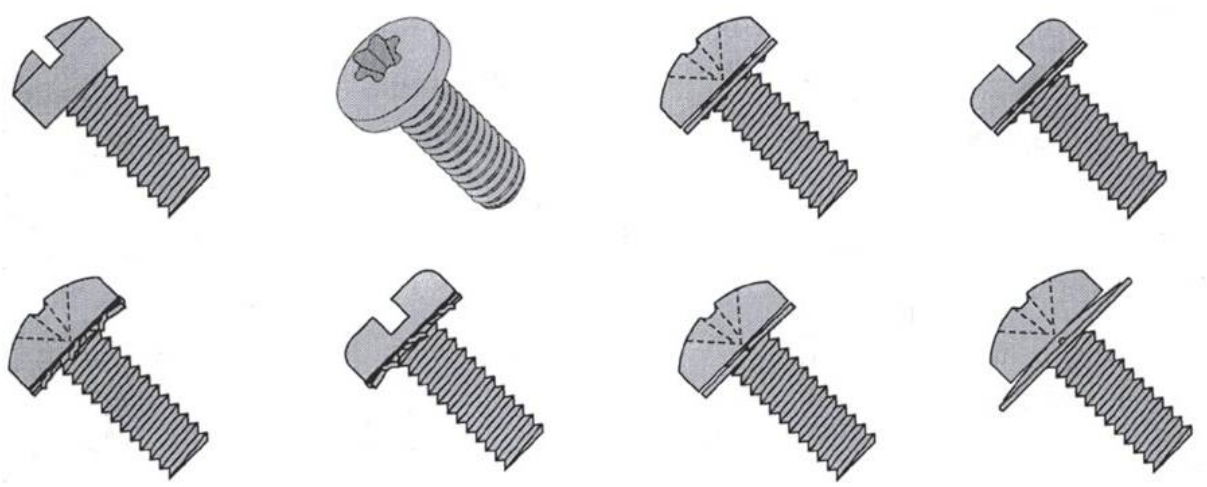
What Torque Should Be Used To Tighten Metric Machine Screws?



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 (inch pounds and Newton meters; 1Nm = 9 in.lb.)
D = Nominal thread diameter (expressed in inches; 1 mm = .03937 inches)
K = Nut factor (.22 for zinc electroplating)
P = Pounds of clamping force (75% of yield strength)

There are various strength levels of metric machine screws and each has a different recommended tightening value. ISO has two predominate machine screw strength levels: Property Class 4.8 (close to SAE 60M) and Property Class 8.8 (close to SAE 120M). Property Class 4.8 indicates a minimum tensile strength of 480 mega pascal (MPa). This is equal to approximately 70,000 pounds per square inch (PSI). Property Class 8.8 indicates a minimum tensile strength of 880 mega pascal (MPa). This is equal to approximately 127,000 pounds per square inch (PSI).

Tighten Torque Values for Metric Machine Screws with Zinc Electroplated Finish

Thread Size	Property Class 4.8		Property Class 8.8	
	inch pounds	Newton meters	inch pounds	Newton meters
M3 X 0.50	7	0.8	14	1.6
M3.5 X 0.6	12	1.3	22	2.5
M4 X 0.70	17	1.9	33	3.6
M5 X 0.80	35	3.9	66	7.4
M6 X 1.00	60	6.7	113	12.5
M8 X 1.25	145	16.1	274	30.4
M10 X 1.50	288	32.0	542	60.2

Notes:

1. D = decimal inch major diameter (expressed in inches)
2. K = .22 nut factor for zinc electroplating (most common finish on machine screws)
3. P = 75% of minimum yield strength

Determining tightening torque by testing

The above chart 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.

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.