

36.78 A 7.5hp motor is 93% efficient. How much waste heat is generated due to losses?

- A. $810 \frac{Btu}{hr}$
- B. $1340 \frac{Btu}{hr}$
- C. $1440 \frac{Btu}{hr}$
- D. $2580 \frac{Btu}{hr}$

The heat losses from the motor result from input electrical power that is not converted into brake horsepower. Since motors are rated in *bhp*, the mechanical output power is always equal to the nominal rating of the motor, in this case 7.5hp. Therefore, the losses do not come out of the 7.5hp, but rather, come out of the input electrical power leaving (precisely) the *bhp* left to be delivered.

Calculate the electrical input power to the motor.

$$\dot{W}_{in} = \frac{bhp}{\eta_{motor}} = \frac{7.5hp}{0.93} = 8.065hp$$

The waste heat is the difference between the input electrical power and the output shaft power. Calculate the losses. Convert units to $\frac{Btu}{hr}$.

$$\dot{Q}_{losses} = (8.065hp) \left(\frac{0.7457KW}{hp} \right) \left(\frac{3412 \frac{Btu}{hr}}{KW} \right) = 1437 \frac{Btu}{hr}$$

Answer C