

The JETS Challenge

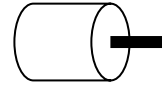
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Challenge 77 – The Horsepower Challenge

Problem:

The shaft diameter required in a large electric motor is given by

$$D = 68.47 \cdot \sqrt[3]{\frac{P}{n \cdot \tau}}$$



where D is the diameter (inches); P is power transmitted in horsepower; n is speed of the shaft in revolutions per minute (rpm) and τ is torsional stress trying to rip the metal apart in psi.

Find the horsepower that can be transmitted by a 2 inch diameter shaft rotating at 800 rpm with an allowable torsional stress of 2700 psi.

Solution:

$$D=2$$

$$n = 800 \text{ rpm}$$

$$\tau = 2700 \text{ psi}$$

$$\text{so } 2 = 68.47 \sqrt[3]{\frac{P}{(800)(2700)}}$$

$$\left(2 \sqrt[3]{\frac{2,160,000}{68.47}}\right)^3 = P$$

$$\frac{2^3 \times (2,160,000)}{68.47^3} = P$$

$$53.83 \text{ hp} = P$$