

GENERAL INFORMATION

USEFUL FACTORS OR FORMULAS

$$\text{WHP} = \frac{\text{Ft. Head} \times \text{GPM}}{3960}$$

$$\text{BHP} = \frac{\text{WHP}}{\text{EFF}} \text{ or } \text{BHP} = \frac{\text{Ft. Head} \times \text{GPM}}{3960 \times \text{EFF (Pump)}}$$

$$\text{EFF} = \frac{\text{WHP}}{\text{BHP}} \times 100$$

WHP = Water Horsepower

BHP = Brake Horsepower

EFF = Pump Efficiency

To determine the approximate horsepower required for an ACE centrifugal pump at a given flow and pressure:

$$\text{HP} = \frac{\text{GPM} \times \text{PSI}}{1714 \times .5}$$

To determine the speed at which a liquid is traveling:

$$\text{Velocity (ft/sec)} = \frac{.408 \times \text{GPM}}{(\text{pipe diameter})^2}$$

To determine the heat generated from by-passed hydraulic oil:

$$\text{BTU Per Hour} = \text{GPM} \times \text{PSI} \times 1.48$$

$$12,000 \text{ BTU/HR} = 1 \text{ Ton Refrigeration}$$

$$\text{Feet Head} = \frac{\text{PSI (water)} \times 2.31}{\text{specific gravity}}$$

$$\text{PSI (pounds per square inch)} = \text{Feet Head} \times .433$$

$$\text{Weight of one U.S. Gallon of water} = 8.34 \text{ pounds}$$

$$\text{One cubic foot (cu. ft.) of water contains } 7.48 \text{ gallons}$$

$$\text{Specific gravity of water (sp. gr.)} = 1.0$$

SPECIFIC GRAVITY

Water weighs 8.34 lbs./gallon and has a specific gravity of 1. Since specific gravity is a ratio of the weight of a liquid compared to the weight of water, the specific gravity of a liquid such as 28% nitrogen fertilizer, which weighs 10.65 lbs./gallon would be figured thus:

$$\frac{10.65 \text{ lbs./gallon}}{8.34 \text{ lbs./gallon}} = 1.28 \text{ specific gravity}$$

SOLUTION WEIGHT	SPECIFIC GRAVITY	CONVERSION FACTOR
8.0 lbs./gal.	.96	.98
8.34 lbs./gal.	1.0	1.0
9.0 lbs./gal.	1.08	1.04
10.0 lbs./gal.	1.2	1.1
10.65 lbs./gal.	1.28	1.13
11.0 lbs./gal.	1.32	1.15

All pump capacities (GPM) in this catalog are based on water. When pumping fluids that are heavier than water, pump capacity will be less than stated on each pump performance table. To compensate for pumping heavy liquids, multiply the required pump capacity in GPM times the appropriate conversion factor from the above chart.

EXAMPLE: Required pump capacity is 50 GPM of 28% nitrogen fertilizer.

$$50 \times 1.13 = 56.5 \text{ GPM}$$

Then select a pump from the preceding pages that will deliver 56.5 GPM at the desired pressure.

CONVERSION FACTORS

	Multiply	By	To Obtain
LENGTH	inches	25.40	millimeters (mm)
	inches	2.540	centimeters (cm)
	feet	0.3048	meters (m)
	miles	1.609	kilometers (km)
AREA	acres	4046.7	square meters (m ²)
	acres	0.4047	hectares (ha)
	hectares	2.471	acres
VOLUME	gallons	3.785	cubic decimeters (dm ³)
	gallons	3.785	liters (L)
	gallons	231	cubic inches (in ³)
	Imperial gallons	4.546	liters (L)
	Imperial gallons	1.201	U.S. gallons
	U.S. gallons	.833	Imperial gallons
	liter	0.264	gallon
	pounds water	0.119	gallon
FLOW RATE	gallons/hour (gph)	3.785	liters/hour (L/h)
	gallons/minute (gpm)	3.785	liters/minute (L/m)
APPL. RATE	gallons/acre (gpa)	9.353	liters/hectare (L/ha)
PRESSURE	pounds per square inch (psi)	6.895	kilopascals (kPa)
	PSI	2.31	ft. (head) of water
	ft. (head) of water	0.433	PSI
	inches mercury (in Hg)	0.491	PSI
	bar	14.5	PSI
	kilopascal (KPA)	0.145	PSI
SPEED	miles/hour (mph)	1.609	kilometers/hour (km/h)
	kilometers/hour (km/h)	0.621	miles/hour (mph)

PIPE & HOSE FRICTION TABLES

FLOW PRESSURE DROP IN PSI FOR VARIOUS PIPE SIZES (10FT. LENGTH)

IN GPM	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"
.2	.2							
.3	.4							
.4	.6	.16						
.5	1.0	.24						
.6	1.5	.34						
.8	2.5	.60	.13					
1.0	3.7	.89	.19	.08				
1.5	8.0	<u>1.8</u>	.40	.13				
2.0		3.1	<u>.65</u>	.21	.05			
2.5		4.7	1.1	.32	.08			
3.0		6.3	1.5	.45	.11			
3.5			2.0	.60	.14			
4.0			2.5	.78	.18	.06		
4.5			3.1	.98	.23	.08		
5.0			3.8	<u>1.2</u>	.28	.09		
6.0			5.2	1.6	.38	.11		
8.0				2.8	<u>.63</u>	.20	.06	
10.0				4.2	1.0	.30	.08	.04
15.0					2.2	<u>.61</u>	.16	.08
20.0					3.8	1.1	.29	.13
25.0						1.7	<u>.41</u>	.20
30.0						2.4	.59	.27
35.0							.79	<u>.36</u>
40.0							1.0	.48
50.0								.71

NOTE: The above figures are for standard pipe of either seamless or welded construction, in good clean condition. Recommended maximum capacity to keep velocity at approximately 5 ft. per second is shown above heavy lines.

**PRESSURE DROP IN PSI FOR VARIOUS HOSE SIZES
25 ft. length with no coupling**

FLOW IN GPM	1/4" I.D.	3/8" I.D.	1/2" I.D.	5/8" I.D.	3/4" I.D.	1" I.D.	1 1/4" I.D.	1 1/2" I.D.
.2	.8							
.3	1.5							
.4	2.5							
.5	4.0	.5						
.6	5.0	.8						
.8	9.0	1.3						
1.0		1.8	.5					
2.0		6.0	1.5					
3.0		13.0	3.1	1.0				
4.0			6.0	1.8				
5.0			8.5	2.5	1.0			
6.0			12.0	3.7	1.5			
8.0				6.5	2.5	.6		
10.0				9.5	3.7	1.0		
15.0					8.0	2.0	.7	
20.0					14.0	3.4	1.2	.4
25.0						5.0	1.8	.6
30.0						6.5	2.5	.9
40.0						12.0	4.4	1.4
50.0							6.0	2.1
60.0							9.0	2.9
70.0							13.0	4.0

NOTE: The above figures are for standard hose in good condition with no couplings.

APPROXIMATE FRICTION LOSS IN PIPE FITTINGS

in terms of equivalent feet of straight pipe.

PIPE SIZE STD. WT.	ACTUAL INSIDE DIAM. IN.	GATE VALVE	GLOBE VALVE	45° ELBOW	RUN OF STD. TEE	STD. ELBOW OR RUN OF TEE REDUCED 1/2	STD. TEE THRU SIDE OUTLET
		FULL OPEN	FULL OPEN				
1/8	.269	.15	8	.35	.40	.75	1.4
1/4	.364	.20	11	.50	.65	1.1	2.2
1/2	.622	.35	18.6	.78	1.1	1.7	3.3
3/4	.824	.44	23.1	.97	1.4	2.1	4.2
1	1.049	.56	29.4	1.2	1.8	2.6	5.3
1-1/4	1.380	.74	38.6	1.6	2.3	3.5	7.0
1-1/2	1.610	.86	45.2	1.9	2.7	4.1	8.1
2	2.067	1.1	58	2.4	3.5	5.2	10.4
2-1/2	2.469	1.3	69	2.9	4.2	6.2	12.4