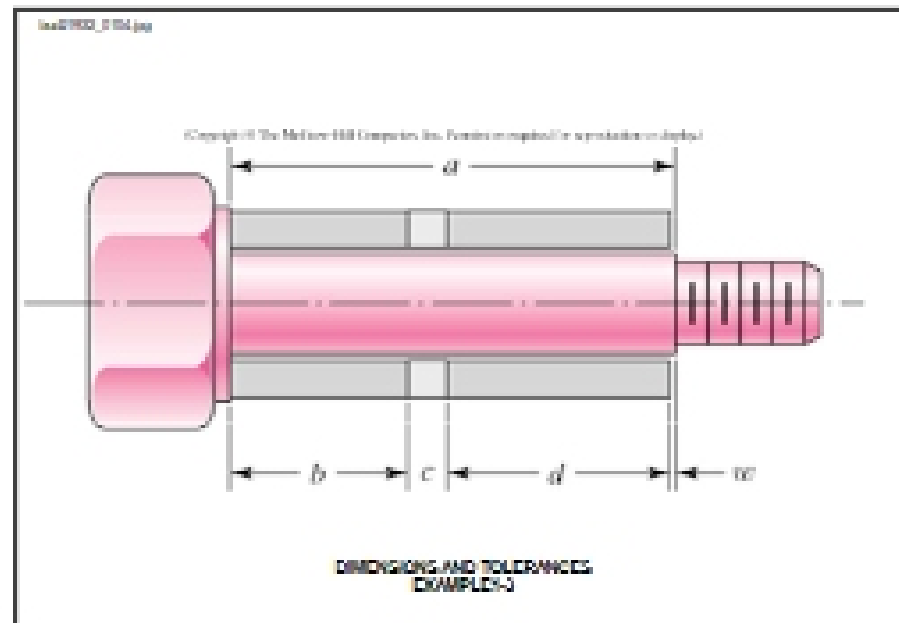
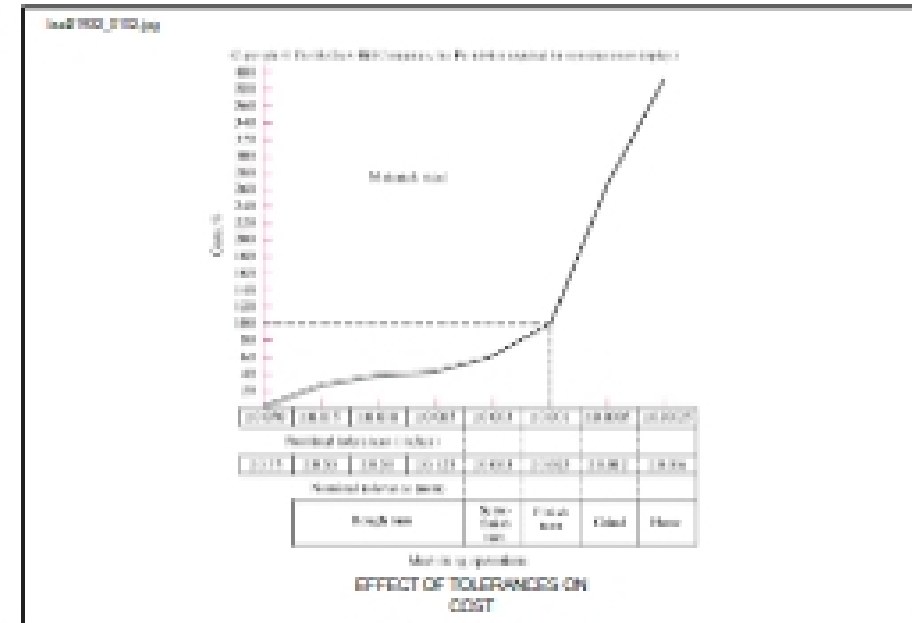
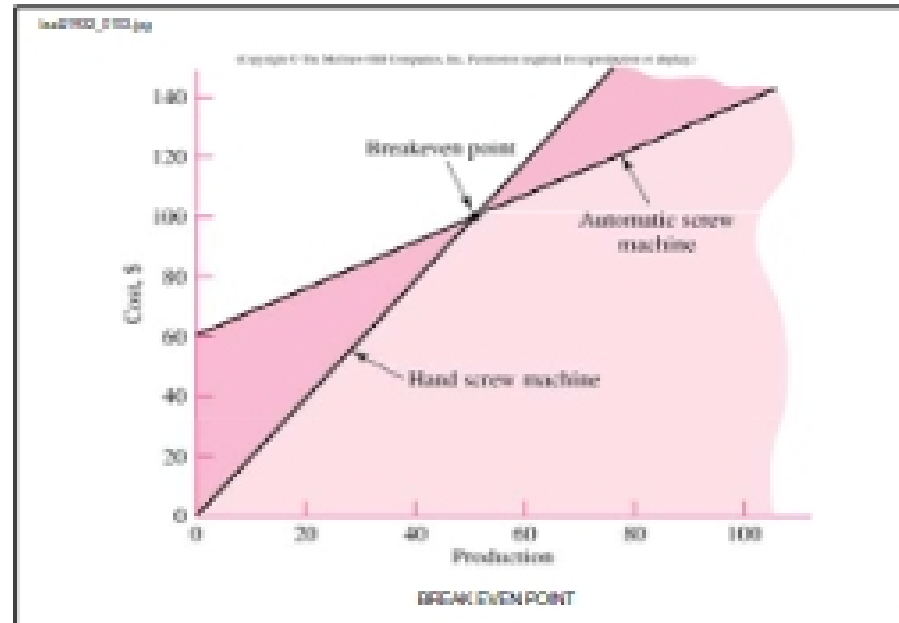


DESIGN CONSIDERATIONS

- Functionality
- Strength/Stress
- Distortion/Deflection/Stiffness
- Safety
- Cost/Economics
- Noise
- Many Others....

Other Considerations

- Uncertainty
- Design Factor
- Factor of Safety
- Dimensions and Tolerances
- Units
- Significant Figures
- Transmission Case Study



EXAMPLE 1-3 A cylindrical steel shaft, shown in three right-angle cross-sectional parts on the next slide, is to be machined from a 100-mm diameter bar. To reduce the fixturing, the part to most easily be machined is to be the longest. The parts for the assembly depicted in Fig. 1-16 are to be machined as follows:

- (a) The inner diameter is $\phi = 40 \pm 0.05$ mm.
- (b) The outer diameter is $\phi = 40 \pm 0.05$ mm.
- (c) The length is $L = 100 \pm 0.05$ mm.
- (d) The hole diameter is $\phi = 40 \pm 0.05$ mm.

Figure 1-16
An assembly of three cylindrical cross-sectional parts of a shaft.

All parts using the part with the tolerance most supplied by custom, the part containing the dimension d is made to 1 mm.

Solution:

- The most value of d is given by:

$$d = 100 - 2(0.05) = 99.90 = 99.90 \pm 0.05 \text{ mm}$$
- The largest tolerances are at the ends of the parts:

$$L_1 = 100 \pm 0.05 \text{ mm}, L_2 = 100 \pm 0.05 \text{ mm}, L_3 = 100 \pm 0.05 \text{ mm}$$
- Then, $w = 0.002$ in 0.002 mm.

$$L_{max} = 100 + 0.002 = 100.002 \text{ mm}$$

$$L_{min} = 100 - 0.002 = 99.998 \text{ mm}$$

The total length of the shaft is given by:

$$L = 100 \pm 0.05 \text{ mm}, L_1 = 100 \pm 0.05 \text{ mm}, L_2 = 100 \pm 0.05 \text{ mm}$$
 Thus, $L = 100 \pm 0.05 \text{ mm}$.