

7.D3 (a) For this portion of the problem we are to determine the ductility of cold-worked steel that has a Brinell hardness of 240. From Figure 6.19, a Brinell hardness of 240 corresponds to a tensile strength of 820 MPa (120,000 psi), which, from Figure 7.19(b), requires a deformation of 17%CW. Furthermore, 17%CW yields a ductility of about 13%EL for steel, Figure 7.19(c).

(b) We are now asked to determine the radius after deformation if the uncold-worked radius is 10 mm (0.40 in.). From Equation 7.8 and for a cylindrical specimen

$$\%CW = \left[\frac{\pi r_0^2 - \pi r_d^2}{\pi r_0^2} \right] \times 100$$

Now, solving for r_d from this expression, we get

$$\begin{aligned} r_d &= r_0 \sqrt{1 - \frac{\%CW}{100}} \\ &= (10 \text{ mm}) \sqrt{1 - \frac{17}{100}} = 9.11 \text{ mm} \quad (0.364 \text{ in.}) \end{aligned}$$