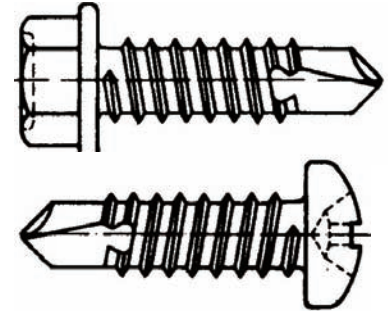


Which Self Drilling Screw Specification Should be Followed?

by Larry Borowski

Most purchasers of self drilling screws do not indicate a particular specification when ordering. Therefore, manufacturers of self drilling screws must have a set of requirements they will routinely use when they are not given specific instructions by the buyer.

There are three main standards that cover self drilling screw requirements. These standards are: SAE J78, JIS B1125, and DIN 7504. The requirements are similar, but not exactly the same. The following charts compare their major requirements:



Strength and Hardness

Size		SAE J78			JIS B1125			DIN 7504		
Inch	Metric	Torsional Strength (Nm)	Case Hardness	Core Hardness	Torsional Strength (Nm)	Case Hardness	Core Hardness	Torsional Strength (Nm)	Case Hardness	Core Hardness
#6	3.9	2.7	HV 544 Minimum	HV 318 to 392	3.4	HV 550 Minimum	HV 240 to 450	3.4	HV 560 Minimum	HV 270 to 425
#8	4.2	4.7			4.4			4.5		
#10	4.8	6.9			6.3			6.5		
#12	5.5	10.4			10.0			10.0		
1/4	6.3	17.0			13.0			14.0		

Drilling Performance

Size		SAE J78			JIS B1125			DIN 7504		
Inch	Metric	Test Plate Thickness (mm) *	End Load (Newtons)	Maximum Time (seconds)	Test Plate Thickness (mm) *	End Load (Newtons)	Maximum Time (seconds)	Test Plate Thickness (mm) *	End Load (Newtons)	Maximum Time (seconds)
#6	3.9	1.65	134	2.5	1.60	155	3.0	2.00	150	4.5
#8	4.2	1.65	134	3.0	1.60	155	3.0	3.00	250	5.0
#10	4.8	1.65	156	3.5	1.60	180	3.5	4.00	250	7.0
#12	5.5	1.65	200	4.0	1.60	220	4.0	5.00	350	11.0
1/4	6.3	1.65	200	5.0	1.60	220	5.0	5.00	350	13.0
Drilling Speed (rpm)		2500 #6-#10 1800 #12 & 1/4			2500-3000 all sizes			1800-2500 #6-#10 1000-1800 #12 & 1/4		

*Note: Test material should be cold rolled steel with a hardness of Rockwell B65-80.

Based on experience with the manufacturing and testing of self drilling screws, I do not believe any one of the above specifications is better than the other. I believe some parts of the various specifications are more practical than the others, but I find them all lacking in their approach to testing for hydrogen embrittlement.

When buyers do not clearly define their requirements for self drilling screws I suggest manufacturers adopt the requirements shown in the following chart. If a buyer does raise a quality concern, a manufacturer using the following chart for their internal requirements can claim to be in compliance with all three specifications listed above.

Recommended Performance Requirements for Self Drilling Screw Manufacturers

Size		Strength & Hardness			Drilling Performance		
Inch	Metric	Torsional Strength (Nm)	Case Hardness	Core Hardness	Test Plate Thickness (mm) *	End Load (Newtons)	Maximum Time (seconds)
#6	3.9	3.4	HV 560 Minimum	HV 318 to 392	2.00	150	4.5
#8	4.2	4.7			3.00	250	5.0
#10	4.8	6.9			4.00	250	7.0
#12	5.5	10.4			5.00	350	11.0
1/4	6.3	17.0			5.00	350	13.0
Drill Speed (rpm)		1800 – 2500 all sizes					

Note: Test material should be cold rolled steel with a hardness of Rockwell B65-80.

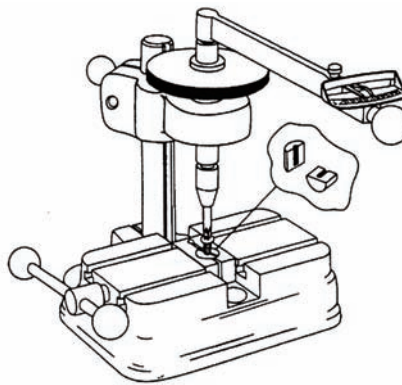
The drilling requirements in SAE J78 or JIS B1125 are not as demanding as many of the applications in which self drilling screws are used. The more stringent drilling requirements in DIN 7504 are more representative of the use of many self drilling screw applications. The DIN specification requires heavier test end load forces and allows longer drilling times than do the SAE and JIS specifications.

The high allowable core hardness values in JIS B1125 and DIN 7504 are concerning because the possibility for hydrogen embrittlement increases directly with the core hardness of screws. Hydrogen embrittlement is very unlikely when a screw's core hardness is not greater than HV 354 (RC 36). When the self drilling screws will be electroplated I recommend manufacturers try to restrict core hardness to between HV 318 and 354 if possible to lessen the possibility of the occurrence of hydrogen embrittlement.

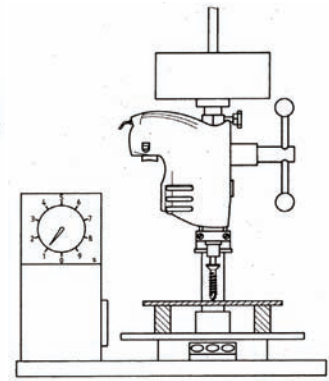
Neither JIS B1125 or DIN 7504 address hydrogen embrittlement testing and I do not feel the test requirements in SAE J78 are the best available testing for hydrogen embrittlement. I believe the testing torque for each lot of screws should be determined by testing instead of using a standard test torque for all lots of screws of a given diameter. Below is the hydrogen embrittlement test procedure I feel is the best for helping detect hydrogen embrittlement before parts are shipped to users.

Hydrogen Embrittlement Test Procedure:

1. Place hardened washers having a thickness equal or greater in thickness than two thread pitches (if the thread pitch is 1.4 mm, the washer thickness should be at least 2.8 mm) on the test screws.
2. Drill 5 screws into the material thicknesses shown above in the DIN 7504 specification until the point penetrates the bottom of the plate, but do not



Torsional Strength Test



Drill Time Test

seat the screws. Using a torque wrench, tighten the screws until they twist in two. Record the breaking values.

3. Calculate the test torque value by determining the average failure value of all five screws and then multiply that value by .80.

4. Drill at least 25, and preferably 50, pieces from each manufacturing lot in the test plate, but do not seat them. Using a torque wrench seat every screw to the test value calculated in Step #3.

5. After 24 hours, apply the same test torque value again in the clockwise (tightening) direction. If any part breaks, hydrogen embrittlement is present and the entire lot should be reprocessed. For additional caution the re-tightening can be performed at 48 and 72 hours.

If no parts break before or during the re-tightening, hydrogen embrittlement is probably not present in the manufacturing lot from which the screws were taken.

Self drilling screws are very useful labor-saving fasteners. Users are seldom concerned about exactly how fast they drill as long as they drill consistently without the points breaking off or burning up during use. Before shipment, if self drilling screws meet the above requirements for torsional strength, drilling performance, and hydrogen embrittlement before shipment, users will be satisfied when using the screws in production applications.