June 2008, 5.1, The aluminium top of a high pressure hydraulic pump is held down with eight 6 mm x 30 mm, high tensile SI bolts (Young's modulus is $210x10^9$). The thickness of the aluminium top and packing is 13 mm. A pretension of 500 kPa is induced in the bolts with a torque wrench, set very low to reduce the effect of friction in the threads and collar. Neglect the reduction in diameter due to the thread.
The thread pitch is 1 mm and the angle between the threads is 60^0.
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How many turns must the bolt head be turned from the pretension position to raise the tension in a bolt to 350 MPa?

(8)

Answer

Turns =(360^0 / thread pitch) x stretch in the bolt and stretch = strain x length
and stress = strain x Youngs modulus

$$\left[6\,mm\,bolts; thread\ length = 2\times 6 + 6 = 18\,mm\right]$$

$$\sigma = F/A \qquad E = \sigma/\varepsilon = F/A \times l/x = \sigma \times l/x$$

$$210\times 10^9 = (350 - 0,5)\times 10^6\ x\ 13/x$$

$$x = 2,136\times 10^{-2}\ mm$$

$$1\,turn = 1\,mm = 360^0$$

$$2,136\times 10^{-2}\ mm\ or\ turn = 7,69^0 \quad of\ a\ turn \qquad (8)$$

Die aluminium kop van 'n hoë druk hidroliese pomp is met agt 6 mm x 30 mm hoë trekvaste,SI, boutjies vasgemaak (Young se modulus is $210x10^9$). Die dikte van die aluminiumkop en die packing is 13 mm. 'n Voorspanning van 500 kPa word in die boutjies geïnduseer deur 'n wringsleutel wat laag gestel is om die effek van wrywing in die groefdraad en boutkop te verminder. Verontagsaam die vermindering in deursnee van die groefdraad. Die groefdraad het 'n 1 mm steek en die hoek van die groefdraad is 60^0 tussen die groewe.

Hoeveel draaie moet die kop van die bout gedraai word vanaf die posisie van die voorspanning om die spanning in 'n bout na 350 Mpa te verhoog?
