

PROBLEM 2.36

KNOWN: Operating data is provided for a belt sander.

FIND: Evaluate the power transmitted by the belt to the surface and work done in one minute of sanding.

SCHEMATIC & GIVEN DATA:

Belt speed =
1500 ft/min
Normal force
on sander =
15 lbf

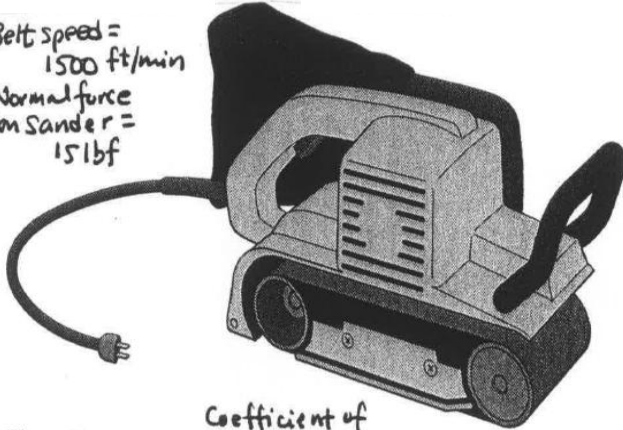


Fig. P2.35

Coefficient of
friction is 0.2

(b) In one minute of sanding, the work done on the surface is

$$W = \left(0.096 \frac{\text{Btu}}{\text{s}}\right) \left| \frac{60 \text{ s}}{\text{min}} \right| (1 \text{ min})$$
$$= 5.76 \text{ Btu} \quad \leftarrow$$

ENGR. MODEL

1. The force exerted by the belt is related to the normal force, F_N , by the coefficient of friction:

$$F = (\text{coeff. of friction}) F_N = 0.2 F_N$$

ANALYSIS: (a) Using Eq. 2.13, the power, \dot{W} , transmitted is

$$\dot{W} = F \cdot V = 0.2 F_N V$$

or

$$\dot{W} = 0.2 (15 \text{ lbf}) \left(1500 \frac{\text{ft}}{\text{min}}\right) \left| \frac{1 \text{ min}}{60 \text{ s}} \right| \left| \frac{1 \text{ Btu}}{778 \text{ ft} \cdot \text{lbf}} \right|$$
$$= 0.096 \text{ Btu/s}$$

or

$$\dot{W} = 0.096 \frac{\text{Btu}}{\text{s}} \left| \frac{3600 \text{ s}}{\text{h}} \right| \left| \frac{1 \text{ hp}}{2545 \text{ Btu/h}} \right|$$
$$= 0.136 \text{ hp} \quad \leftarrow$$