



## Tightening Torque

# Calculating Tightening Torque

A common question asked is for the recommended tightening torques of a bolt. Hence, recommended tightening torque values have been available for many years. This article details the formula behind generating these values and some variables that affect the corresponding clamp loads.

## Formula for Calculating Tightening Torque

$T = k \cdot D \cdot P$  where

T = Tightening Torque in "Nm"

k = Nut Factor

D = Nominal Diameter of bolt in "mm"

P = Target Clamping Load in kN (65% of Proof Load\* recommended)

\*To obtain Proof Load in (kN), multiply Proof Stress in (MPa) by Tensile Stress Area in (mm<sup>2</sup>) and divide by 1000.  
Refer to AS 4291.1/ISO 898.1

There are a number of variables that can affect the tightening torque. These include but are not limited to the nut factor, the finish of the fasteners, the property grade of the fasteners, the surface conditions such as hardness, roughness and flatness, the type of the joints as well as the number of fasteners in the joint.

Commonly used *k* factors are:

Finish	<i>k</i> factor
Plain/Dry	0.20
Zinc	0.14
Highly lubricated	0.10
HDG	0.42
Lightly oiled HDG	0.22

These *k* factors are an estimate and serve only as a guide.

## Determining Seating Torque by On-Site Calibration/Testing where clamp load is critical

- Assemble 10 to 12 bolts as they are to be constructed
- Using a calibrated torque wrench, torque the fasteners to failure and record the maximum torque values achieved
- Take the average of these maximum torque values
- Use a seating torque equal to 65-70% of the above average value

To determine the optimum tightening torque, the exact application should be simulated using a tension indicating device. The fastener is tightened until the desired target load (P) which will be indicated on the tension indicating device. The tightening torque required to achieve this desired tension is the tightening torque that should be used for the particular application.

For structural bolting where clamping load is critical, it is recommended to use *k*-factor of *k*2 bolt assemblies as per EN14399-3 where the *k* factor is already established via calibration. Tightening torque can be obtained by using the above equation with the clamp force taken as 0.7Fu where Fu is the ultimate failure load of the bolt. For correct installation method using EN14399-3 K2 assemblies refer to EN1090-2.