by Larry Borowski

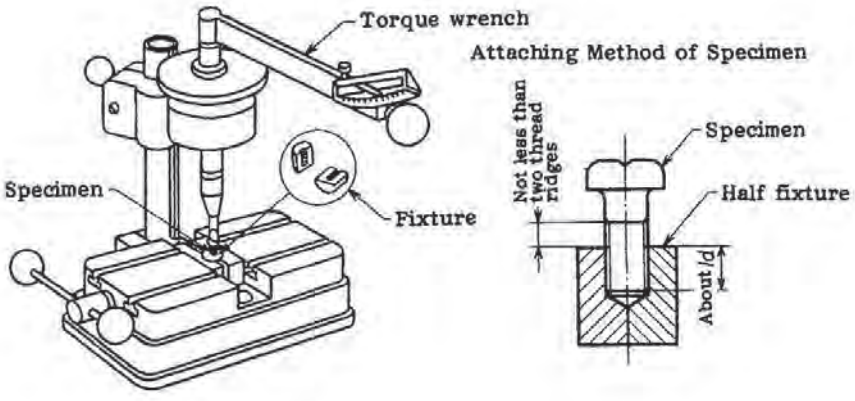
Torsional Strength Test
is Critical in Many Tapping Screw Specifications

Tapping Screws must be both dimensionally and physically compliant to their applicable specifications to perform properly for end-users. Unfortunately, many fastener suppliers only evaluate the dimensional size of the parts they supply and ignore the required physical tests that evaluate the strength and fastening performance of the parts.

The Torsional Strength test or Breaking Torque test is one of the most widely specified physical tests in tapping screw standards. The Torsional Strength test determines if a screw has adequate strength to perform its intended function when put into final use. In most screw specifications in which the torsional strength test is required, the parts are not required to be tested for tensile strength. The torsional strength of a screw determines its ability to resist being twisted into two pieces where as the tensile test determines a screw or bolt's ability to resist being pulled from end-to-end into two pieces.

Below is a list of consensus standards that contain requirements for Torsional Strength testing of tapping screws.

ASME B18.6.4	ISO 2702
SAE J78	ISO 3506-1
SAE J81	ISO 898-7
SAE J933	JIS B 1125
SAE J1237	DIN 7504
	DIN 7500



Although these standards do not always agree on the Torsional Strength values for a particular size fastener, fortunately for screw suppliers there is agreement regarding the testing apparatus and the procedure. The typical torsional strength testing apparatus is illustrated below.

Torsional Strength Test Apparatus

1. The purpose of the torsional strength testing fixture is to enable the operator to establish and maintain full engagement of the screw driving tool with the screw's driving feature throughout the torsional strength test.

   The upper arm of the fixture can be adjusted up and down its main shaft to accommodate the testing of screws having various lengths. On the end of the upper arm is the fixture's rotating shaft through which the torsional testing torque is applied to the screw. The lower end of this shaft generally has a male square drive to which various screw driving bits or drive sockets can be affixed.

   The lower base of the fixture provides a channel directly below the rotating shaft for clamping the split collets that hold the screw by the thread without deforming it while the torsional test is performed.

2. Threaded split collets are used for holding the screws during the test and come in two styles. One style is for testing screws less than ¼" or 6 mm in diameter, and generally are small in size and fit into a split collet holder. The collet holder fits into the channel in the base of the test fixture. The other style is for screws greater than ¼" or 6 mm in diameter and are generally larger and fit directly into the channel of the fixture's base without need for the collet holder.

   It is critical that screws be gripped in these threaded split collets to prevent the threads from being crushed or cut by the clamping action. The collets

also keep the screws from rotating while being tested. If the threads are crushed or cut when clamped, as is the case when screws are clamped in a vise, the screw's torsional values are frequently lower than when the parts are held properly in the threaded split collets.

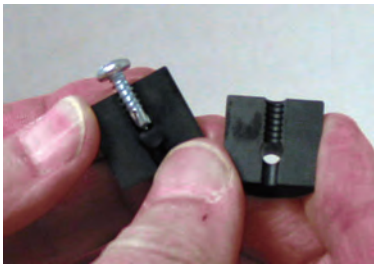
3. A calibrated torque wrench is engaged in the fixture's rotating center shaft on top of the fixture for measuring the amount of torque required to twist the test screw into two pieces. Torque wrenches come in many styles and types, both analog and digital. The only critical features of the torque wrench used to perform the torsional strength test is that it must be calibrated and it should have a "memory needle" mechanism or peak torque function that indicates the highest torque value occurring during each test.

The torque wrench calibration requirements vary slightly among the standards and specifications, but the most common requirement is for the wrench to be accurate to within +/- 2%. Torque wrenches are not necessarily accurate in the lower 20% of their full range and should not be used for testing in that lowest 20% range.

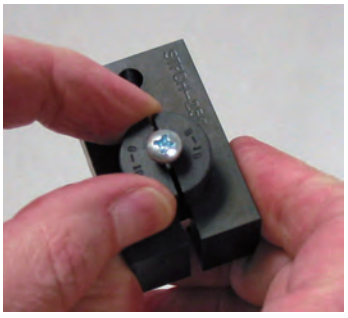
The step-by-step procedure is explained below:

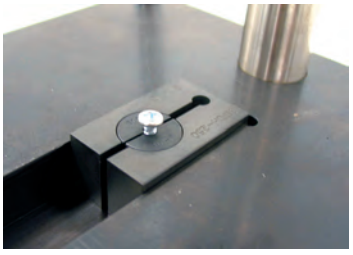
Torsional Test Procedure

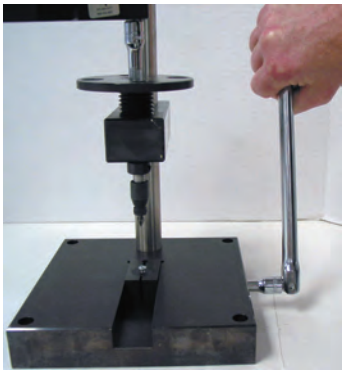
1. The threaded split collet that matches the test screw's size and thread pitch is selected, and the screw is screwed into the collet while the collet is not yet clamped in the fixture's base. For proper testing, at least two screw thread pitches must remain above the top surface of the collet. At the same time, for extremely short screws, there should be at least two screw thread pitches captured by the split collet.



2. The collet is placed in the split collet holder. The split collet holder is then placed in the fixture's base so that the screw is positioned directly below the rotating spindle of the fixture. The clamp in the fixture's base is then tightened sufficiently to prevent the screw from turning in the collet when the torque is applied to the screw.

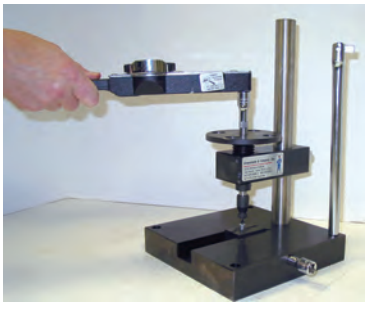






3. The appropriate style and size driver bit or socket is affixed to the lower end of the fixture's rotating shaft using an adaptor or bit holder if necessary. The upper arm is lowered until the bit or socket fully engages the screw's recess or head and the upper arm is firmly clamped to the fixture's main shaft. The driver or socket's height relative to the screw's head can be further adjusted by rotating the threaded adjustment wheel which houses the fixture's rotating shaft in the upper arm.

4. The torque wrench is firmly engaged in the upper end of the rotating shaft's female square recess. The wrenches indicator is set to "zero" before any torque is exerted on the wrench.



5. A smooth continuous torque is applied by the torque wrench until the screw twists into two separate pieces. The torsional strength of the tested screw is the highest torque value observed on the wrench at any point during the test.

Note: All torque wrenches have a specific point on the handle where the force must be exerted to achieve accurate torque values. This point is designated as a notch, pivot, or by some other means. The operator's force should be concentrated at that designated location on the wrench handle to achieve accurate and repeatable results.

Torsional strength testing is an integral part of many tapping screw standards and specifications. When screws exceed their minimum required torsional strength in the applicable specification, it is a good indication that the screw will perform properly in its intended application. Torsional Strength or Breaking Torque tests should be performed by screw suppliers using the appropriate testing apparatus and the correct test procedure to assure the validity of the results obtained by testing. ■