USEFUL FACTORS OR FORMULAS

Feet Head = PSI (water) x 2.31
          sp.gr.

PSI (pounds square inch) = Ft Head x .433
Specific gravity of water (sp. gr.) = 1.0

GPA = \frac{5940 \times GPM \text{ (per Nozzle)}}{\text{MPH} \times W}

GPM (per Nozzle) = \frac{\text{GPA} \times \text{MPH} \times W}{5940}

GPA = \text{Gallons Per Acre}
GPM = \text{Gallons Per Minute}
\text{MPH} = \text{Miles Per Hour}
W = \text{Nozzle spacing (in inches)}
    \text{for broadcast spraying}
W = \text{Spray width (in inches)}
    \text{for single nozzles,}
    \text{band spraying, or boomless}
    \text{spraying}
W = \text{Row spacing (in inches)}
    \text{divided by}
    \text{the number of nozzles per row for}
    \text{directed spraying.}

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

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

\text{EFF} = \text{WHP} \times 100 \div \text{BHP}

\text{WHP} = \text{Water Horsepower}
\text{BHP} = \text{Brake Horsepower}
\text{EFF} = \text{Pump Efficiency}

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:

\begin{align*}
10.65 \text{ lbs./gallon} &= 1.28 \text{ specific gravity} \\
8.34 \text{ lbs./gallon} &= 1.0
\end{align*}

<table>
<thead>
<tr>
<th>Solution Weight</th>
<th>Specific Gravity</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 lbs./gal.</td>
<td>.96</td>
<td>.98</td>
</tr>
<tr>
<td>8.34 lbs./gal.</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>9.0 lbs./gal.</td>
<td>1.08</td>
<td>1.04</td>
</tr>
<tr>
<td>10.0 lbs./gal.</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>10.65 lbs./gal.</td>
<td>1.28</td>
<td>1.13</td>
</tr>
<tr>
<td>11.0 lbs./gal.</td>
<td>1.32</td>
<td>1.15</td>
</tr>
</tbody>
</table>

All pump capacitites (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 following pages that will deliver 56.5 GPM at the desired pressure.

CONVERSION FACTORS

<table>
<thead>
<tr>
<th></th>
<th>Multiply</th>
<th>By</th>
<th>To Obtain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length inches</td>
<td></td>
<td>25.40</td>
<td>millimeters (mm)</td>
</tr>
<tr>
<td>inches</td>
<td></td>
<td>2.540</td>
<td>centimeters (cm)</td>
</tr>
<tr>
<td>feet</td>
<td></td>
<td>0.3048</td>
<td>meters (m)</td>
</tr>
<tr>
<td>miles</td>
<td></td>
<td>1.609</td>
<td>kilometers (km)</td>
</tr>
</tbody>
</table>
To determine the speed at which a liquid is traveling:

\[
\text{Velocity (ft./sec)} = \frac{0.408 \times \text{GPM}}{\text{pipe diameter}^2}
\]

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

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

12,000 BTU/HR = 1 Ton Refrigeration

Weight of one U.S. Gallon of water = 8.34 pounds
One cubic foot (cu.ft.) of water contains 7.48 gallons

---

### Conversion Factors

<table>
<thead>
<tr>
<th>Area</th>
<th>acres</th>
<th>4046.7</th>
<th>square meters (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>acres</td>
<td>0.4047</td>
<td>hectares (ha)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Volume</th>
<th>gallons</th>
<th>3.785</th>
<th>cubic decimeters (dm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gallons</td>
<td>3.785</td>
<td>liters (L)</td>
</tr>
<tr>
<td></td>
<td>Imperial gallons</td>
<td>4.546</td>
<td>liters (L)</td>
</tr>
<tr>
<td></td>
<td>Imperial gallons</td>
<td>1.201</td>
<td>U.S. gallons</td>
</tr>
<tr>
<td></td>
<td>U.S. gallons</td>
<td>.833</td>
<td>Imperial gallons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow Rate</th>
<th>gallons/hour (gph)</th>
<th>3.785</th>
<th>liters/hour (L/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gallons/minute (gpm)</td>
<td>3.785</td>
<td>liters/minute (L/m)</td>
</tr>
</tbody>
</table>

| Appl. Rate | gallons/acre (gpa) | 9.353 | liters/hectare (L/ha) |

| Pressure    | pounds per square inch (psi) | 6.895 | kilopascals (kPa)     |

| Speed       | miles/hour (mph) | 1.609 | kilometers/hour(km/h) |

---

**Conversion Factors**

- \( \text{Liters/Min.} \times 0.264 = \text{GPM (U.S.)} \)
- \( \text{GPM (U.S.)} \times 3.785 = \text{Liters/Min.} \)
- \( \text{Ft. (head)} \times 0.433 = \text{PSI} \)
- \( \text{Lbs. water} \times 0.119 = \text{Gal.} \)
- \( \text{PSI} \times 6.9 = \text{KPA (kilopascal)} \)
- \( \text{KPA (kilopascal)} \times 0.145 = \text{PSI} \)
- \( \text{Inches Mercury (Hg)} \times 4.91 = \text{PSI} \)
- \( \text{Liter} \times 0.264 = \text{Gal.} \)
- \( 1 \text{ BAR} = 14.5 \text{ PSI} \)
- \( 1 \text{ US Gal.} = 231 \text{ in}^3 \)

---

**PULLEY RATIO**

To get the desired performance from an ACE Frame Mounted Pump, the proper speed ratio between the pump and drive source must be established. The following formula should be helpful:

\[
\frac{\text{Pump RPM}}{\text{Driveshaft RPM}} = \frac{\text{Drive Pulley Diameter}}{\text{Pump Pulley Diameter}}
\]
For example: To drive an FMC-150-MAG pump at 5000 RPM with a drive source RPM of 3600 and knowing that the clutch pulley diameter on the pump is 5.25", what should the diameter of the drive pulley be?

\[
\frac{5000 \text{ RPM}}{3600 \text{ RPM}} = \frac{\text{Drive Pulley Diameter}}{5.25''}
\]

1) \(5000 \times 5.25 = 26250\)
2) \(26250 \div 3600 = 7.29\)

The drive pulley diameter, when rounded off should be 7.25" (7 ¼").

**PTO TUMBLE ROD MOUNTING**

**BELT TENSION**

Proper belt alignment and belt tension will prevent premature bearing failure in the clutch and/or the pump. Use a straight edge held on the faces of the pulleys to check alignment. To provide proper belt tension, lay the straight edge on the tops of both pulleys as shown. Use mild force to deflect the belt as shown. Use a ruler to measure the amount of deflection. Proper tension will allow 1/2" of deflection for each foot of distance between the pulleys. For example: If the distance between the pulleys is three feet, the deflection should be 1 1/2".
PUMP ROTATION
The direction of rotation is always determined WHEN FACING THE SHAFT. This rule applies for the pump shaft and the driver shaft. Ace Frame Mounted pumps are available in both clockwise (CW) and counterclockwise (CCW) rotation. Ace model numbers which include a “CW” have a clockwise rotation; all other models are counterclockwise rotation.

When direct coupling shafts, always MATCH THE OPPOSITE ROTATION pump with the shaft. As illustrated, a gasoline engine with CCW rotation will direct couple to a FMC-CW-800 pump with clockwise rotation. When mounting a pump with belts and pulleys, either pump rotation can be used to match the drive shaft rotation and the desired direction of the pump.

The rotation of several common power sources are as follows: Gasoline engine and electric motor shafts rotate in a counterclockwise direction; a tractor PTO shaft rotates in a clockwise direction; the front tractor engine crankshaft rotates in a counterclockwise direction.

PTO Shaft: clockwise (CW) rotation

Electric Motor: counter clockwise (CCW)
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