# Important Hydroelectric Power Generation Formulas PDF

Formulas
Examples
with Units

## List of 15
### Important Hydroelectric Power Generation Formulas

### 1) Flow Rate for Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$Q_t = \frac{P \cdot 8.8}{\eta \cdot H}$$

Example with Units

$$0.4602\,\text{m}^3/\text{s} = \frac{170\,\text{W} \cdot 8.8}{14 \cdot 232.2\,\text{m}}$$

### 2) Flow Rate given Power in Kilowatt Formula

Evaluate Formula

Formula

$$Q_t = \frac{P \cdot 11.8}{\eta \cdot H}$$

Example with Units

$$0.6171\,\text{m}^3/\text{s} = \frac{170\,\text{W} \cdot 11.8}{14 \cdot 232.2\,\text{m}}$$

### 3) Flow Rate given Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$F = \frac{P \cdot 550}{\eta \cdot H \cdot \gamma_w}$$

Example with Units

$$0.0029\,\text{m}^3/\text{s} = \frac{170\,\text{W} \cdot 550}{14 \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}$$

### 4) Flow Rate given Power obtained from Water Flow in Kilowatt Formula

Evaluate Formula

Formula

$$F = \frac{P \cdot 738}{\eta \cdot H \cdot \gamma_w}$$

Example with Units

$$0.0039\,\text{m}^3/\text{s} = \frac{170\,\text{W} \cdot 738}{14 \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}$$

### 5) Potential Energy of Volume of Water in Hydroelectric Power Generation Formula

Evaluate Formula

Formula

$$PE = \gamma_w \cdot h$$

Example with Units

$$117.72\,\text{J} = 9.81\,\text{kN/m}^3 \cdot 12\,\text{m}$$

### 6) Total Weight of Water given Potential Energy in Hydroelectric Power Generation Formula

Evaluate Formula

Formula

$$\gamma_w = \frac{PE}{h}$$

Example with Units

$$9.7667\,\text{kN/m}^3 = \frac{117.2\,\text{J}}{12\,\text{m}}$$

## 7) Effective Head Formulas

### 7.1) Effective Head for Power in Kilowatt Formula

Evaluate Formula

Formula

$$H = \frac{P \cdot 11.8}{Q_t \cdot \eta}$$

Example with Units

$$311.4907\,\text{m} = \frac{170\,\text{W} \cdot 11.8}{0.46\,\text{m}^3/\text{s} \cdot 14}$$

### 7.2) Effective Head for Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$H = \frac{P \cdot 8.8}{Q_t \cdot \eta}$$

Example with Units

$$232.2981\,\text{m} = \frac{170\,\text{W} \cdot 8.8}{0.46\,\text{m}^3/\text{s} \cdot 14}$$

## 8) Efficiency of Turbine Formulas

### 8.1) Efficiency of Turbine and Generator for Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$\eta = \frac{P \cdot 8.8}{Q_t \cdot H}$$

Example with Units

$$14.0059 = \frac{170\,\text{W} \cdot 8.8}{0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m}}$$

### 8.2) Efficiency of Turbine and Generator given Power in Kilowatt Formula

Evaluate Formula

Formula

$$\eta = \frac{P \cdot 11.8}{Q_t \cdot H}$$

Example with Units

$$18.7807 = \frac{170\,\text{W} \cdot 11.8}{0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m}}$$

### 8.3) Efficiency of Turbine and Generator given Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$\eta = \frac{P \cdot 550}{Q_t \cdot H \cdot \gamma_w}$$

Example with Units

$$89.2324 = \frac{170\,\text{W} \cdot 550}{0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}$$

### 8.4) Efficiency of turbine and generator given Power obtained from water flow in Kilowatt Formula

Evaluate Formula

Formula

$$\eta = \frac{P \cdot 738}{F \cdot H \cdot \gamma_w}$$

Example with Units

$$11.0155 = \frac{170\,\text{W} \cdot 738}{0.005\,\text{m}^3/\text{s} \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}$$

# 9) Power obtained from Water Flow Formulas

## 9.1) Power obtained from Water Flow in Horsepower Formula

Evaluate Formula

Formula

$$P = \frac{\eta \cdot Q_t \cdot H \cdot \gamma_w}{550}$$

Example with Units

$$26.6719\,\text{W} = \frac{14 \cdot 0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}{550}$$

## 9.2) Power obtained from Water Flow in Kilowatt Formula

Evaluate Formula

Formula

$$P = \frac{H \cdot Q_t \cdot H \cdot \gamma_w}{738}$$

Example with Units

$$329.6818\,\text{W} = \frac{232.2\,\text{m} \cdot 0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m} \cdot 9.81\,\text{kN/m}^3}{738}$$

## 9.3) Power obtained from Water Flow in Kilowatt given Effective Head Formula

Evaluate Formula

Formula

$$P = \frac{\eta \cdot Q_t \cdot H}{11.8}$$

Example with Units

$$126.7261\,\text{W} = \frac{14 \cdot 0.46\,\text{m}^3/\text{s} \cdot 232.2\,\text{m}}{11.8}$$

## Variables used in list of Hydroelectric Power Generation Formulas above

- **F** Flow rate *(Cubic Meter per Second)*
- **h** Vertical Distance Water can Fall *(Meter)*
- **H** Effective Head *(Meter)*
- **P** Hydroelectric Power *(Watt)*
- **PE** Potential Energy *(Joule)*
- $Q_t$ Discharge from Dam *(Cubic Meter per Second)*
- $\gamma_w$ Unit Weight of Water *(Kilonewton per Cubic Meter)*
- **η** Efficiency of Turbine

## Constants, Functions, Measurements used in list of Hydroelectric Power Generation Formulas above

- Measurement: **Length** in Meter (m)
  *Length Unit Conversion*
- Measurement: **Energy** in Joule (J)
  *Energy Unit Conversion*
- Measurement: **Power** in Watt (W)
  *Power Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second ($m^3/s$)
  *Volumetric Flow Rate Unit Conversion*
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter ($kN/m^3$)
  *Specific Weight Unit Conversion*

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