FLUID POWER DATA

FORMULAS

Basic Fluid Power Formulas:

Pressure	FORCE TRANSMITTED OVER AN AREA	$P = \frac{\text{FORCE (Pounds)}}{\text{AREA (Square Inches)}} = \frac{F}{A} = \text{PSI}$	
Flow	RATE EXPRESSED AS FLOW (GALLONS) VS. TIME (MIN)	$Q = \frac{\text{VOLUME (Gallons)}}{\text{TIME (Minutes)}} = \frac{\text{GAL}}{\text{MIN}} = \text{GPM}$	
Horsepower	FLUID POWER IN HORSEPOWER	$HP = \frac{\text{PRESSURE (PSI) X FLOW (GPM)}}{1714} = \frac{P \times Q}{1714}$	

Fluid Formulas:

Velocity	FLUID SPEED EXPRESSED AS FLOW (GPM) VS. INTERNAL PIPE FLOW AREA (SQ-IN)	$V = \frac{.3208 \times \text{FLOW (GPM)}}{\text{INTERNAL AREA (Sq In)}} = \frac{.3208 \times Q}{A}$ or $V = \frac{.4085 \times \text{FLOW (GPM)}}{\text{INTERNAL DIAMETER}^2} = \frac{.4085 \times Q}{ID^2}$	
Compressibility	APPROX. 1/2% PER 1000PSI- THEORETICAL. USE 3% PER 1000PSI AS A SAFE FIGURE ONCE AIR HAS BEEN BLED	$V_A = \frac{\text{PRESSURE (PSI) X VOLUME}}{250{,}000 \text{ (approx.)}} = \frac{PSI \times VOL}{250{,}000}$	
Expansion	ADDITIONAL OIL GENERATED ABOVE ORIGINAL VOLUME DUE TO THERMAL EXPANSION	$V_A = \frac{\text{TEMP. CHANGE (°F) X VOLUME}}{2000 \text{ (approx.)}} = \frac{\Delta T \times VOL}{2000}$	
Specific Gravity	EXPRESSED AS A COEFFICIENT (GENERALLY .86-.90 FOR MOST AW32 THRU AW68 OILS)	$S_G = \frac{\text{WEIGHT OF ONE CU-FT OF FLUID}}{\text{WEIGHT OF ONE CU-FT OF WATER}} = \frac{W}{62.4283}$	
Flow Coeff. C_v	COEFFICIENT OF FLOW - EXPRESSED IN GALLONS PER MINUTE OF 60° F WATER AT ONE PSI PRESSURE DROP ACROSS THE VALVE OR OTHER FLOW DEVICE.	$C_v = \frac{\text{FLOW RATE (GPM) X } \sqrt{\text{SPEC. GRAVITY}}}{\sqrt{\text{PRESSURE DROP (PSI)}}} = \frac{GPM \times \sqrt{S_G}}{\sqrt{\Delta P}}$	
Viscosity	FOR VISCOSITIES OF 32 TO 100 SAYBOLT UNIVERSAL SECONDS:	$CS = .2253 \times SUS - \frac{194.4}{SUS}$	APPROXIMATE VISCOSITIES AT 100°F: AW32- 150 SUS AW46- 205 SUS AW68- 310 SUS
	FOR VISCOSITIES OF 100 TO 240 SAYBOLT UNIVERSAL SECONDS:	$CS = .2193 \times SUS - \frac{134.6}{SUS}$	
	FOR VISCOSITIES ABOVE 240 SAYBOLT UNIVERSAL SECONDS:	$CS = \frac{SUS}{4.635}$	

Cylinder Formulas:

Area	OF A CIRCLE EXPRESSED AS SQUARE INCHES	$A = \pi \times \text{RADIUS}^2 \text{ (Inches)} = \pi \times r^2$	
		$A = \frac{\pi}{4} \times \text{DIAMETER}^2 \text{ (Inches)} = \frac{\pi D^2}{4} = .7854 \times D^2$	
Force	EXPRESSED IN POUNDS, IN FLUID GENERATED BY PRESSURE X AREA	$F = \text{PRESSURE (PSI) X AREA (Sq-In)} = P \times A$	
Speed	EXPRESSED IN INCHES/ SEC	$S = \frac{\text{3.85 X FLOW (GPM)}}{\text{CYL. EFFECTIVE AREA (Sq-In)}} = \frac{3.85 \times Q}{A}$	
Flow Rate	FLOW EXPRESSED IN GPM. NOTE: DEDUCT ROD AREA FOR CYL. RETRACT.	$Q = .26 \times \text{CYL. AREA (Sq-In) X SPEED (In-Sec)} = .26 \times A \times S$	