9-7 Determine the size of steel rod, to the nearest sixteenth of an inch, needed to support a tensile load of 40 kips if the allowable tensile stress of steel is 22 ksi.

Solution.

$$P_{allow} = \sigma_{allow} A$$

$$A = \frac{P}{\sigma_{allow}}$$

$$= \frac{40 \text{ kips}}{22 \text{ ksi}}$$

$$= \frac{40\,000 \text{ lb}}{22\,000 \frac{\text{lb}}{\text{in}^2}}$$

$$= 1.818 \text{ in}^2$$

$$A = \pi r^2$$

$r = \frac{d}{2}$

$$= \frac{\pi d^2}{4}$$

$$= 0.7854 d^2$$

$$1.818 \text{ in}^2 = 0.7854 d^2$$

$$d = \sqrt{\frac{1.818 \text{ in}^2}{0.7854}}$$

$$= 1.52 \text{ in}$$

Use $\underline{\underline{d = 1\ 9/16 \text{ in}}}$ (1.5625 in)

$\frac{1}{16} = 0.0625$

$\frac{2}{16} = 0.125$

$\frac{3}{16} = 0.1875$

$\frac{4}{16} = 0.25$

$\frac{5}{16} = 0.3125$

$\frac{6}{16} = 0.375$

$\frac{7}{16} = 0.4375$

$\frac{8}{16} = 0.5$

$\frac{9}{16} = 0.5625$

$\frac{10}{16} = 0.625$

$\frac{11}{16} = 0.6875$

$\frac{12}{16} = 0.75$

$\frac{13}{16} = 0.8125$

$\frac{14}{16} = 0.875$

$\frac{15}{16} = 0.9375$

$\frac{16}{16} = 1.0$