Thread Force calculation

Thread Size

Input the thread size
Size := 10mm

Input the Thread pitch
Pi := 1.5mm

Using machinery hand book calculating thread nomenclature (This calculated dimensions are approx. only)

Basic Major diameter of the thread
d := Size

Basic pitch diameter
d2 := Size − 0.6495Pi d2 = 9.026mm

Basic root or minor diameter
d1 := Size − 1.082532Pi d1 = 8.376mm

Induced thread force from tightening torque
Tt := (2 2.5 3 3.5 4 5) kgf m
Tt = (19.613 24.517 29.42 34.323 39.227 49.033) J

Using relation between torque and clamping force Hand book-P.no:1408

Tf := Kj Ff d
Kj = "Torque co efficient" Ff = "force due to torque" d = Size

Kj := 0.2 Ff := \( \frac{Tt}{Kj \cdot d} \)

Ff = \( \left(9.807 \times 10^3\ 1.226 \times 10^4\ 1.471 \times 10^4\ 1.716 \times 10^4\ 1.961 \times 10^4\ 2.452 \times 10^4\right) N \)

What is the above force meant? Can we take the above force as acting over the shaft?

Machinery hand book

Axial load developed due to turning force

Turning force required to axial tension T1

T2 overcome the thread friction T3 overcome the underhead friction

\( \alpha := 30 \text{deg} \quad \mu := Kj \quad \text{len} := 30.5 \text{mm} \)

b := 1.5 d \( \mu := 0.165 \)

\( (T1) = Pb \left[ \frac{\text{len}}{2 \cdot \pi} + \frac{d2 \cdot \mu}{2 \cdot \cos(\alpha)} + \frac{(d + b) \cdot \mu^2}{4} \right] \)

\( Ff1 := 4 \cdot Tt \cdot \pi \cdot \frac{\cos(\alpha)}{2 \cdot \text{len} \cdot \cos(\alpha) + 2 \cdot d2 \cdot \mu \cdot \pi + \mu^2 \cdot \cos(\alpha) \cdot \text{d} + \mu^2 \cdot \pi \cdot \cos(\alpha) \cdot b} \)

\( Ff1 = \left(2.831 \times 10^3\ 3.539 \times 10^3\ 4.247 \times 10^3\ 4.955 \times 10^3\ 5.662 \times 10^3\ 7.078 \times 10^3\right) N \)
Referring bolts manufacturers catalog approximately 15% of force created by the bolts remaining 85% are utilised to overcome the friction

Axial force developed by bolts 15% of $F_1$

$F_2 := 15\% \cdot F_1$

$F_2 = \left( 424.67 \quad 530.84 \quad 637.01 \quad 743.18 \quad 849.35 \quad 1.06 \times 10^3 \right) \text{ N}$

Can we conclude this force is induced axially by bolts while fastening?