

Example of identical flow and head Hydropower Calculations, (SI) & (US) units:

(SI)

$$h := 150 \cdot \text{m}$$

$$\rho := 1000 \cdot \frac{\text{kg}}{\text{m}^3}$$

$$\eta_{\text{turb}} := 85\%$$

$$\eta_{\text{gen}} := 89\%$$

$$Q := .095 \cdot \frac{\text{m}^3}{\text{s}}$$

$$\rho = 1 \frac{\text{kg}}{\text{liter}}$$

$$\eta := \eta_{\text{turb}} \cdot \eta_{\text{gen}}$$

$$\eta = 75.65\%$$

$$g = 9.807 \frac{\text{m}}{\text{s}^2}$$

$$\rho \cdot g \cdot h = 1.471 \times 10^3 \text{ kPa}$$

$$\text{Power} := \eta \cdot \rho \cdot g \cdot h \cdot Q$$

$$\text{Power} = 105.717 \text{ kW}$$

$$\text{Power} = 141.769 \text{ hp}$$

Common Metric (SI) -

Power(m, m³) Hydro Calc:

$$\eta \cdot 9.807 \frac{\text{s} \cdot \text{kW}}{\text{m}^4} \cdot h \cdot Q = 105.72 \text{ kW}$$

(SI) <-- **Kilowatts kW** --> (US)

$$\eta \cdot 13.151 \frac{\text{s} \cdot \text{hp}}{\text{m}^4} \cdot h \cdot Q = 141.77 \text{ hp}$$

(SI) <-- **Horsepower hp** --> (US)

$$Q = 0.095 \frac{\text{m}^3}{\text{s}}$$

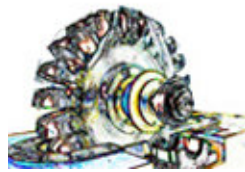
$$Q = 95 \frac{\text{liter}}{\text{s}}$$

Gravity static hydraulic pressure constant for water at a specific density is given by; pressure **const = (ρ x g)**

Note: The units used in measurement determine the value of the constant (vary by 1/length unit to the fourth power.)

$$(\rho \cdot g) = 9.807 \frac{\text{s}}{\text{m}^4} \cdot \text{kW}$$

$$(\rho \cdot g) = 13.151 \frac{\text{s}}{\text{m}^4} \cdot \text{hp}$$



Note:

$$(\rho \cdot g) = 0.085 \frac{\text{s}}{\text{ft}^4} \cdot \text{kW}$$

$$\frac{1}{11.82} = 0.085$$

$$(\rho \cdot g) = 0.114 \frac{\text{s}}{\text{ft}^4} \cdot \text{hp}$$

$$\frac{1}{8.81} = 0.114$$

(US)

$$h = 492.126 \text{ ft}$$

$$\rho = 62.428 \frac{\text{lb}}{\text{ft}^3}$$

$$Q = 3.355 \frac{\text{ft}^3}{\text{s}}$$

$$\rho = 8.345 \frac{\text{lb}}{\text{gal}}$$

$$g = 32.174 \frac{\text{ft}}{\text{s}^2}$$

$$\rho \cdot g \cdot h = 3.07224 \times 10^4 \text{ psf}$$

$$\rho \cdot g \cdot h = 213.35 \text{ psi}$$

$$\text{Power} := \eta \cdot \rho \cdot g \cdot h \cdot Q$$

$$\text{Power} = 105.717 \text{ kW}$$

$$\text{Power} = 141.769 \text{ hp}$$

Common British (US) -

Power(ft, CFS) Hydro Calc:

$$\eta \cdot \frac{h \cdot Q}{11.8146 \cdot \frac{\text{ft}^4}{\text{s} \cdot \text{kW}}} = 105.717 \text{ kW}$$

$$\eta \cdot \frac{h \cdot Q}{8.81 \cdot \frac{\text{ft}^4}{\text{s} \cdot \text{hp}}} = 141.77 \text{ hp}$$

$$Q = 1.506 \times 10^3 \text{ gpm}$$

Hydropower (SI) & (US) Units Calculation Example -- SmallHydro.com --

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