



POWER CONVERSION

This note presents the conversion of mechanical horsepower hp and metric power ps in kW .

Imperial power to kilowatt

The mechanical horsepower hp is defined as

$$1 \text{ hp} = \frac{33000 \text{ ft}\cdot\text{lb}}{1 \text{ mn}}$$

or expressed in seconds, knowing that $1 \text{ mn} = 60 \text{ s}$

$$1 \text{ hp} = \frac{550 \text{ ft}\cdot\text{lb}}{1 \text{ s}}$$

Knowing that $1 \text{ ft} = 0.3048 \text{ m}$ and $1 \text{ lb} = 0.4536 \text{ kg}$

$$1 \text{ hp} = 550 \times 0.3048 \times 0.4536 \frac{\text{m}\cdot\text{kg}}{\text{s}} = 76.0402 \frac{\text{m}\cdot\text{kg}}{\text{s}}$$

and knowing that gravity acceleration $g = 9.80665 \frac{\text{m}}{\text{s}^2}$, the mechanical horsepower becomes

$$1 \text{ hp} = (76.0402 \times 9.80665) \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3} = 745.717279 \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3}$$

Using the definitions $1 \text{ W} = 1 \frac{\text{J}}{\text{s}} = 1 \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3}$ implies that

$$1 \text{ hp} = 745.717 \text{ W} \longrightarrow 1 \text{ kW} = 1.341 \text{ hp}$$

Metric power to kilowatt

The metric power ps is defined as

$$1 \text{ ps} = 75 \frac{\text{m}\cdot\text{kg}}{\text{s}}.$$

Knowing that gravity acceleration $g = 9.80665 \frac{\text{m}}{\text{s}^2}$, ps becomes

$$1 \text{ ps} = (75 \times 9.80665) \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3} = 735.499 \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3}$$

knowing that $1 \text{ W} = 1 \frac{\text{m}^2\cdot\text{kg}}{\text{s}^3}$, it gives

$$1 \text{ ps} = 735.499 \text{ W} \longrightarrow 1 \text{ kW} = 1.361 \text{ ps}.$$

Some definitions

bhp or brake horsepower is usually used as a more realistic measurement as it considers the power left over after the gearbox, alternator and water pump are working as well as any loss of power due to friction. A *ps* is the equivalent of 98.6% of one *hp*.

Summary

$$1 \text{ hp} = 745.7 \text{ W}$$

$$1 \text{ ps} = 735.5 \text{ W}$$

$$1 \text{ hp} = 1.014 \text{ ps}$$

$$1 \text{ ps} = 0.9863 \text{ hp}$$

$$1 \text{ kW} = 1.341 \text{ hp} = 1.361 \text{ ps}$$

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