



WZ 200

GUIDELINES FOR THE SELECTION OF TORQUE VALUES BY FASTENER SIZE AND GRADE

1. SCOPE

The purpose of this standard is to give guidelines for the selection of tightening torques with assembly joints for property class (grade) 8.8 and 10.9 fasteners, and for spaced thread forming screws. This torque standard may be used to initially set the tightening torque, but testing is recommended to verify the final torque specification.

2. REFERENCES

ISO 261	General purpose metric screw threads - General Plan
ISO 273	Fasteners - Clearance holes for bolts and screws
ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel
ISO 965	General purpose metric screw threads - Tolerances
ISO 1478	Tapping screws thread
WX100	Finish Specification
PT-3	Global Torque Standard
FST-10	Torque-Angle-Failure

3. FIELD OF APPLICATION

The recommended torque values apply only for tools with a process capability, C_{pk} of 1.67 or better, based on the $\pm 15\%$ variance and the specified working range of the particular tool.

The recommendations given for grade 8.8 and 10.9 fasteners are based on the following assumptions:

- ISO coarse pitch metric threads.
- A hex flange bolt geometry and performance in accordance with WA900, or a hex flange nut geometry in accordance with WE900.
- An associated bolt and nut property class where an 8.8 bolt is used with an 8 nut or higher, or a 10.9 bolt is used with a 10 nut or higher, as well as the minimum thread engagement so that the failure mode results in the fracture of the bolt.
- Surface treatments and a thread tolerance class in accordance with WX100.
- Clearance holes in accordance with ISO 273, so that the effective bearing diameter is defined as $(d_w + d_a)/2$ with a hex flange geometry.
- Joints should withstand the clamp load so that the ultimate fracture is with the fastener.
- Joints should have a tightening angle of 20 to 800°, taken from the threshold torque.

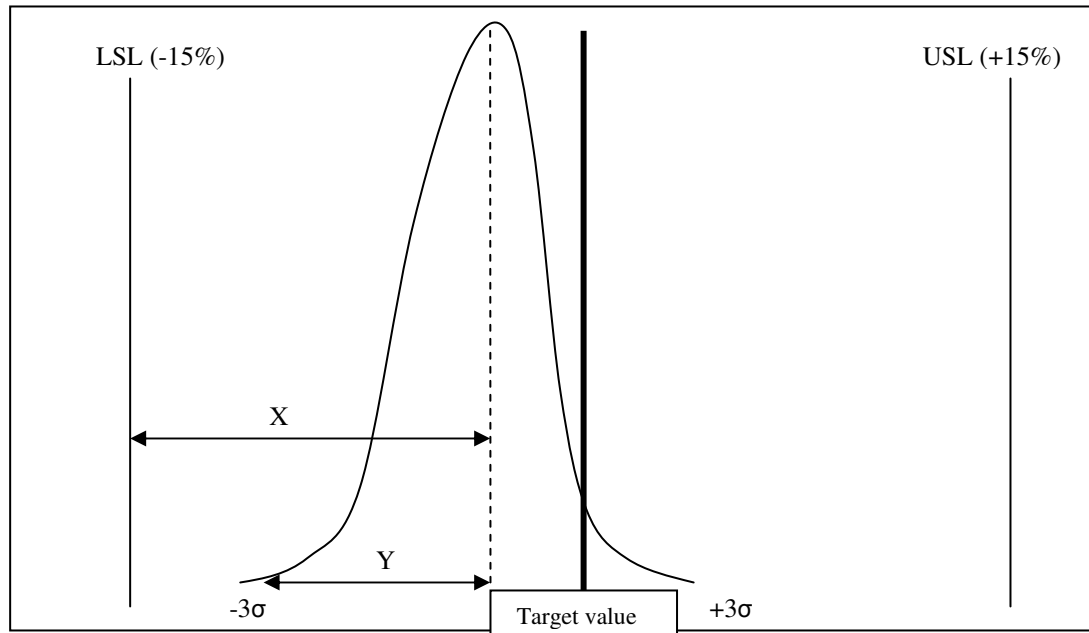
4. TIGHTENING TORQUE DEFINITIONS

The torque specifications shall consist of a recommended nominal tightening torque and a symmetrical tolerance ($\pm 15\%$ variance). Fastener Standard Test, FST-10, will establish the process capability as shown in Figure 1. Manufacturing will need to establish the following:

- A mean tightening torque or assembly torque that supports PT-3, and the affects of joint relaxation. The specific residual torque or inspection torque shall be determined for each particular joint.
- The total torque deviation should be contained within a 6σ tolerance zone.



Figure 1: The process capability, $C_{pk} = (\text{Process Average} - \text{LSL})/3\sigma = X/Y$ for this example.



5. FACTORS AFFECTING TORQUE SELECTION

The nominal tightening torque and tolerance shall be selected with respect to the following:

- The Torque-Tension relationship of a joint, which relates the tightening torque and clamp force. Variation can be reduced by using standard fasteners in accordance with WA900 and WE900, surface treatments in accordance with WX100, and torque tension ratios in accordance with WZ101. Standard torque values for a specific size and property class shown in Table I, are based on an average 0.14 ± 0.03 coefficient of friction. If the average value of the assembly coefficient of friction is lower than 0.11 or higher than 0.17, alternatives torque values given in the Global Torque Standard PT-3 can be used.
- The assembly properties of the joint and the resulting tolerance limits will affect or restrict the selection of assembly tools. As a general rule, the highest torque allowed by the assembly torque distribution and the ultimate torque limits should be used. The +3 Sigma limit must be less than the ultimate torque to reliability prevent fracturing of the fastener. Alternative torques can be used for both static and dynamic high strength joints with the proper analysis of both the joint and the assembly tooling.
- The ultimate failure torque of the joint.
- The design engineer will determine the load requirements of the joint, based on the intended function, and verify the load against the nominal tightening torque.
- Minimum thread engagement and bearing surface area.
- The utilization level of the fastener.