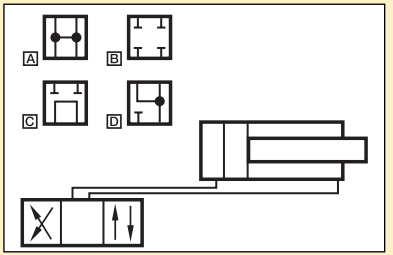
Hydraulic Formulas

The following formulas can be helpful in designing and sizing hydraulic systems for specific applications.

psi	=	$\frac{F}{A}$	Fluid pressure (psi) = Force (lbs.) ÷ Area (sq. in.)
A	=	πr^2	Cylinder area (sq. in.) = 3.1416 x Radius^2 (in.)
F	=	PA	Cylinder force (lbs.) = Pressure (psi) x Area (sq. in.)
V	=	$\frac{.3208Q}{A}$	Cylinder speed (ft./sec.) = (231 x GPM) ÷ (12 x 60 x Area)
HP	=	$\frac{QP}{1714}$	Hydraulic horsepower = Pressure (psi) x GPM ÷ 1714
T	=	$\frac{PD}{2\pi}$	Fluid motor torque (in. -lbs.) = Pressure (psi) x displ. (cu. in.) ÷ 62822
N	=	$\frac{231\ Q}{d}$	Fluid motor speed (RPM) = 231 x GPM ÷ displ. (cu. in.)
HP	=	$\frac{TN}{63025}$	Fluid motor horsepower = Torque (in.-lbs.) x RPM ÷ 63025
Q	=	$\frac{ND}{231}$	Pump output flow (GPM) = Speed (RPM) x displ. (cu. in.) ÷ 231

1 Gallon	=	231 Cubic Inches
Input HP	=	psi x GPM x .0007
Hydraulic Motor HP	=	Torque x RPM ÷ 63025
Volume (in.^{3})	=	Area (in.^{2}) x Stroke (in.)
Area	=	(Piston Dia.)^2 x .7854
Flow (GPM)	=	Rod Speed (in./min.) x Area (in.^{2}) ÷ 231
Force (lbs.)	=	Pressure Applied (psi) x Piston Area (in.^{2})

Spool Schematic



A Open Center

Used when cylinder "drift" is necessary under pressure (i.e. snow plow blade)

B Closed Center

Used when cylinder must lock into place along travel path and fluid flow from supply is blocked completely (i.e. air-powered press)

C Tandem Center

Same as "B" but allows fluid to flow through valve, reducing created fluid heat and facilitating more functions downstream (i.e. multiple valves in series)

D Float Center

In the center position the cylinder can move free-wheeling in or out under no pressure (i.e. free-wheeling hydraulic motor)