

Given: Spur gear with pitch diameter of 4 in., face width = 2 in., 20 teeth. Torque = 1800 in-lb at slow speed.

Find: (a) Required radial interference on 1 in. diameter steel shaft to transmit torque, (b) stress in the gear due to interference.

Solution: Use coefficient of friction  $\mu = 0.5$

$$T = \mu F_n a$$

$$F_n = p(2\pi a)L$$

$$\Rightarrow p = \frac{T}{\mu a (2\pi a)L}$$

$$a = 0.5 \text{ in (shaft radius)}$$

$$L = 2 \text{ in (face width)}$$

$$p = \underline{\underline{764 \text{ psi}}}$$

$$\text{diametral pitch} = p_d = \frac{N}{d} = \frac{20}{4} = 5$$

$$\text{dedendum} = \frac{1.250}{p_d} = \frac{1.250}{5} = 0.25$$

$$\Rightarrow r_d = \frac{4 - 2 \times 0.25}{2} = 1.75 \text{ in (radius of dedendum circle)}$$

$$\sigma_{\theta} = \frac{a^2 p_i}{b^2 - a^2} \left( 1 + \frac{b^2}{a^2} \right)$$

$$= \frac{0.5^2 \text{ in} (764 \text{ psi})}{(1.75^2 - 0.5)^2} \left( 1 + \frac{1.75^2}{0.5^2} \right)$$

$$= \underline{\underline{0.90 \text{ ksi}}}$$

$$\sigma_r = \underline{\underline{0.76 \text{ ksi}}}$$

Given: Basic Size of shaft and hole = 50 mm.

Fit - "snug fit but must be freely assembled and disassembled."

Find: Dimension and tolerance for shaft and hole.

Solution: From Table 4-5, Shigley

Fit designation - H7/h6

	Hole	Shaft
Tolerance Grade	0.030 mm	0.019 mm
Upper Deviation	0.030 mm	0.000 mm
Lower Deviation	0.000 mm	-0.019 mm
Max Diameter	50.000 mm	50.000 mm
Min Diameter	50.030 mm	49.981 mm
Ave. Diameter	50.015 mm	49.991 mm

Hole Dwg Call Out  $50.015^{+0.015}_{-0.015}$

OR  $\underline{\underline{50.000^{+0.030}_{-0.000}}}$

Shaft Dwg Call Out  $49.991^{+0.009}_{-0.010}$

OR  $\underline{\underline{50.000^{+0.000}_{-0.019}}}$

For holes and shafts, the second set of call outs are more commonly used.