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.
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

The content of this standard is advisory only and its use by anyone is entirely voluntary. Reliance on its content for any purpose by anyone is at the sole risk of that person and F.I.P. is not responsible for any loss, claim or damage arising therefrom. These tests are intended as referee tests for acceptance but the user must determine if a given fastener is suitable and acceptable in his own application regardless of these test results. In compiling this standard, F.I.P. has made a determined effort to present its contents accurately. If errors exist they are typographical and F.I.P. is not responsible for any claim traceable to such error. F.I.P. has not investigated, nor will it investigate, patents which may apply to the subject contents. Prospective users of this standard are responsible for advising themselves and protecting themselves against any patent infringement liability which may arise out of such use.
**F.I.P. 1000**

**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.
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.
3. DRIVE TEST

Applicable To: All Tapping Screws except BT(25).
Test Purpose: To detect parts whose threads may collapse during installation, causing parts to drive improperly or not at all.
 Specification: See charts that follow.
Apparatus required:
A. Appropriate test plates (TP-xx-xx).
B. Driving tools (power driver optional; do not exceed 500 RPM).
Minimum Recommended Sample Size: 4 pieces per lot; lot size not to exceed 250,000
Procedure:
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.”
Failure: The parts have failed if the threads which penetrated the plate have deformed to any extent at all.
Possible Failure Cause:
A. Case Hardness too shallow.
B. Case Hardness too low.
C. Test Plate too hard.
D. Test Plate hole too small.
4. DRIVE TORQUE TEST

Applicable To: Thread Rolling Screws only.
Test Purpose: 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.
Specification: See charts that follow.
Apparatus required:
A. Specified test plates (same as those for "Drive Test").
B. Torque Wrench, accurate within +/–2% (TW-xxx).

Minimum Recommended Sample Size: 4 pieces per lot; lot size not to exceed 250,000.
Procedure:
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."

Failure: 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.

Possible Failure Causes:
5. DRILL-DRIVE TEST

Applicable To: Self-Drilling Screws only.
Test Purpose: 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: See charts that follow.
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.

<table>
<thead>
<tr>
<th>Sample Size</th>
<th>Slow Drill¹</th>
<th>Excessive Drill²</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>50</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

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.
6. HYDROGEN EMBRITTLEMENT TEST

Applicable to: All electroplated Tapping Screws.

Test Purpose: 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.

Warning: 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.

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

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

Minimum Recommended Sample Size: 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.)

Procedure:
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."

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

Possible Failure Causes:
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.
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.”

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:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Core Hardness</th>
<th>Case Hardness</th>
<th>Case Depth</th>
<th>Minimum Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>All except Self-Drilling Screws</td>
<td>RC 28-38</td>
<td>RC 45 min.</td>
<td>#2 through #6: .002-.007</td>
<td>8 pc. per lot; lot size not to exceed 250,000.</td>
</tr>
<tr>
<td>Self-Drilling Screws</td>
<td>RC 32-39</td>
<td>RC 52-58</td>
<td>#7 through #12: .004-.009</td>
<td>same</td>
</tr>
<tr>
<td></td>
<td>#1/4 and larger: .006-.011</td>
<td>same</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Applicable To: All Tapping Screws having recesses or slots.

Test Purpose: 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:
- 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.
## TABLE OF CONTENTS

- **FIP-1000.1** Type A; Inch
- **FIP-1000.2** Types AB B BT; Inch and Metric
- **FIP-1000.3** Type F and T (23); Inch
- **FIP-1000.4** Type F and T (23); Metric
- **FIP-1000.5** Thread Rolling Screw; Inch
- **FIP-1000.6** Thread Rolling Screw; Metric
- **FIP-1000.7** Self Drilling Screws; Inch and Metric
## TAPPING SCREW PERFORMANCE SPECIFICATIONS
### SPECIFICATION F.I.P. – 1000.1

### TYPE A
- inch only -

### TEST PLATES (RB 70-85)

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DUCTILITY minimum degrees</th>
<th>MINIMUM TORSIONAL STRENGTH lb.-in.</th>
<th>Thickness +/- .002</th>
<th>Hole Size +/- .001</th>
<th>HYDROGEN EMBRITTLEMENT TORQUE lb.-in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-32</td>
<td>10</td>
<td>4</td>
<td>.048</td>
<td>.076</td>
<td></td>
</tr>
<tr>
<td>3-28</td>
<td>10</td>
<td>9</td>
<td>.048</td>
<td>.081</td>
<td></td>
</tr>
<tr>
<td>4-24</td>
<td>10</td>
<td>12</td>
<td>.048</td>
<td>.086</td>
<td></td>
</tr>
<tr>
<td>5-20</td>
<td>10</td>
<td>18</td>
<td>.048</td>
<td>1.065</td>
<td></td>
</tr>
<tr>
<td>6-18</td>
<td>10</td>
<td>24</td>
<td>.075</td>
<td>.116</td>
<td></td>
</tr>
<tr>
<td>7-16</td>
<td>10</td>
<td>30</td>
<td>.075</td>
<td>1.285</td>
<td></td>
</tr>
<tr>
<td>8-15</td>
<td>10</td>
<td>39</td>
<td>.075</td>
<td>.136</td>
<td></td>
</tr>
<tr>
<td>9-14</td>
<td>10</td>
<td>43</td>
<td>.075</td>
<td>.149</td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>10</td>
<td>48</td>
<td>.125</td>
<td>.159</td>
<td></td>
</tr>
<tr>
<td>12-11</td>
<td>10</td>
<td>83</td>
<td>.125</td>
<td>.1875</td>
<td></td>
</tr>
<tr>
<td>14-10</td>
<td>10</td>
<td>125</td>
<td>.125</td>
<td>.2165</td>
<td></td>
</tr>
<tr>
<td>16-10</td>
<td>10</td>
<td>152</td>
<td>.1875</td>
<td>.238</td>
<td></td>
</tr>
<tr>
<td>18-9</td>
<td>10</td>
<td>196</td>
<td>.1875</td>
<td>.261</td>
<td></td>
</tr>
<tr>
<td>20-9</td>
<td>10</td>
<td>250</td>
<td>.1875</td>
<td>.290</td>
<td></td>
</tr>
<tr>
<td>24-9</td>
<td>10</td>
<td>492</td>
<td>.1875</td>
<td>.3438</td>
<td></td>
</tr>
<tr>
<td>Minimum Sample Size</td>
<td>8 pcs</td>
<td>4 pcs</td>
<td></td>
<td></td>
<td>13 pcs</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Material</th>
<th>Case Hardness</th>
<th>Core Hardness</th>
<th>Case Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Heading Quality Killed Steel Wire 0.13%-0.27% Carbon 0.64%-1.71% Manganese</td>
<td>RC 45 min.</td>
<td>RC 28-38</td>
<td>#2 through #6 .002-.007 #7 through #12 .004-.009 1/4 and larger .006-.011</td>
</tr>
</tbody>
</table>

August 2003
# TAPPING SCREW PERFORMANCE SPECIFICATIONS

**SPECIFICATION F.I.P. – 1000.2**

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

![Image of screws](image)

### TYPE AB

### TYPE B

### TYPE BT

### TAPPING SCREW PERFORMANCE SPECIFICATIONS

#### SIZE

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DUCTILITY Minimum degrees</th>
<th>MINIMUM TORSIONAL STRENGTH Lb.-in.*</th>
<th>TEST PLATES (RB 70-85)</th>
<th>HYDROGEN EMBRITTLEMENT TORQUE Lb.-in.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Thickness +/- .002 in**</td>
<td>Hole Size +/- .001 in**</td>
<td></td>
</tr>
<tr>
<td>INCH</td>
<td>METRIC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-32</td>
<td>M2.2 X 0.79</td>
<td>10</td>
<td>4</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.076</td>
</tr>
<tr>
<td>3-28</td>
<td>M2.9 X 1.06</td>
<td>10</td>
<td>9</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.081</td>
</tr>
<tr>
<td>4-24</td>
<td>M3.5 X 1.27</td>
<td>10</td>
<td>13</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.086</td>
</tr>
<tr>
<td>5-20</td>
<td>M4.2 X 1.41</td>
<td>10</td>
<td>18</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.1065</td>
</tr>
<tr>
<td>6-20</td>
<td>M4.8 X 1.59</td>
<td>10</td>
<td>24</td>
<td>.075</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.116</td>
</tr>
<tr>
<td>7-19</td>
<td>M5.5 X 1.81</td>
<td>10</td>
<td>30</td>
<td>.075</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.1285</td>
</tr>
<tr>
<td>8-18</td>
<td>M6.3 X 2.12</td>
<td>10</td>
<td>39</td>
<td>.075</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.136</td>
</tr>
<tr>
<td>10-16</td>
<td>M7 X 2.32</td>
<td>10</td>
<td>56</td>
<td>.125</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.159</td>
</tr>
<tr>
<td>12-14</td>
<td>M8 X 2.52</td>
<td>10</td>
<td>88</td>
<td>.125</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.1875</td>
</tr>
<tr>
<td>1/4-14</td>
<td>M6.3 X 1.81</td>
<td>10</td>
<td>142</td>
<td>.1875</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.2165</td>
</tr>
<tr>
<td>5/16-12</td>
<td>M8 X 2.12</td>
<td>10</td>
<td>290</td>
<td>.1875</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.272</td>
</tr>
<tr>
<td>3/8-12</td>
<td>M9.5 X 2.12</td>
<td>10</td>
<td>590</td>
<td>.1875</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.3281</td>
</tr>
</tbody>
</table>

**Minimum Sample Size**
- 8 pcs
- 4 pcs
- 13 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

<table>
<thead>
<tr>
<th>Material</th>
<th>Case Hardness</th>
<th>Core Hardness</th>
<th>Case Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Heading Quality Killed Steel Wire</td>
<td>RC 45 min.</td>
<td>RC 28-38</td>
<td>#2 through #6 .002-.007</td>
</tr>
<tr>
<td>0.13%-0.27% Carbon</td>
<td></td>
<td></td>
<td>#7 through #12 .004-.009</td>
</tr>
<tr>
<td>0.64%-1.71% Manganese</td>
<td></td>
<td></td>
<td>1/4 and larger .006-.011</td>
</tr>
</tbody>
</table>

August 2003
TAPPING SCREW PERFORMANCE SPECIFICATIONS
SPECIFICATION F.I.P. – 1000.3

TYPE F, AND T(23)
- INCH -

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

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

<table>
<thead>
<tr>
<th>Material</th>
<th>Case Hardness</th>
<th>Core Hardness</th>
<th>Case Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Heading Quality Killed Steel Wire</td>
<td>RC 45 min.</td>
<td>RC 28-38</td>
<td>#2 through #6 .002-.007</td>
</tr>
<tr>
<td>0.13%-0.27% Carbon</td>
<td></td>
<td></td>
<td>#7 through #12 .004-.009</td>
</tr>
<tr>
<td>0.64%-1.71% Manganese</td>
<td></td>
<td></td>
<td>1/4 and larger .006-.011</td>
</tr>
</tbody>
</table>

August 2003

Greenslade & Company, Inc.
2234 Wenneca Ave., Fort Worth, TX 76102 USA
Phone: 817-870-8888 Fax: 817-870-9199
E-mail: sales@greensladeandcompany.com Web site: www.greensladeandcompany.com
### TAPPING SCREW PERFORMANCE SPECIFICATIONS

**SPECIFICATION F.I.P. – 1000.4**

#### TYPE F, AND T(23) - METRIC –

![TYPE F](image1) ![TYPE T(23)](image2)

**TEST PLATES (RB 70-85)**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DUCTILITY Minimum degrees</th>
<th>MINIMUM TORSIONAL STRENGTH Lb.-in.*</th>
<th>TEST PLATES Thickness +/- .002 in**</th>
<th>Hole Size +/- .001 in**</th>
<th>HYDROGEN EMBRITTLEMENT TORQUE Lb.-in.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2 X .04</td>
<td>10</td>
<td>4</td>
<td>.078</td>
<td>.067</td>
<td>SEE NOTE BELOW</td>
</tr>
<tr>
<td>M2.5 X .045</td>
<td>10</td>
<td>10</td>
<td>.094</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>M3 X .5</td>
<td>10</td>
<td>18</td>
<td>.109</td>
<td>.102</td>
<td></td>
</tr>
<tr>
<td>M3.5 X .6</td>
<td>10</td>
<td>27</td>
<td>.140</td>
<td>.122</td>
<td></td>
</tr>
<tr>
<td>M4 X .7</td>
<td>10</td>
<td>41</td>
<td>.140</td>
<td>.138</td>
<td></td>
</tr>
<tr>
<td>M5 X .8</td>
<td>10</td>
<td>83</td>
<td>.1875</td>
<td>.177</td>
<td></td>
</tr>
<tr>
<td>M6 X 1.0</td>
<td>10</td>
<td>142</td>
<td>.250</td>
<td>.213</td>
<td></td>
</tr>
<tr>
<td>M8 X 1.25</td>
<td>10</td>
<td>354</td>
<td>.312</td>
<td>.291</td>
<td></td>
</tr>
<tr>
<td>Minimum Sample Size</td>
<td>8 pcs</td>
<td>4 pcs</td>
<td></td>
<td></td>
<td>13 pcs</td>
</tr>
</tbody>
</table>

*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**

<table>
<thead>
<tr>
<th>Material</th>
<th>Case Hardness</th>
<th>Core Hardness</th>
<th>Case Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Heading Quality Killed Steel Wire</td>
<td>RC 45 min.</td>
<td>RC 28-38</td>
<td>#2 through #6 .002-.007</td>
</tr>
<tr>
<td>0.13%-0.27% Carbon</td>
<td></td>
<td></td>
<td>#7 through #12 .004-.009</td>
</tr>
<tr>
<td>0.64%-1.71% Manganese</td>
<td></td>
<td></td>
<td>1/4 and larger .006-.011</td>
</tr>
</tbody>
</table>

August 2003
# TAPPING SCREW PERFORMANCE SPECIFICATIONS

**SPECIFICATION F.I.P. – 1000.5**

## THREAD ROLLING SCREWS

- **INCH** -

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DUCTILITY Min. degrees</th>
<th>MINIMAL TORSIONAL STRENGTH Lb.-in.</th>
<th>TEST PLATES (RB 70-85)</th>
<th>DRIVE TORQUE</th>
<th>HYDROGEN EMBRITTLEMENT TORQUE Lb.-in.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Thickness +/- .002</td>
<td>Hole Size +/- .001</td>
<td>Phos &amp; Oil Cad Lb.-in.</td>
<td>Zinc Lb.-in.</td>
</tr>
<tr>
<td>2-56</td>
<td>10</td>
<td>6</td>
<td>.125</td>
<td>.075</td>
<td>4.5</td>
</tr>
<tr>
<td>3-48</td>
<td>10</td>
<td>10</td>
<td>.125</td>
<td>.087</td>
<td>7.5</td>
</tr>
<tr>
<td>4-40</td>
<td>10</td>
<td>14</td>
<td>.125</td>
<td>.098</td>
<td>9</td>
</tr>
<tr>
<td>5-40</td>
<td>10</td>
<td>22</td>
<td>.125</td>
<td>.110</td>
<td>12</td>
</tr>
<tr>
<td>6-32</td>
<td>10</td>
<td>24</td>
<td>.125</td>
<td>.120</td>
<td>14</td>
</tr>
<tr>
<td>8-32</td>
<td>10</td>
<td>48</td>
<td>.1875</td>
<td>.147</td>
<td>25</td>
</tr>
<tr>
<td>10-24</td>
<td>10</td>
<td>65</td>
<td>.1875</td>
<td>.166</td>
<td>35</td>
</tr>
<tr>
<td>10-32</td>
<td>10</td>
<td>74</td>
<td>.1875</td>
<td>.172</td>
<td>35</td>
</tr>
<tr>
<td>1/4-20</td>
<td>10</td>
<td>156</td>
<td>.250</td>
<td>.219</td>
<td>90</td>
</tr>
<tr>
<td>5/16-18</td>
<td>10</td>
<td>330</td>
<td>.312</td>
<td>.277</td>
<td>180</td>
</tr>
<tr>
<td>3/8-16</td>
<td>10</td>
<td>600</td>
<td>.375</td>
<td>.339</td>
<td>240</td>
</tr>
</tbody>
</table>

Minimum Sample Size: 8 pcs for sample size 4 pcs

### 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

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.
### TAPPING SCREW PERFORMANCE SPECIFICATIONS
**SPECIFICATION F.I.P. – 1000.6**

**THREAD ROLLING SCREWS**
- **METRIC** -

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DUCTILITY Min. degrees</th>
<th>MINIMUM TORSIONAL STRENGTH Lb.-in.*</th>
<th>TEST PLATES (RB 70-85)</th>
<th>DRIVE TORQUE</th>
<th>HYDROGEN EMBRITTLEMENT TORQUE lb.-in.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Thickness +/- .002**</td>
<td>Hole Size +/- .001**</td>
<td>Phos &amp; Oil Cad Lb.-in.*</td>
<td>Zinc Lb.-in.*</td>
</tr>
<tr>
<td>M2x0.4</td>
<td>10</td>
<td>6</td>
<td>.125</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>M2.5x0.45</td>
<td>10</td>
<td>11</td>
<td>.125</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>M3x0.5</td>
<td>10</td>
<td>19</td>
<td>.125</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>M3.5x0.6</td>
<td>10</td>
<td>31</td>
<td>.125</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>M4x0.7</td>
<td>10</td>
<td>46</td>
<td>.207</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>M5x0.8</td>
<td>10</td>
<td>93</td>
<td>.207</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>M6x1.0</td>
<td>10</td>
<td>157</td>
<td>.250</td>
<td>66</td>
<td>81</td>
</tr>
<tr>
<td>M8x1.25</td>
<td>10</td>
<td>380</td>
<td>.315</td>
<td>142</td>
<td>177</td>
</tr>
<tr>
<td>M10x1.5</td>
<td>10</td>
<td>770</td>
<td>.394</td>
<td>245</td>
<td>310</td>
</tr>
</tbody>
</table>

| Minimum Sample Size | 8 pc | 4 pc | 4 pc | 4 pc | 13 pc |

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

**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**

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

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

SELF DRILLING SCREWS

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

Minimum Sample Size
8 pc
4 pc
13 pc

<table>
<thead>
<tr>
<th>SIZE</th>
<th>Inch</th>
<th>Metric</th>
<th>TEST PLATE (RB 90-85) Thickness +/- .002 in**</th>
<th>DRILL SPEED RPM</th>
<th>AXIAL LOAD FINISH</th>
<th>DRILL-DRIVE TIME Max. sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2500</td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2500</td>
<td></td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>4-24</td>
<td>5</td>
<td>M2.9 x 1.06</td>
<td>2500</td>
<td>25</td>
<td>30</td>
<td>45</td>
</tr>
<tr>
<td>6-20</td>
<td>5</td>
<td>M3.5 x 1.27</td>
<td>2500</td>
<td>35</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>8-18</td>
<td>5</td>
<td>M4.2 x 1.41</td>
<td>2500</td>
<td>35</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>10-16</td>
<td>5</td>
<td>M4.8 x 1.59</td>
<td>2500</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>12-14</td>
<td>5</td>
<td>M5.5 x 1.81</td>
<td>1800</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>1/4-14</td>
<td>5</td>
<td>M6.3 x 2.12</td>
<td>1800</td>
<td>45</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

Minimum Sample Size
Recommended Sample Size
See Note 2
See Note 3

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

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.

3. 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.

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.

HYDROGEN EMBRITTLEMENT TEST
Applicable to Electroplated Self Drilling Screws.

1. 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.

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, 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.

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
Hardness: 0.13%-0.27% Carbon
Case Depth: 0.64%-1.71% Manganese

Greenslade & Company, Inc.
2234 Wrennea Ave., Fort Worth, TX 76102 USA
Phone: 817-870-8888 Fax: 817-870-9199
E-mail: greensladeandcompany@sbcglobal.net
Web site: www.greensladeandcompany.com
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)

<table>
<thead>
<tr>
<th>Inspector: ___________________________</th>
<th>Passed</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test #1  Ductility</td>
<td>______</td>
<td>______</td>
</tr>
<tr>
<td>Test #2  Torsional Strength</td>
<td>______</td>
<td>______</td>
</tr>
<tr>
<td>Test #3  Drive Test (except BT)</td>
<td>______</td>
<td>______</td>
</tr>
<tr>
<td>Test #4  Drive Torque (TRS only)</td>
<td>______</td>
<td>______</td>
</tr>
<tr>
<td>Test #5  Hydrogen Embrittlement</td>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>

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: ___________________________

Greenslade & Company, Inc.
2234 Wrennca Ave., Fort Worth, TX 76102 USA  Phone: 817-870-8888 Fax: 817-870-9199
E-mail: greensladeandcompany@sbcglobal.net  Web site: www.greensladeandcompany.com
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 underhead)
      ______ + ______ + ______ + ______ + ______ = ______
      x .16
      Test Tightening Torque: ______
   B. Tighten 8 pieces of Test Tightening Torque.
      Leave for 24 hours and retighten to same value.
      Pass ______  Fail ______
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 ______

<table>
<thead>
<tr>
<th>Initial Test</th>
<th>Retest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>Sample Size</td>
</tr>
<tr>
<td>1 ______</td>
<td>1 ______</td>
</tr>
<tr>
<td>2 ______</td>
<td>2 ______</td>
</tr>
<tr>
<td>3 ______</td>
<td>3 ______</td>
</tr>
<tr>
<td>4 ______</td>
<td>4 ______</td>
</tr>
<tr>
<td>5 ______</td>
<td>5 ______</td>
</tr>
<tr>
<td>6 ______</td>
<td>6 ______</td>
</tr>
<tr>
<td>7 ______</td>
<td>7 ______</td>
</tr>
<tr>
<td>8 ______</td>
<td>8 ______</td>
</tr>
<tr>
<td>9 ______</td>
<td>9 ______</td>
</tr>
<tr>
<td>10 ______</td>
<td>10 ______</td>
</tr>
<tr>
<td>11 ______</td>
<td>11 ______</td>
</tr>
<tr>
<td>12 ______</td>
<td>12 ______</td>
</tr>
<tr>
<td>13 ______</td>
<td>13 ______</td>
</tr>
<tr>
<td>14 ______</td>
<td>14 ______</td>
</tr>
<tr>
<td>15 ______</td>
<td>15 ______</td>
</tr>
<tr>
<td>16 ______</td>
<td>16 ______</td>
</tr>
<tr>
<td>17 ______</td>
<td>17 ______</td>
</tr>
<tr>
<td>18 ______</td>
<td>18 ______</td>
</tr>
<tr>
<td>19 ______</td>
<td>19 ______</td>
</tr>
<tr>
<td>20 ______</td>
<td>20 ______</td>
</tr>
<tr>
<td>21 ______</td>
<td>21 ______</td>
</tr>
<tr>
<td>22 ______</td>
<td>22 ______</td>
</tr>
<tr>
<td>23 ______</td>
<td>23 ______</td>
</tr>
<tr>
<td>24 ______</td>
<td>24 ______</td>
</tr>
<tr>
<td>25 ______</td>
<td>25 ______</td>
</tr>
</tbody>
</table>

Pass ______ Fail ______

#Slow ______ #Excessive ______

Pass ______ Fail ______

Signed __________________________