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# Hydraulic Motors Formulas

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# List of 12 Hydraulic Motors Formulas

## Hydraulic Motors

### 1) Actual Discharge given Volumetric Efficiency

Open Calculator

fx $$Q_{actual} = \frac{Q_{th}}{\eta_v} \cdot 100$$

ex $$8m^3/s = \frac{0.04m^3/s}{0.5} \cdot 100$$

### 2) Actual Torque Delivered

Open Calculator

fx $$T_{actual} = \frac{P_{actual}}{2 \cdot \pi \cdot \Omega}$$

ex $$7.599089N*m = \frac{1500W}{2 \cdot \pi \cdot 5rev/s}$$

### 3) Mechanical Efficiency

Open Calculator

fx $$\eta_m = \frac{T_{actual}}{T_{theoretical}} \cdot 100$$

ex $$62.5 = \frac{250N*m}{400N*m} \cdot 100$$

## 4) Overall Efficiency Percentage

Open Calculator

fx $$\eta_o = \frac{\eta_{vol} \cdot \eta_m}{100}$$

ex $$50 = \frac{100 \cdot 50}{100}$$

## 5) Pressure of Liquid Entering Motor

Open Calculator

fx $$p = \frac{T_{theoretical}}{V_D}$$

ex $$20000\text{Pa} = \frac{400\text{N*m}}{0.02\text{m}^3/1}$$

## 6) Theoretical Discharge for Hydraulic Motors

Open Calculator

fx $$Q_{th} = V_D \cdot \Omega$$

ex $$0.628319\text{m}^3/\text{s} = 0.02\text{m}^3/1 \cdot 5\text{rev}/\text{s}$$

## 7) Theoretical Discharge given Volumetric Efficiency

Open Calculator

fx $$Q_{th} = \frac{\eta_v}{100} \cdot Q_{actual}$$

ex $$0.0035\text{m}^3/\text{s} = \frac{0.5}{100} \cdot 0.7\text{m}^3/\text{s}$$

## 8) Theoretical Power

Open Calculator

fx $$P_{th} = \frac{2 \cdot \pi \cdot N \cdot T_{theoretical}}{60}$$

ex $$58643.06W = \frac{2 \cdot \pi \cdot 1400rev/min \cdot 400N*m}{60}$$

## 9) Theoretical Power given Volumetric Displacement

Open Calculator

fx $$P_{th} = \frac{2 \cdot \pi \cdot N \cdot V_D \cdot p}{60}$$

ex $$2345.723W = \frac{2 \cdot \pi \cdot 1400rev/min \cdot 0.02m^3/1 \cdot 800Pa}{60}$$

## 10) Theoretical Torque Developed

Open Calculator

fx $$T_{theoretical} = V_D \cdot p$$

ex $$16N*m = 0.02m^3/1 \cdot 800Pa$$

## 11) Theoretical Volumetric Displacement given Torque and Pressure

Open Calculator

fx $$V_D = \frac{T_{theoretical}}{p}$$

ex $$0.5m^3/1 = \frac{400N*m}{800Pa}$$

## 12) Volumetric Efficiency of Motor given Theoretical and Actual Discharge

Open Calculator

**fx** $$\eta_{vol} = \frac{Q_{th}}{Q_{actual}} \cdot 100$$

**ex** $$5.714286 = \frac{0.04 m^3/s}{0.7 m^3/s} \cdot 100$$

## Variables Used

- **N** Angular Speed of Driving Member *(Revolution per Minute)*
- **p** Pressure of Liquid Entering Motor *(Pascal)*
- $P_{actual}$ Actual Power Delivered *(Watt)*
- $P_{th}$ Theoretical Power *(Watt)*
- $Q_{actual}$ Actual Discharge *(Cubic Meter per Second)*
- $Q_{th}$ Theoretical Discharge *(Cubic Meter per Second)*
- $T_{actual}$ Actual Torque *(Newton Meter)*
- $T_{theoretical}$ Theoretical Torque *(Newton Meter)*
- $V_D$ Theoretical Volumetric Displacement *(Cubic Meter Per Revolution)*
- $\eta_m$ Mechanical Efficiency
- $\eta_o$ Overall Efficiency
- $\eta_v$ Volumetric Efficiency
- $\eta_{vol}$ Volumetric Efficiency of Motor
- $\Omega$ Angular Speed *(Revolution per Second)*

# Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  *Archimedes' constant*
- Measurement: **Pressure** in Pascal (Pa)
  *Pressure Unit Conversion*
- Measurement: **Power** in Watt (W)
  *Power Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  *Volumetric Flow Rate Unit Conversion*
- Measurement: **Angular Velocity** in Revolution per Second (rev/s), Revolution per Minute (rev/min)
  *Angular Velocity Unit Conversion*
- Measurement: **Torque** in Newton Meter (N*m)
  *Torque Unit Conversion*
- Measurement: **Volumetric Displacement** in Cubic Meter Per Revolution (m³/1)
  *Volumetric Displacement Unit Conversion*

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- Buoyancy Formulas
- Centrifugal pumps Formulas
- Compressible Flow Formulas
- Draft Tube Formulas
- Dynamics of Fluid Flow Formulas
- Flow in Open Channels Formulas
- Forces developed by moving fluid Formulas
- Forces on Submerged Bodies Formulas
- Francis Turbine Formulas
- Hydraulic Linear Actuators Formulas
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