Thread Force calculation

Thread Size

Input the thread size $Size := 10mm$

Input the Thread pitch $Pi := 1.5mm$

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

Basic Major diameter of the thread $d := Size$

Basic pitch diameter $d2 := Size - 0.649519Pi$ $d2 = 9.026mm$

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

Induced thread force from tightening torque

$Tt := (2 \quad 2.5 \quad 3 \quad 3.5 \quad 4 \quad 5)\cdot kgf\cdot m$ $Tt = (19.613 \quad 24.517 \quad 29.42 \quad 34.323 \quad 39.227 \quad 49.033)\ J$

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

$Tf = Kj\cdot Ff\cdot d$

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

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

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

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

Machinary hand book

Axial load developed due to turning force

Turning force required to axial tension T1

T2 over come the thread friction T3 overcome the underhead friction

$\alpha := 30deg$ $\mu := Kj$ $len := 30.5mm$

$b := 1.5\cdot d$ $\mu 2 := 0.165$

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

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

$Ff1 = (2.831\times 10^3 \quad 3.539\times 10^3 \quad 4.247\times 10^3 \quad 4.955\times 10^3 \quad 5.662\times 10^3 \quad 7.078\times 10^3)\ N$

Referring bolts manufacturers catalog approximately 15% of force created by the bolts remaining 85% are utlised to overcome the friction

Axial force developed by bolts 15% of Ff1

$$Ff2 := 15\% \cdot Ff1$$

$$Ff2 = \left(424.673 \;\; 530.841 \;\; 637.009 \;\; 743.177 \;\; 849.345 \;\; 1.062 \times 10^{3}\right) \text{N}$$

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