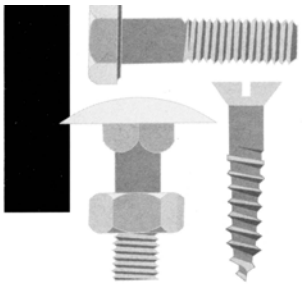
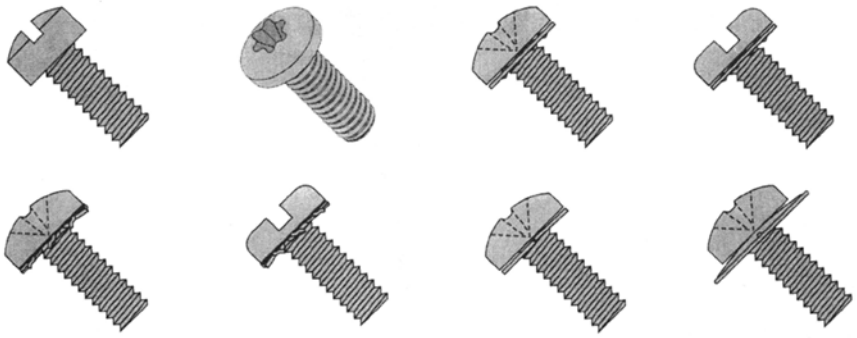


What Torque Should Be Used to Tighten Inch Machine Screws?

by Joe Greenslade



A lot is written about bolt and nut tightening, but little is written about tightening machine screws. It is just as important to carefully select an appropriate tightening torque for securing machine screw joints as it is for securing bolt and nut joints. Properly secured joints are directly related to the quality of the end product assembly. The means of calculating the suggested tightening torque is the same for machine screws as it is for bolts. The values are just smaller.

CALCULATING MACHINE SCREW TIGHTENING TORQUE VALUES

The most widely used formula for calculating threaded fastener tightening torque is:

T = DKP

Where:

T = Torque in inch pounds (in. lb.)
D = Nominal thread major diameter
K = Nut factor
P = Pounds of clamping force

There are strength levels of inch machine screws and each has a different recommended tightening value. SAE J82 has two machine screw strength levels: Grade 60M and Grade 120M. The Grade 60M indicates a minimum tensile strength of 60,000 P.S.I.; the 120M indicates 120,000 P.S.I. minimum tensile strength. Grade 5.2 in SAE J429 is the equivalent of the SAE J82 Grade 120M having a minimum ultimate tensile strength of 120,000 P.S.I.

DETERMINING TIGHTENING TORQUE BY TESTING

The chart on page 53 provides reasonable tightening values, but they are not the optimum tightening values for every application. A far better way to establish a tightening torque for a particular application is by conducting a simple study.

To determine the ideal tightening torque for any particular application joint, do the following:

1. Make up 12 of the exact application joints being studied.
2. Tighten the machine screws until something in the joint completely fails; then record every failure torque value.

   The best failure is the twisting in two of the screw, but this does not always happen. The internal thread may strip; the components may crush or distort. It makes no difference what fails.
3. Calculate the average torque value at which this particular joint fails.
4. The optimum tightening value for the particular joint being studied is 60% of the average failure value.

Joe Greenslade has been active in the fastener industry since 1970. He has held positions with major fastener producers in sales engineering, marketing, product design, manufacturing management, and research and development management.

Mr. Greenslade holds twelve U.S. patents on various fastener related products. He has authored over 136 trade journal articles on fastener applications, manufacturing and quality issues. He is one of the fastener industry's most frequent speakers at trade association meetings and conferences. He is the youngest person ever inducted to the Fastener Industry Hall of Fame.

Mr. Greenslade is active in numerous fastener industry associations and societies holding office in several of them.

In addition to guiding the activities of Greenslade & Company, Mr. Greenslade works as a consultant with fastener suppliers and end users on product design, applications engineering, and quality issues. In this capacity he works to resolve fastener applications problems, to help select the best fastening approaches in new product designs, to assist in the standardization of fasteners used within an organization, and to provide training on various aspects of fastening technology and fastener quality assurance. He also serves as Expert Witness in litigation involving fastener related issues. He can be reached at: phone 817-870-8888, fax 817-870-9199 or email: greensladeandcompany@sbcglobal.net.

Tighten Torque Values for Zinc Electroplated Inch Machine Screws

Size	SAE J82, 60M	SAE J82, 120M SAE J429, Gd 5.2
	in. lb.	in. lb.
4-40	5	10
4-48	6	12
5-40	8	16
5-44	8	16
6-32	10	20
6-40	11	22
8-32	18	37
8-36	19	38
10-24	26	53
10-32	30	60
12-24	41	81
12-28	43	87
1/4-20	63	125
1/4-28	73	145
5/16-18	130	260
5/16-24	144	289
3/8-16	230	460
3/8-24	260	520

Notes:
1. D = decimal inch major diameter
2. K = .22 nut factor for zinc electroplating
3. P = 60% of minimum ultimate tensile strength

CALCULATIONS ARE FINE, BUT TESTING IS SUPERIOR

The correct tightening of all threaded fasteners is critical to obtaining an end product of consistently high quality and dependability. Determining tightening torque by calculations or taking values from charts like the one provided in this article is better than just guessing at what a particular torque should be. The best approach to establishing the optimum tightening torque value for a particular joint is determined by performing the simple study described above. ■

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