11-9

In a tension test of a steel specimen with 0.50-in. diameter and 2.00-in. gage length, the maximum load is 15 200 lb, the final length is 2.59 in., and the final diameter at the necked-down section is 0.423 in. Calculate (a) the ultimate strength, (b) the percent of elongation, and (c) the percent reduction in area.

Solution.

$$A = \frac{\pi d^2}{4} = \frac{\pi (0.5\,in)^2}{4} = 0.1963\ in.^2$$

Necked-down section

$$A = \frac{\pi d^2}{4} = \frac{\pi (0.423\,in)^2}{4} = 0.1405\ in.^2$$

(a) $$\sigma_u = \frac{15\,200\ lb}{0.1963\ in^2} = 77\,400\ psi$$

(b) $$\%\ Elongation = \frac{2.59\ in - 2.00\ in}{2.00\ in} \times 100\% = 29.5\%$$

(c) $$\%\ reduction\ in\ area = \frac{0.1963\ in.^2 - 0.1405\ in.^2}{0.1963\ in.^2} \times 100\% = 28.4\%$$