Measuring Recess Strength...a Requirement on Military Screws

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Inspecting a screw's recess strength is another one of those requirements which has been on the books since at least 1977, but was largely ignored by fastener producers until the recent past. This requirement is covered in several military related specifications, but the most widely used is MIL-B-87114A.

The purpose of this requirement is to insure that a screw can be properly tightened in its application and removed without distorting or destroying its recess. In MIL-B-87114A this requirement is stated in paragraph 3.2.3.5 and the test procedure is detailed in paragraph 4.3.10. The test torque values are listed in **Table III**. The recess styles currently covered by this specification are at least the ribbed cruciform, the standard and ribbed off set cruciform, and the dovetail slot.

If the inspector has the proper test fixture (STF-87114), **Figure1**, the procedure is relatively fast and simple. The test steps are as follows:

1. The correct size and style of driver bit is placed in the test fixture's bit holder.
2. The screw is securely clamped into the test fixture chuck.
3. The 20-lbs (± 1lb) test weight is placed on the fixture lever arm. Notice that the end load pressure is applied through the screw holding chuck of the fixture so that the pressure cannot be influenced by the inspector when applying test torque.
4. The test bit is engaged in the screw's recess and the bit's height location is adjusted in the fixture so that the end load lever arm is level.
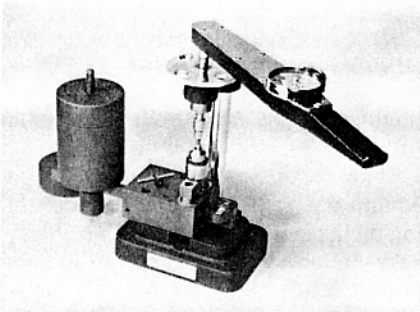

Fig.1 — STF-87114A test fixture.

Table III. Head, Shank, and Torque Values

Flush Tension Head   **Pan Head**   **Flush Reduced Head**

Nominal Dia (inch)	100° Flush tension and pan head bolt				100° Flush reduced head bolt			
	H Gage protrusion (inch) 1/	V Gage Dia (inch) 1/	Shank straightness (inches per inch)	Recess minimum torque (lbf-in)	H Gage protrusion (inch)	V Gage Dia (inch)	Shank straightness (inches per inch)	Recess minimum torque (lbf-in)
0.190	.0300 .0275	.3147 .3145	.0030	50	.0220 .0195	.2441 .2439	.0030	35
0.250	.0360 .0330	.4245 .4243	.0030	125	.0255 .0225	.3315 .3313	.0030	50
0.312	.0410 .0375	.5389 .5387	.0030	250	.0295 .0260	.4047 .4045	.0030	125
0.375	.0460 .0420	.6532 .6530	.0025	430	.0320 .0285	.4854 .4852	.0025	250
0.438	.0465 .0425	.7784 .7782	.0025	925	.0415 .0375	.5697 .5695	.0025	430
0.500	.0535 .0490	.8902 .8900	.0020	1250	.0425 .0380	.6499 .6497	.0020	750
0.562	.0590 .0540	1.0028 1.0026	.0020	1650	.0490 .0440	.7200 .7198	.0020	1100
0.625	.0660 .0610	1.1124 1.1122	.0020	2400	.0515 .0460	.8011 .8009	.0020	1400
0.750	.0760 0700	1.3440 1.3438	.0020		.0550 .0490	.9702 .9700	.0020	
0.875	.0855 .0785	1.5732 1.5730	.0020		.0890 .0820	1.1124 1.1122	.0020	
1.000	.0955 .0890	1.8026 1.8024	.0020		.0980 .0915	1.2896 1.2894	.0020	
1.125	.1600 .1515	1.9214 1.9212	.0020					
1.250	.1810 .1715	2.1286 2.1284	.0020					

1/ Not applicable to pan head bolts.

5. By using a calibrated torque wrench the test torque from **Table III** is applied first in the tightening and then in the loosening direction. Each screw is tested this way only once.
6. The wing or slot widths of the recess are to be measured to determine if they have been distorted. This measurement is usually made by using a microscope or optical comparator.
7. All flush head screws must be measured for their protrusion height to determine if the recess has been distorted by raising a burr around the recess. The proper protrusion measuring fixtures must be used to make this measurement.

Screw are rejectable based on this requirement if:
a. Recess strips out in either direction below the specified torque values.
b. Recess is distorted so that the wing or slot widths measure too wide after testing.
c. Recess is distorted so that the protrusion height measures too high after testing.

As stated in the beginning, recess strength testing has been frequently ignored in the past. Now and in the future fastener suppliers must not ignore this or any of the other tests required in the specifications they are responsible for following.