC 28-38	RC 32-39
Case Hardness:	RC 45 min.	RC 52-58
Case Depth:	#2 through #6 .002-.007	same
	#7 through #12 .004-.009	same
	1/4 and larger .006-.011	same

Minimum Recommended Sample Size: 8 pc. per lot; lot size not to exceed 250,000.

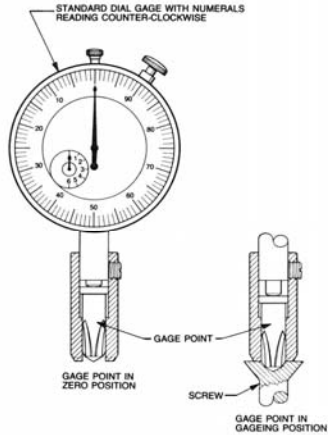
Note: Material shall be from cold heading quality, killed steel wire having 0.13%-0.27% carbon and 0.64-1.71% manganese.



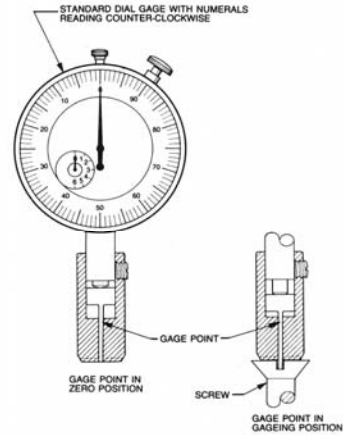
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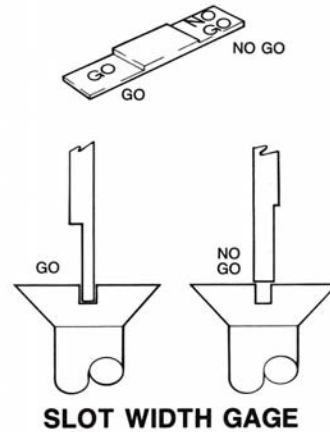
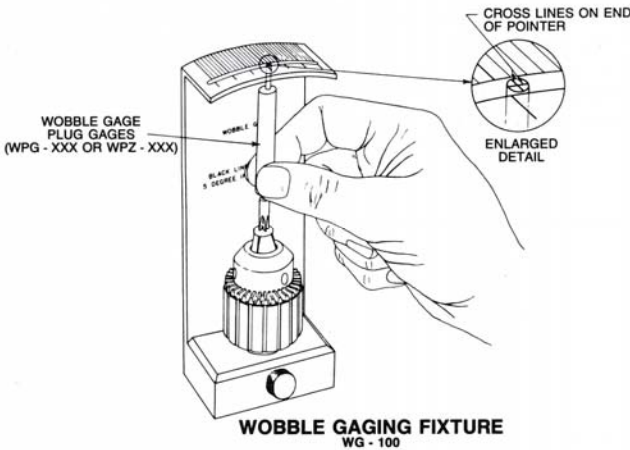




RECESS PENETRATION GAGE



SLOT DEPTH GAGE



SLOT WIDTH GAGE

9. RECESS AND SLOT MEASUREMENT

Applicable To:
Test Purpose:

All Tapping Screws having recesses or slots.
To detect parts which will be difficult to drive because of sloppy driver fit. All tapping screws require effective torque delivery to install properly for good seating and to prevent driver disengagement damage to other assembly parts.

Apparatus Required:

A. Penetration Gage and Wobble Gage for Phillips, Pozidriv, Frearson. B. Slot Width Gages and Slot Depth Gages for Slotted Heads.

Sample Size:

100 pieces per lot; lot size not to exceed 250,000.

Procedure:

A. Penetration Gage provides an actual measurement of the gaging penetration depth of crossed recesses. This measurement should fall within the specified tolerance.
B. Wobble Gage measures the angular tightness of the recess within specified maximum limits.
C. Slot Width Gages measure on a Go-NoGo basis for acceptability.
D. Slot Depth Gages provide an actual slot depth measurement.

Failure:

Lots are rejectable if more than 2 pieces of the 100 samples exceed the specification limits.

Possible Failure Causes:

A. Poor manufacturing control on dimensions.
B. Incorrect gage use.



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FIP-1000.7	Self Drilling Screws; Inch and Metric

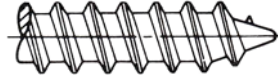




TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFICATION F.I.P. – 1000.1

TYPE A
- inch only -



TYPE A

SIZE	DUCTILITY minimum degrees	MINIMUM TORSIONAL STRENGTH lb.-in.	TEST PLATES (RB 70-85)		HYDROGEN EMBRITTLMENT TORQUE lb.-in.
			Thickness +/- .002	Hole Size +/- .001	
2-32	10	4	.048	.076	SEE NOTE BELOW
3-28	10	9	.048	.081	
4-24	10	12	.048	.086	
5-20	10	18	.048	.1065	
6-18	10	24	.075	.116	
7-16	10	30	.075	.1285	
8-15	10	39	.075	.136	
9-14	10	43	.075	.149	
10-12	10	48	.125	.159	
12-11	10	83	.125	.1875	
14-10	10	125	.125	.2165	
16-10	10	152	.1875	.238	
18-9	10	196	.1875	.261	
20-9	10	250	.1875	.290	
24-9	10	492	.1875	.3438	
Minimum Sample Size	8 pcs	4 pcs			13 pcs

HYDROGEN EMBRITTLMENT TEST

(All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material
Cold Heading Quality Killed Steel Wire
0.13%-0.27% Carbon
0.64%-1.71% Manganese

Case Hardness
RC 45 min.

Core Hardness
RC 28-38

Case Depth
#2 through #6 .002-.007
#7 through #12 .004-.009
1/4 and larger .006-.011

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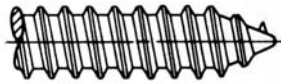




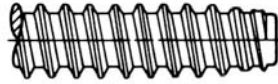
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SPECIFICATION F.I.P. – 1000.2

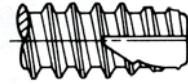
TYPE AB, B, BT(25)
- INCH AND METRIC -



TYPE AB



TYPE B



TYPE BT

SIZE		DUCTILITY Minimum degrees	MINIMUM TORSIONAL STRENGTH Lb.-in.*	TEST PLATES (RB 70-85)		HYDROGEN EMBRITTLMENT TORQUE Lb.-in.*
INCH	METRIC			Thickness +/- .002 in**	Hole Size +/- .001 in**	
2-32	M2.2 X 0.79	10	4	.048	.076	SEE NOTE BELOW
3-28		10	9	.048	.081	
4-24	M2.9 X 1.06	10	13	.048	.086	
5-20		10	18	.048	.1065	
6-20	M3.5 X 1.27	10	24	.075	.116	
7-19		10	30	.075	.1285	
8-18	M4.2 X 1.41	10	39	.075	.136	
10-16	M4.8 X 1.59	10	56	.125	.159	
12-14	M5.5 X 1.81	10	88	.125	.1875	
1/4-14	M6.3 X 1.81	10	142	.1875	.2165	
5/16-12	M8 X 2.12	10	290	.1875	.272	
3/8-12	M9.5 X 2.12	10	590	.1875	.3281	
Minimum Sample Size		8 pcs	4 pcs			

*one lb.-in. equals .113 Nm

**one inch equals 25.4mm

HYDROGEN EMBRITTLEMENT TEST

(All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material
Cold Heading Quality Killed Steel Wire
0.13%-0.27% Carbon
0.64%-1.71% Manganese

Case Hardness
RC 45 min.

Core Hardness
RC 28-38

Case Depth
#2 through #6 .002-.007
#7 through #12 .004-.009
1/4 and larger .006-.011

August 2003



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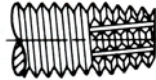




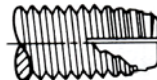
TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFICATION F.I.P. – 1000.3

TYPE F, AND T(23) - INCH -



TYPE F



TYPE T(23)

SIZE	DUCTILITY Minimum degrees	MINIMUM TORSIONAL STRENGTH Lb.-in.	TEST PLATES (RB 70-85)		HYDROGEN EMBRITTLMENT TORQUE Lb.-in.
			Thickness +/- .002	Hole Size +/- .001	
2-56	10	5	.078	.073	SEE NOTE BELOW
3-48	10	9	.094	.081	
4-40	10	13	.109	.096	
5-40	10	18	.109	.101	
6-32	10	23	.140	.120	
8-32	10	42	.140	.147	
10-24	10	56	.1875	.173	
10-32	10	74	.1875	.177	
12-24	10	93	.1875	.199	
1/4-20	10	140	.250	.228	
1/4-28	10	179	.250	.234	
5/16-18	10	306	.3125	.290	
5/16-24	10	370	.3125	.295	
Minimum Sample Size	8 pcs	4 pcs			

HYDROGEN EMBRITTLMENT TEST

(All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material
Cold Heading Quality Killed Steel Wire
0.13%-0.27% Carbon
0.64%-1.71% Manganese

Case Hardness
RC 45 min.

Core Hardness
RC 28-38

Case Depth
#2 through #6 .002-.007
#7 through #12 .004-.009
1/4 and larger .006-.011

August 2003



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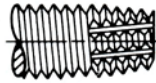




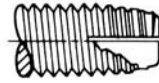
TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFICATION F.I.P. – 1000.4

TYPE F, AND T(23) - METRIC -



TYPE F



TYPE T(23)

SIZE	DUCTILITY Minimum degrees	MINIMUM TORSIONAL STRENGTH Lb.-in.*	TEST PLATES (RB 70-85)		HYDROGEN EMBRITTLMENT TORQUE Lb.-in.*
			Thickness +/- .002 in**	Hole Size +/- .001 in**	
M2 X .04	10	4	.078	.067	SEE NOTE BELOW
M2.5 X .045	10	10	.094	.083	
M3 X 0.5	10	18	.109	.102	
M3.5 X 0.6	10	27	.140	.122	
M4 X 0.7	10	41	.140	.138	
M5 X 0.8	10	83	.1875	.177	
M6 X 1.0	10	142	.250	.213	
M8 X 1.25	10	354	.312	.291	
Minimum Sample Size	8 pcs	4pcs			13 pcs

*one lb.-in. equals .113 Nm

**one inch equals 25.4mm

HYDROGEN EMBRITTLMENT TEST (All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material
Cold Heading Quality Killed Steel Wire
0.13%-0.27% Carbon
0.64%-1.71% Manganese

Case Hardness
RC 45 min.

Core Hardness
RC 28-38

Case Depth
#2 through #6 .002-.007
#7 through #12 .004-.009
1/4 and larger .006-.011

August 2003



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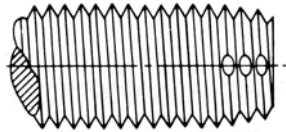
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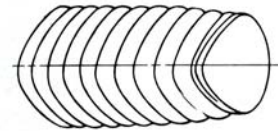
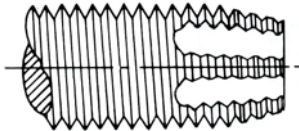


TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFICATION F.I.P. – 1000.5



THREAD ROLLING SCREWS
- INCH -



SIZE	DUCTILITY Min. degrees	MINIMAL TORSIONAL STRENGTH Lb.-in.	TEST PLATES (RB 70-85)		DRIVE TORQUE		HYDROGEN EMBRITTLMENT TORQUE Lb.-in.
			Thickness +/- .002	Hole Size +/- .001	Phos & Oil Cad Lb.-in.	Zinc Lb.-in.	
2-56	10	6	.125	.075	4.5	6	SEE NOTE BELOW
3-48	10	10	.125	.087	7.5	9.5	
4-40	10	14	.125	.098	9	13	
5-40	10	22	.125	.110	12	16	
6-32	10	24	.125	.120	14	20	
8-32	10	48	.1875	.147	25	32	
10-24	10	65	.1875	.166	35	52	
10-32	10	74	.1875	.172	35	52	
1/4-20	10	156	.250	.219	90	120	
5/16-18	10	330	.312	.277	180	240	
3/8-16	10	600	.375	.339	240	300	
Minimum Sample Size	8 pcs	4 pcs			4 pcs	4 pcs	13 pcs

HYDROGEN EMBRITTLMENT TEST

(All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material
Cold Heading Quality Killed Steel Wire
0.13%-0.27% Carbon
0.64%-1.71% Manganese

Case Hardness
RC 45 min.

Core Hardness
RC 28-38*

Case Depth
#2 through #6 .002-.007
#7 through #12 .004-.009
1/4 and larger .006-.011

January 2004

*Note: The possibility of the occurrence of hydrogen embrittlement is greatly reduced if the core hardness is restricted to a maximum of RC 36.



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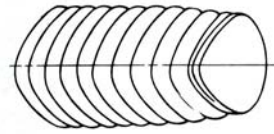
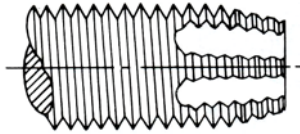
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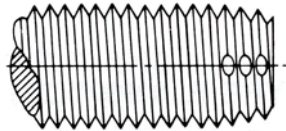


TAPPING SCREW PERFORMANCE SPECIFICATIONS

SPECIFICATION F.I.P. – 1000.6



THREAD ROLLING SCREWS - METRIC -



SIZE	DUCTILITY Min. degrees	MINIMUM TORSIONAL STRENGTH Lb.-in.*	TEST PLATES (RB 70-85)		DRIVE TORQUE		HYDROGEN EMBRITTLMENT TORQUE lb.-in.*
			Thickness +/- .002**	Hole Size +/- .001**	Phos & Oil Cad Lb.-in.*	Zinc Lb.-in.*	
M2x0.4	10	6	.125	.070	4	5	SEE NOTE BELOW
M2.5x0.45	10	11	.125	.088	7	9	
M3x0.5	10	19	.125	.106	11	15	
M3.5x0.6	10	31	.125	.124	17	21	
M4x0.7	10	46	.207	.142	22	30	
M5x0.8	10	93	.207	.179	42	53	
M6x1.0	10	157	.250	.2125	66	81	
M8x1.25	10	380	.315	.2875	142	177	
M10x1.5	10	770	.394	.362	248	310	
Minimum Sample Size	8 pc	4 pc			4 pc	4 pc	

* one lb.-in. equals .113 Nm

** one inch equals 25.4 mm

HYDROGEN EMBRITTLMENT TEST (All Electroplated Tapping Screws)

1. Seat 5 screws with flat washers under head into the correct test plate to screw failure and record all 5 torque values.
2. Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
3. Using 8 more screws from the same lot, seat them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
4. After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material	Case Hardness	Core Hardness	Case Depth
Cold Heading Quality Killed Steel Wire 0.13% - 0.27% Carbon 0.64% - 1.71% Manganese	RC 45 min.	RC 28-38*	#2 through #6 .002-.007 #7 through #12 .004-.009 ¼ and larger .006-.011

January 2004

* Note: The possibility of the occurrence of hydrogen embrittlement is greatly reduced if the core hardness is restricted to a maximum of RC 36.



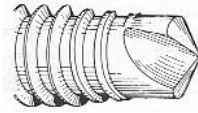
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TAPPING SCREW PERFORMANCE SPECIFICATIONS SPECIFICATION F.I.P. – 1000.7



SELF DRILLING SCREWS

SIZE		DUCTILITY Minimum degrees	TORSIONAL STRENGTH Min. lb.-in.*	HYDROGEN EMBRITTLEMENT		TORQUE Minimum lb.-in.*
Inch	Metric			TEST PLATE (RB 60-85) +/- .002 in**		
				Style 2	Style 3	
4-24	M2.9 x 1.06	5	14	.079	--	SEE NOTE BELOW
6-20	M3.5 x 1.27	5	24	.090	.110	
8-18	M4.2 x 1.41	5	42	.098	.142	
10-16	M4.8 x 1.59	5	61	.110	.173	
12-14	M5.5 x 1.81	5	92	.142	.209	
1/4-14	M6.3 x 2.21	5	150	.173	.209	
Minimum Sample Size		8 pc	4 pc			

SIZE		TEST PLATE (RB 90-85) Thickness +/- .002 in.**	DRILL SPEED RPM	AXIAL LOAD			DRILL-DRIVE TIME Max. sec.
Inch	Metric			FINISH			
				A	B	C	
4-24	M2.9 x 1.06	.062	2500	25	30	45	2.0
6-20	M3.5 x 1.27	.062	2500	30	35	45	2.5
8-18	M4.2 x 1.41	.062	2500	30	35	45	3.0
10-16	M4.8 x 1.59	.062	2500	35	40	50	3.5
12-14	M5.5 x 1.81	.062	1800	45	50	60	4.0
1/4-14	M6.3 x 2.12	.062	1800	45	50	60	5.0
Minimum Recommended Sample Size			See Note 2				See Note 3

NOTES:

*one lb.-in. equals .113 Nm
**one inch equals 25.4mm

1. Finish Classifications:		3. Sample Size:		B. If any parts exceed drill time double sample size and retest		
A. Plating thicknesses up to .0003 thickness.	Lot Size	Sample Size	Acceptable Defects	Sample Size	Slow Drill	Excessive Drill
B. Plating thicknesses over .0003 thickness.	0-5,000	6	0	12	1	0
C. Chrome plated parts.	5,001-15,000	12	0	24	1	0
	15,001-50,000	18	0	36	2	1
	50,001 and over	25	0	50	3	1

2. Tool speed shall be 2500 RPM for screw sizes #4 through #10. Tool speed of 1800 RPM is recommended for screw sizes #12 and 1/2. However, 2500 RPM may be used provided care is exercised to minimize influence of high heat buildup due to surface speed

"Slow Drill" is time in excess of the maximum drill time but less than twice the maximum.
"Excessive Drill" is time in excess of maximum drill time by more than twice the maximum.

HYDROGEN EMBRITTLEMENT TEST Applicable to Electroplated Self Drilling Screws.

- Drill and drive 5 screws with flat washers under head into the correct test plate to screw breaking failure and record all 5 torque values.
- Add the 5 values and multiply the sum by .16 (16%) to determine the "Test Tightening Torque."
- Using 8 more screws from the same lot, drill and drive them with flat washers under head into the same test plate to the "Test Tightening Torque" and allow to sit 24 hours.
- After 24 hours retighten to same value as in Step #3. If any parts fail during the 24 hour period or when retightening the lot is rejectable.

MATERIAL AND HEAT TREAT

Material	Hardness	Case Depth
Cold Heading Quality Killed Steel Wire	Case Hardness RC 52-58	#2 through #6 .002-.007
0.13%-0.27% Carbon	Core Hardness RC 32-39	#8 through #12 .004-.009
0.64%-1.71% Manganese		1/4 .006-.011

Note: The possibility of the occurrence of hydrogen embrittlement is greatly reduced if the core hardness is restricted to a maximum of RC 36.



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TAPPING SCREW PERFORMANCE TEST
(all types)

End User: _____ Date: _____
Distributor: _____
Supplier: _____
PO# to Supplier: _____ Quantity Received: _____
Part Number: _____
Description: _____

Test Results Summary (details on back)

Inspector: _____		<u>Passed</u>	<u>Failed</u>
Test #1	Ductility	_____	_____
Test #2	Torsional Strength	_____	_____
Test #3	Drive Test (except BT)	_____	_____
Test #4	Drive Torque (TRS only)	_____	_____
Test #5	Hydrogen Embrittlement	_____	_____

DISPOSITION:

PASSED AND ACCEPTED: _____

FAILED: _____ A. Conditionally accepted for production trial

_____ B. Rejected and returned to vendor for replacement

Return authorized by _____

Date _____

COMMENTS

Signed: _____



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PART DESCRIPTION:

Test #1: Ductility 10 degrees (5 degrees Self-Drilling Screws only)

Test 8 pieces

Pass _____ Fail _____

Test #2: Torsional Strength; Min. Torque

Test 4 pieces

#1 _____ #2 _____ #3 _____ #4 _____

Test #3: Drive Test

Test 4 pieces

Pass _____ Fail _____

Test #4: Drive Torque (TRS only); Max. Torque _____

Test 4 pieces

#1 _____ #2 _____ #3 _____ #4 _____

Pass _____ Fail _____

Test #5: Hydrogen Embrittlement

A. Torque 5 pieces to failure (washers overhead)

_____ + _____ + _____ + _____ + _____ = _____
x .16

Test Tightening Torque: _____

B. Tighten 8 pieces of Test Tightening Torque.
Leave for 24 hours and retighten to same value.

Pass _____ Fail _____



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SELF-DRILLING SCREW DRILL-DRIVE PERFORMANCE TEST REPORT

End User: _____ Date: _____

Distributor: _____

Supplier: _____

PO# to Supplier: _____ Quantity Received: _____

Part Description: _____

Specifications: Axial Load _____ Speed _____ Max. Time _____

Initial Test

Retest

Sample Size _____

Sample Size _____

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____
- 9 _____
- 10 _____
- 11 _____
- 12 _____
- 13 _____
- 14 _____
- 15 _____
- 16 _____
- 17 _____
- 18 _____
- 19 _____
- 20 _____
- 21 _____
- 22 _____
- 23 _____
- 24 _____
- 25 _____

- | | | | |
|----|-------|----|-------|
| 1 | _____ | 26 | _____ |
| 2 | _____ | 27 | _____ |
| 3 | _____ | 28 | _____ |
| 4 | _____ | 29 | _____ |
| 5 | _____ | 30 | _____ |
| 6 | _____ | 31 | _____ |
| 7 | _____ | 32 | _____ |
| 8 | _____ | 33 | _____ |
| 9 | _____ | 34 | _____ |
| 10 | _____ | 35 | _____ |
| 11 | _____ | 36 | _____ |
| 12 | _____ | 37 | _____ |
| 13 | _____ | 38 | _____ |
| 14 | _____ | 39 | _____ |
| 15 | _____ | 40 | _____ |
| 16 | _____ | 41 | _____ |
| 17 | _____ | 42 | _____ |
| 18 | _____ | 43 | _____ |
| 19 | _____ | 44 | _____ |
| 20 | _____ | 45 | _____ |
| 21 | _____ | 46 | _____ |
| 22 | _____ | 47 | _____ |
| 23 | _____ | 48 | _____ |
| 24 | _____ | 49 | _____ |
| 25 | _____ | 50 | _____ |

_____ Pass _____ Fail

#Slow _____ #Excessive _____

_____ Pass _____ Fail

Signed _____



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