Estimation of a 3/8"-16 UNC class 10.9 bolt as used for barrel fixation

$$T := F_{pret} \cdot \left(\frac{p}{2 \cdot \pi} + \frac{d_{pitch} \cdot \mu_{thread}}{2 \cdot \cos(\theta)} + \frac{D_{m.bhead} \cdot \mu_{bhead\_on\_st}}{2} \right) = 41.573 \ N \cdot m$$

Torque as specified by N-V.

$$\frac{F_{pret} \cdot \frac{p}{2 \cdot \pi}}{T} \cdot 100 = 7.6$$

Only 8% of the torque goes into tension of bolt

$$\frac{F_{pret} \cdot \frac{d_{pitch} \cdot \mu_{thread}}{2 \cdot \cos(\theta)}}{T} \cdot 100 = 17.3$$

17% of the torque spent on overcoming friction in threads.

$$\frac{F_{pret} \cdot \frac{D_{m.bhead} \cdot \mu_{bhead\_on\_st}}{2}}{T} \cdot 100 = 75.1$$

A whopping 75% of the torque is spent on overcoming bolt head vs. barrel friction. Dry conditions assumed.

$$D_{bore} := 77 \ mm$$

$$A_{bore} := \frac{\pi}{4} \cdot D_{bore}^{2}$$

$$p_{comb} := 100 \ bar$$

Engineering estimate

$$F_{sum.tensile} := p_{comb} \cdot A_{bore} = 46.566 \ kN$$

One cylinder fires at given time

$$N_{bolt} := 4$$

$$F_{t.dyn.Ed} := \frac{F_{sum.tensile}}{N_{bolt}} = 11.6 \ kN$$

$$F_{t.Ed} := F_{pret} + F_{t.dyn.Ed} = 24.1 \ kN$$

Compressibility of barrel is neglected

$$F_{t.Rd} := \frac{f_{yb} \cdot A_s}{1.25} = 36 \ kN$$

$$UF := \frac{F_{t.Ed}}{F_{t.Rd}} = 0.671$$

Total tensile load is well below allowable prop.limit stress for a 10.9 bolt.

$$F_{pret} := 0.75 \cdot \frac{f_{yb} \cdot A_s}{1.25} = 27 \ kN$$

if steel nut is used

$$F_{t.ult} := \frac{0.9 \cdot f_{ub} \cdot A_s}{1.25} = 36 \ kN$$

Ultimate tensile capacity using plastic reserve acc. to Eurocode (static loading only).