1/2 UNC CLASS 7 (THEIR MEAN GRADE 7)
ROLLED THREADS
80% PRELOAD
3 in THICK STEEL JOINT
1000 lb EXTERNAL LOAD
FIND FOS AGAINST YIELD AND SEPARATION

SINCE THE JOINT AND BOLT ARE BOTH STEEL, \( k_m = 8k_b \); \( C = \frac{1}{a} \)

\[ F_i = 0.8A_tS_p = 0.8\left(0.1419\text{ in}^2\right)105\text{ ksi} = 11,920\text{ lb} \]

\[ F_b = C P_{\text{ext}} + F_i = \frac{1}{a}(1000\text{ lb}) + 11,920\text{ lb} = 12,031\text{ lb} \]

\[ F_m = (1-C)P_{\text{ext}} - F_i = \left(1 - \frac{1}{a}\right)(1000\text{ lb}) - 11,920\text{ lb} = -11,031\text{ lb} \]

\[ \sigma_{b,\text{max}} = \frac{F_{\text{max}}}{A_t} = \frac{12,031\text{ lb}}{0.1419\text{ in}^2} = 84,785\text{ psi} \]

\[ N_{y,b} = \frac{115\text{ ksi}}{84,785\text{ ksi}} = 1.34 \]

**JOINT WILL SEPARATE WHEN** \( F_m = F_i \)

\[ (1-C)P_{\text{ext}} = 11,920\text{ lb} \Rightarrow P_{\text{ext,sep}} = \frac{11,920\text{ lb}}{(1-C)} = 13,410\text{ lb} \]

\[ N_{\text{sep}} = \frac{13,410\text{ lb}}{1,000\text{ lb}} = 13.4 \]

**NOTE:** THESE FACTORS OF SAFETY VARY FROM THE TEXT ANSWERS BECAUSE THE TEXT SOLUTION USES THE CONE FRUSTRA METHOD TO FIND THE JOINT STIFFNESS AND CONSIDERS ACTUAL THREAD LENGTH FOR BOLT STIFFNESS. THIS METHOD USES EFFECTIVE CYLINDER AND NOMINAL BOLT DIAMETER.