Equations

Problem 7.D7

A Cylindrical brass rod having a minimum tensile strength of 450 MPa, a ductility of at least 13% EL, and a final diameter of 12.7 mm is desired. Some 19.0 mm stodk that has been cold-worked to 35% is available. Describe the procedure the you would follow to obtain this material. Assume that the brass will crack at 65% CW.

Use Figure 7.17. For the yield strength, you must have at least 27% CW. For the ductility you must not exceed 29% CW. Split the difference and go with 28% CW.

We could start with an anneal, but we could also do more cold work first. Let's try that to save on the heating bill. We will then anneal, and then cold work to the final 28% requirement.

Let's see what diameter we need prior to the last step

$$28 = \frac{(d_1^2 - 12.7^2)}{d_1^2} \cdot 100. \tag{1}$$

Factor of $\pi/4$ cancles out!. We find that we need a diameter of 15 mm, just before that last bit of cw. Can we get there from 19.0. To answer this lets find the startting diameter.

$$35 = \frac{(d_0^2 - 19^2)}{d_0^2} \cdot 100 \tag{2}$$

So we have zero cold work at 23.6. Starting there, try to get to 15.

$$\mathit{CW} = \frac{d_0^2 - d_1^2}{d_0^2} \cdot 100 \tag{3}$$

OK, so about 60% CW would result. We might risk that, or not depending on experience in the field. If we did decide to ristk it, we could make the final product as follow.

1. Continue drawing the 19.0 mm stock down to 15.0 mm. 60% CW results. We should hopefully be ok, though we are close to cracking.

2. Anneal.

3. Cold work 28% down to 12.7 mm, final desired diameter.

If worried about failure by cracking, do an anneal before doing step 1.

Solution

$CW = 59.67 \quad d_0 = 23.57$
$d_1 = 14.97$