

1-4 A motor is supplying 70 N–m of torque to its load. If the motor's shaft is turning at 1500 r/min, what is the mechanical power supplied to the load in watts? In horsepower?

➤ Also, how much energy is supplied by the motor during a 2 minute period?

Given: $n_m = 1500$ r/min & $\tau = 70$ N-m.

$$\omega = n_m (2\pi \text{ rad/1 rev}) (1 \text{ min/60 s}) = 1500 \text{ r/min} (2\pi \text{ rad/1 rev}) (1 \text{ min/60 s}) \\ \Rightarrow \omega = 157.079633 \text{ rad/s}$$

$$\text{Per (1-15), } P = \tau \omega = 70 (157.079) \Rightarrow \underline{P = 10,995.574 \text{ W.}}$$

$$\text{Converting to horsepower, } P = 10,995.574 \text{ W} (1 \text{ hp/746 W}) \Rightarrow \underline{P = 14.74 \text{ hp.}}$$

From (1-2),

$$\omega = \frac{d\theta}{dt} \Rightarrow \theta = \int_0^t \omega dt = \omega t = 157.08 \text{ rad/s} (2 \text{ min}) (60 \text{ s / min}) = 18,849.556 \text{ rad}$$

$$\text{Per (1-12), } W = \tau \theta = 70 (18,849.556) \Rightarrow \underline{W = 1,319,468.9 \text{ J} = 1.3195 \text{ MJ.}}$$