Dynamischer Festigkeitsnachweis Welle

Samstag, 23. Januar 2021 18:48

Werkstoff (S235 JR) S275 JR

A % min	R_{mN} min	R_{eN} $R_{p0,2N}$ min.	σ_{zdWN}	σ_{bWN}	τ_{tWN}
(26	360	235	140	180	105)
23	410	275	170	215	125

mit $K_1 = 1$ wg $d = 15\,mm$

$$\sigma_{bWK} = \frac{\sigma_{bW} \cdot K_1(d)}{K_\sigma} = \frac{215 \cdot 1}{0{,}88} = 298{,}6 \; \frac{N}{mm^2}$$

$$K_\sigma = \left[\frac{\beta_\sigma}{K_2(d)} + \frac{1}{K_{F\sigma}} - 1 \right] \frac{1}{K_V} \Rightarrow K_\sigma = 0{,}72$$

$\rightarrow K_V = 2 \rightarrow$ Nitrieren

$$K_2(d) = K_g = 1 - 0{,}2 \; \frac{\lg\left(\frac{d}{7{,}5\,mm}\right)}{\lg 20}$$

$$= 0{,}95$$

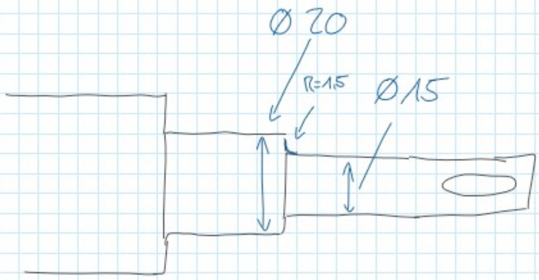
$\frac{D}{d} = 1{,}33 \rightarrow c_b \approx 0{,}6$

$$\beta_\sigma = 1 + c_b \; (\beta_{K(2,0)} - 1)$$

$$= 1 + 0{,}6 \; (1{,}5 - 1)$$

$$= 1{,}3$$

$\frac{R}{d} = 0{,}1$



$R_z = 16\,\mu m$

$$K_{F\sigma} = 1 - 0{,}22 \; \lg(R_z) \cdot \lg\left(\frac{R_m}{20} - 1\right)$$

$$= 0{,}93$$

$$\tau_{tWK} = \frac{\tau_{tW} \cdot K_1}{K_\tau} = 192{,}3 \; \frac{N}{mm^2}$$

$$\tau_{tADK} = \frac{\tau_{tWK}}{1 + \psi_{\tau K} \cdot \frac{\tau_{tm}}{\tau_{ta}}} = 182{,}3 \; \frac{N}{mm^2}$$

$$K_\tau = \left[\frac{\beta_\tau}{K_2(d)} + \frac{1}{K_{F\tau}} - 1 \right] \frac{1}{K_V} = 0{,}65$$

$\psi_{\tau K} = \tau_{tWK}$

$$K_\tau = \left[\frac{\beta_\tau}{K_2(d)} + \frac{1}{K_{F\tau}} - 1 \right] \frac{1}{K_V} = 0,65$$

$$\psi_{\tau K} = \frac{\tau_{tWK}}{2 \cdot K_1 \cdot R_{mN} - \tau_{tWK}}$$

$$K_2(d) = 0,95$$

$$= 0,11$$

$$\sigma_{mv} = \sqrt{(\cancel{\sigma_{bm}})^2 + 3(\tau_{tm}^2)}$$

$$\beta_\tau = 1 + \underbrace{0,95}_{C_t} (1,2 - 1)$$

$$= \sqrt{3} \cdot \tau_{tm}$$

$$= 1,19$$

$$\tau_{mv} = \frac{\sigma_{mv}}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}} \cdot \tau_{tm}$$

$$= \tau_{tm} = 26,3 \frac{N}{mm^2}$$

$$K_{F\tau} = 0,575 \cdot K_{F\sigma} + 0,425$$

$$= 0,96$$

$$S_A = \frac{1}{\sqrt{\left(\frac{\sigma_{ba}}{\sigma_{bWK}}\right)^2 + \left(\frac{\tau_{ta}}{\tau_{tADK}}\right)^2}}$$

da $\sigma_m = 0$

$$= \frac{1}{\sqrt{\left(\frac{135,8}{298,6}\right)^2 + \left(\frac{52,6}{182,3}\right)^2}} \approx 1,86$$

→ ausreichend