

An electric circular saw reaches an operating speed of 1500 rpm after revolving 200 turns. Assuming the acceleration is constant, determine:

(1) the acceleration and

(2) how long it takes to reach 1500 rpm.

Given

$$\omega_0 = 0 \text{ rad/s}$$

$$\omega = 1500 \frac{\text{rev}}{\text{min}} \left(\frac{2\pi \text{ rad}}{1 \text{ rev}} \right) \left(\frac{1 \text{ min}}{60 \text{ s}} \right) = 157.08 \text{ rad/s}$$

$$\Delta \theta = 200 \text{ rev} \left(\frac{2\pi \text{ rad}}{1 \text{ rev}} \right) = 1256.64 \text{ rad}$$

$$(1) \quad \omega^2 = \omega_0^2 + 2\alpha \Delta \theta$$

$$\alpha = \frac{\omega^2 - \omega_0^2}{2\Delta \theta} = \frac{(157.08 \text{ rad/s})^2 - (0)^2}{2(1256.64 \text{ rad})}$$

$$= 9.82 \text{ rad/s}^2$$

(2)

$$\omega = \omega_0 + \alpha t$$

$$t = \frac{\omega - \omega_0}{\alpha}$$

$$= \frac{157.08 \text{ rad/s} - 0}{9.82 \text{ rad/s}^2}$$

$$= 15.9965$$

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