Fluid Power Formulas

Basic Fluid Power Formulas

VARIABLE	WORD FORMULAS W/ UNITS	SIMPLIFIED FORMULA
Fluid Pressure - P	(PSI) = Force (Pounds) / Area (Sq. In.)	P = F / A
Fluid Flow Rate - Q	GPM = Flow (Gallons) / Unit Time (Minutes)	Q = V / T
Fluid Power in Horsepower - HP	Horsepower = Pressure (PSIG) × Flow (GPM)/ 1714	HP = PQ / 1714

Pump Formulas

VARIABLE	WORD FORMULAS W/ UNITS	SIMPLIFIED FORMULA
Pump Output Flow - GPM	GPM = (Speed (rpm) × disp. (cu. in.)) / 231	GPM = (n × d) / 231
Pump Input Horsepower - HP	HP = GPM × Pressure (psi) / 1714 × Efficiency	HP = (Q ×P) / 1714 × E
Pump Efficiency - E	Overall Efficiency = Output HP / Input HP	$E_{Overall} = HP_{Out} / HP_{In} \times 100$
	Overall Efficiency = Volumetric Eff. × Mechanical Eff.	$E_{Overall} = Eff_{Vol} \times Eff_{Mech.}$
Pump Volumetric Efficiency - E	Volumetric Efficiency = Actual Flow Rate Output (GPM) / Theoretical Flow Rate Output (GPM) × 100	$Eff_{Vol} = Q_{Act.} / QT_{heo.} \times 100$
Pump Mechanical Efficiency - E	Mechanical Efficiency = Theoretical Torque to Drive / Actual Torque to Drive × 100	$Eff_{Mech} = T_{Theo} / T_{Act.} \times 100$
Pump Displacement - CIPR	Displacement ($In._3$ / rev.) = Flow Rate (GPM) × 231 / Pump RPM	CIPR = GPM × 231 / RPM
Pump Torque - T	Torque = Horsepower × 63025 / RPM	T = 63025 × HP / RPM
	Torque = Pressure (PSIG) × Pump Displacement (CIPR) / 2π	T = P × CIPR / 6.28

Actuator Formulas

VARIABLE	WORD FORMULAS W/ UNITS	SIMPLIFIED FORMULA
Cylinder Area - A	(Sq. In.) = π × Radius $(inch)^2$	$A = \pi \times R^2$
	(Sq. In.) = π × Diameter $(inch)^2$/ 4	$A = \pi \times D^2 / 4$
Cylinder Force - F	(Pounds) = Pressure (psi) × Area (sq. in.)	F = P × A
Cylinder Speed - v	(Feet / sec.) = (231 × Flow Rate (GPM)) / (12 × 60 × Area)	V = (0.3208 × GPM) / A
Cylinder Volume Capacity - V	Volume = π × $Radius^2$ × Stroke (In.) / 231	$V = \pi \times R^2 \times L / 231$
		(L = length of stroke)
Cylinder Flow Rate - Q	Volume = 12 × 60 × Velocity (Ft./Sec.) × Net Area $(In.)^2$ / 231	Q = 3.11688 × v × A
Fluid Motor Torque - T	Torque (in. lbs.) = Pressure (psi) × disp. $(in.^3$ / rev.) / 6.2822	T = P × d / 6.2822
	Torque = HP × 63025 / RPM	T = HP × 63025 / n
	Torque = Flow Rate (GPM) × Pressure × 36.77 / RPM	T = 36.77 × Q × P / n
Fluid Motor Horsepower - HP	HP = Torque (in. lbs.) × rpm / 63025	HP = T × n / 63025