13-3

From our previous result, $k = 1.314$ N/mm. Now we can examine the stress.

Solid length: $L_s = d N_t = (2.5)(14) = 35$ mm

From Table 10-4, $A = 2211$ and $m = 0.145$. Therefore,

$$S_{ut} = \frac{A}{d^m} = \frac{2211}{(2.5)^{0.145}} = 1935.9 \text{ MPa}.$$

From Table 10-6, $S_{sy} = 0.45 \cdot S_{ut} = 871.2$ MPa

Now we examine the stress

$$K_B \equiv \frac{4C+2}{4C-3} = \frac{4 \cdot 11.4 + 2}{4 \cdot 11.4 - 3} = 1.117$$

$$\tau = K_B \frac{8FD}{\pi d^3} = S_{sy} \text{ (design decision)} \Longrightarrow F = S_{sy} \frac{\pi d^3}{8 D K_B} = 167.9 \text{N}$$

Free length selection. We know that the spring has a load of F maximum. If we want the solid length to be the length at which the load is max,

$$F = k(L_0 - L_s) \Longrightarrow L_0 = \frac{F + k L_s}{k}$$

$$= F/k + L_s$$

$$= 162.8 \text{ mm}$$