

Aufgabe 3

gegeben: $D_0 = 100 \text{ mm}$ $D_1 = 84 \text{ mm}$ $D_i = 70 \text{ mm}$ $k_F = 150 \cdot \varphi_v^{0,35}$ $\varphi_{v1} = 1,20$ $\varphi_{r1} = -1,20$ $\varphi_{t1} = 0,53$ $\varphi_{z1} = 0,67$ gesucht: $\Delta \varphi_{v2}$; φ_{v2} ; k_{F2}

Rechnung: $k_{F2} = 150 \cdot \varphi_{v2}^{0,35} [\text{MPa}]$; $\varphi_{v2} = \varphi_{v1} + \Delta \varphi_{v2}$;

$$\Delta \varphi_{v2} = \sqrt{\frac{2}{3} (\Delta \varphi_{r2}^2 + \Delta \varphi_{t2}^2 + \Delta \varphi_{z2}^2)}$$

① radial

$$1'' \rightarrow 2'' \Delta \varphi_{r2} = \ln \frac{s_2}{s_1} \quad \left| \begin{array}{l} s_2 = \frac{84 \text{ mm} - 70 \text{ mm}}{2} = 7 \text{ mm} \\ s_1 = \frac{100 \text{ mm} - 70 \text{ mm}}{2} = 15 \text{ mm} \end{array} \right.$$

$$\Delta \varphi_{r2} = \ln \left(\frac{7 \text{ mm}}{15 \text{ mm}} \right) = -0,76$$

② tangential

$$1'' \rightarrow 2'' \Delta \varphi_{t2} = \ln \frac{d_{m2}}{d_{m1}} \quad \left| \begin{array}{l} d_{m2} = D_i + s_2 = 70 \text{ mm} + 7 \text{ mm} = 77 \text{ mm} \\ d_{m1} = D_i + s_1 = 70 \text{ mm} + 15 \text{ mm} = 85 \text{ mm} \end{array} \right.$$

$$\Delta \varphi_{t2} = \ln \left(\frac{77 \text{ mm}}{85 \text{ mm}} \right) = -0,10$$

③ axial

$$1'' \rightarrow 2'' \Delta \varphi_{z2} = \ln \frac{h_2}{h_1} \quad \left| \begin{array}{l} h_2 = 12,75 \\ h_1 = 53,9 \end{array} \right.$$

$$\Delta \varphi_{z2} = \ln \left(\frac{12,75}{53,9} \right) = 0,86$$

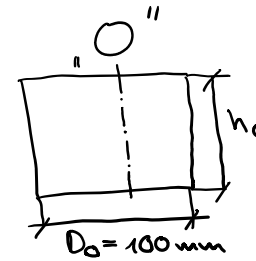
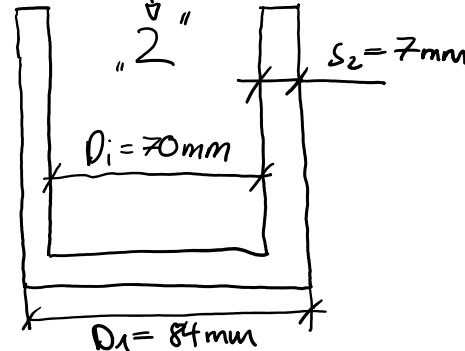
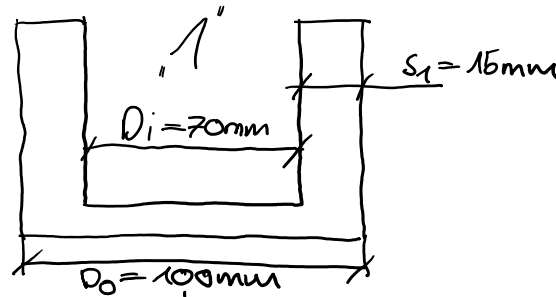
Volumenkonstanz

$$\varphi_{v1} = \varphi_{v2}$$

$$h_1 \cdot \pi \cdot d_{m1} \cdot s_1 = h_2 \cdot \pi \cdot d_{m2} \cdot s_2$$

$$\frac{h_2}{h_1} = \frac{d_{m1} \cdot s_1}{d_{m2} \cdot s_2} = \frac{85 \text{ mm} \cdot 15 \text{ mm}}{77 \text{ mm} \cdot 7 \text{ mm}} = \frac{12,75}{53,9}$$

$$\Delta \varphi_{r2} + \Delta \varphi_{t2} + \Delta \varphi_{z2} = (-0,76) + (-0,10) + (0,86) = 0$$



$$\Delta \varphi_{v2} = \sqrt{\frac{2}{3} ((-0,76)^2 + (-0,10)^2 + (0,86)^2)}$$

$$\Delta \varphi_{v2} = 0,84$$

$$\varphi_{v2} = \varphi_{v1} + \Delta \varphi_{v2} = 1,20 + 0,84 = 2,14$$

$$k_{F2} = 150 \cdot 2,14^{0,35} = 195,77 \text{ MPa}$$