BOLT - EXAMPLE 2

The example below is for a ball bearing encased in a "pillow block" supporting one end of a rotating shaft. The shaft applies a static load of 9kN to the block. Select appropriate screws for the pillow block attachment and specify an appropriate torque.

In the analysis, assume each bolt carries one-half the load. (Some design criteria will specify one bolt carry the entire load as a fail-safe measure.) We will also specify a factor of safety of 4 for the design. Bending loads will not be considered, all loads will be assumed to be axial. Furthermore, to simplify the problem, the loading will be assumed to be static; i.e., no fatigue considerations.

As an initial step, select a class 5.8 steel bolt.

Proof stress = 380 MPa
Ultimate stress = 520 MPa
Yield Strength = 420 MPa

$S_p := 380 \cdot 10^6$

$\sigma_{ult} := 520 \cdot 10^6$ MPa

$\sigma_{yp} := 420 \cdot 10^6$

$F_{max} := 4 \cdot 4500$ Newtons

$F_{max} = 1.8 \cdot 10^4$

$A_t := \frac{F_{max}}{S_p}$

$A_t = 4.737 \cdot 10^{-5}$ *Minimum allowable stress area.*

From table 14-2, text page 896, we find the required bolt to be

M10 X 1.5
Stress area = 58

Assuming we torque to the maximum value of preload, we can then calculate the required torque.

$A_t := 58 \cdot 10^{-6}$

$F_i := 0.9 \cdot A_t \cdot S_p$

$F_i = 1.984 \cdot 10^4$ Newtons

$d_{maj} := 0.010$

$T := 0.2 \cdot F_i \cdot d_{maj}$

$T = 39.672$ Newton – meter *Required torque*