Solutions

2.1

- $F_i = 0.75 A_t S_p = 0.75 \times 84.3 \times 600 = \mathbf{37.9}$ kN.

2.2

- $F_b = F_i + CP = 37.9 + 0.30 \times 10 = \mathbf{40.9}$ kN; $\sigma_b = F_b / A_t = 40\,935 / 84.3 = \mathbf{486}$ MPa, below S_p.
- $n = (S_p A_t - F_i)/(CP) = (50.58 - 37.94)/3.0 = \mathbf{4.21}$.
- $P_0 = F_i/(1 - C) = 37.9/0.70 = \mathbf{54.2}$ kN.

3.1

- $d = mN = 2.5 \times 20 = 50$ mm; $W_t = 2T/d = 2 \times 30/0.050 = \mathbf{1200}$ N.
- $V = \pi d n/60 = \pi \times 0.050 \times 1200/60 = \mathbf{3.14}$ m/s; $K_v = (6.1 + 3.14)/6.1 = \mathbf{1.515}$.
- $\sigma = K_v W_t/(FmY) = 1.515 \times 1200/(25 \times 2.5 \times 0.322) = \mathbf{90.3}$ MPa.
- $n = 150/90.3 = \mathbf{1.66}$.
- A wider face, a larger module with fewer teeth at the same ratio, or a stronger, hardened steel.

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