

# USEFUL FORMULAS



## Formulas

$$\text{Electrical Output HP} = \frac{\text{RPM} \times \text{Torque (Ft-lbs)}}{5252}$$

$$\text{Electrical Output HP (Three Phase)} = \frac{\text{Amps.} \times \text{Volts} \times \text{Motor Eff.} \times \text{Motor P.F.} \times 1.73}{746}$$

$$\text{Hydraulic Torque (Ft-lbs)} = \frac{\text{System Press (psi)} \times \text{Hyd. Motor Displ. (in}^3\text{)} \times \text{Sheave Ratio}}{2 \times 3.1416 \times 12 \text{ in/ft}}$$

$$\text{Hydraulic Horse Power} = \frac{\text{System Press (psi)} \times \text{Hyd. Motor Displ. (in}^3\text{)} \times \text{Hyd. Pump rpm}}{395.934}$$

$$\text{Hydraulic Motor Speed (RPM)} = \frac{\text{Flow (USgpm)} \times 231}{\text{Hydraulic Motor Displacement (in}^3\text{)}}$$

$$\frac{\text{Hydraulic Motor Torque / Rod Torque (ft.lbs)}}{75} = \frac{\text{Hydraulic Motor Displacement (in}^3\text{)} \times \text{Pressure (psi)}}{75}$$

$$\text{Rod Speed} = \text{Hydraulic Motor Speed} / \text{Drive Ratio}$$

$$\text{Rod Stress Range} = \frac{\text{Max. Stress} - \text{Min. Stress}}{\text{Max. Stress}}$$

$$\text{Rod Stress Ratio} = \frac{\text{Measured or Predicted Peak Stress}}{\text{Suggested Maximum Stress}}$$

$$\text{Polish Rod Speed} = \frac{\text{Production Rate (m}^3\text{/d)}}{\text{Pump displacement (m}^3\text{/d/RPM)}}$$

$$\text{Viscosity} = \mu = \frac{\gamma p}{1000} \quad \text{where: } \mu = \text{Dynamic Viscosity (centipoises)}$$

$\gamma = \text{Kinematic Viscosity (centistokes)}$   
 $p = \text{Fluid Density (kilograms per cubic meter)}$

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$$\text{Specific Gravity} = \frac{141.5}{\text{API} + 131.5}$$

(Refer to table below for API values)

$$\begin{aligned} \text{Fresh Water Gradient} &= 0.433 \text{ psi / foot} \\ &= 9.8 \text{ Kpa / meter} \end{aligned}$$

$$\text{Head Pressure (Kpa)} = \text{Fluid Density (kg/m}^3\text{)} \times \text{depth (meters)} \times 0.00981$$

## API Valve Calculation

Oil Density (kg/m <sup>3</sup> )	Specific Gravity	API
780	0.780	49.8
800	0.800	45.3
820	0.820	41.0
840	0.841	36.9
860	0.861	32.9
880	0.881	29.2
900	0.901	25.6
920	0.921	22.2
940	0.941	18.9
960	0.961	15.8
965	0.966	15.0
970	0.971	14.3
975	0.976	13.5
980	0.981	12.8
985	0.986	12.1
990	0.991	11.3
995	0.996	10.6
1000	1.001	9.9
1020	1.021	7.1
1040	1.041	4.5

## Electric Calculations

• Kilowatts (Single phase) =  $\frac{\text{Volts} \times \text{Amps.} \times \text{P.F.}}{1000}$

(Three phase) =  $\frac{1.73 \times \text{Surface Volts} \times \text{Amps.} \times \text{P.F.}}{1000}$

• KVA (Single Phase) =  $\frac{\text{Volts} \times \text{Amps.}}{1000}$

(Three phase) =  $\frac{1.73 \times \text{Surface Volts} \times \text{Amps.}}{1000}$

• Horsepower (Input - Single phase) =  $\frac{\text{Volts} \times \text{Amps.} \times \text{P.F.}}{746}$

(Output - Three phase) =  $\frac{1.73 \times \text{Volts} \times \text{Amps.} \times \text{P.F.}}{746}$

• Horsepower (Output – Single phase) =  $\frac{\text{Volts} \times \text{Amps.} \times \text{Eff.} \times \text{P.F.}}{746}$

(Output – Three phase) =  $\frac{1.73 \times \text{Volts} \times \text{Amps.} \times \text{Eff.} \times \text{P.F.}}{746}$

• Amperes (Horsepower known - Single phase) =  $\frac{\text{H.P.} \times 746}{\text{Volts} \times \text{Eff.} \times \text{P.F.}}$

Horsepower known - Three phase) =  $\frac{\text{H.P.} \times 746}{1.73 \times \text{Volts} \times \text{Eff.} \times \text{P.F.}}$

• Amperes (Kilowatts known - Single phase) =  $\frac{\text{Kilowatts} \times 1000}{\text{Volts} \times \text{P.F.}}$

(Kilowatts known - Three phase) =  $\frac{\text{Kilowatts} \times 1000}{1.73 \times \text{Volts} \times \text{P.F.}}$

• Amperes (KVA known - Single phase) =  $\frac{\text{Kilowatts} \times 1000}{\text{Volts}}$

(KVA known - Three phase) =  $\frac{\text{KVA} \times 1000}{1.73 \times \text{Volts}}$

• Power Factor (Single phase) =  $\frac{\text{KW} \times 1000}{\text{Volts} \times \text{Amps.}}$

(Three phase) =  $\frac{\text{KW (observed)} \times 1000}{\text{Volts} \times \text{Amps.} \times 1.73}$

(Eff.) Efficiency in the above formulas expressed as a decimal

(P.F.) Power Factor in the above formulas expressed as a decimal