SIZING A PRESSURE TANK

The functions of a pressure tank are to:

1. Protect and prolong the life of the pump by preventing rapid cycling of the pump motor;
2. Provide water under pressure for delivery between pump cycles; and
3. Provide additional water storage under pressure to assist the pump in meeting the total demands of a system if the pump or well is incapable of supplying the required capacity.

Selecting a Pressure Tank

When selecting a pressure tank, certain information must be known:

1. System demand;
2. Pump capacity; and
3. Well capacity.

The system demand is a function of water usage and location, expressed as gallon(s) per minute (gpm) and pound(s) per square inch gauge (psig), respectively. Usage or flow (gpm) can be determined using one of several methods (refer to Table I.3.1 for typical demands):

a. The fixture method determines the system demand by totaling the number of fixtures in the home, including outside hose bibs, and multiplying this number by 1 gallon per minute (gpm). For example, 10 fixtures x 1 gpm = 10 gpm.

b. The peak demand method determines system demand considering that more than one fixture will be in use under peak demand. The number of fixtures being used at the same time is determined and multiplied by 3 gpm. For example, 4 fixtures x 3 gpm = 12 gpm.

c. An alternate method determines system demand by calculating the number of bathrooms (half baths are considered as 1) and multiplying by 4 gpm. For a home with 2 ½ bathrooms, multiply 3 x 4 gpm = 12 gpm.

Use the largest system demand determined by the above methods. For determining system demand for water systems supplying farms, and public or commercial buildings such as schools or motels, see our Water Systems Handbook.
The pump capacity should be selected according to the system demand. If a pump exists, the capacity must be determined.

The well capacity should be documented when the well has been declared ready for use and will often be referred to in gallons per hour (gph). If the well capacity is unknown, it should be determined by measuring the well water level. The water level must be lowered via pumping, measured, then allowed to recover to the static water level. A record of the time required to return to static water level along with the well pipe size can be used to calculate the well capacity (recovery). An alternate method of determining if the well capacity is sufficient for system demand is to draw water from the well at or above the peak demand and determine if the well can sustain the peak demand flow.

A typical water system will have adequate well capacity and pump capacity to meet or exceed the system demand. The system will commonly function using a differential pressure switch to control the system pressure at or above the minimum required system pressure.
Total Tank Volume

Selecting the pressure tank total volume for typical systems will consider the pump capacity. Total tank volume is not a measure of tank acceptance volume, which is typically considered to be available water volume or tank drawdown. Total tank volume is a measure of the total tank size required to provide the required available water. The total tank volume will vary depending on tank type.

a. Referring to Table IV.1.2, select the pump capacity, tank type and pressure switch settings to determine the total tank volume.

b. When it is desired to have a pressure switch setting different from those included in the table, the total tank volume can be determined as follows:

\[
\text{Total Tank Volume} = \frac{\text{Minimum Drawdown (from Table IV.1.2)}}{\text{Acceptance Factor}}
\]

(Acceptance Factor is the factor of the total tank volume that will provide available water).

Acceptance Factor is calculated using the pressure tank precharge pressure (2 psig below the pump cut-in pressure). The pressure tank will operate between the pressures set by the pressure switch. The tank precharge pressure should be set at 2 psig below the low pressure cut-in to prevent a noticeable drop in pressure at the fixture.

\[
\text{Acceptance Factor} = 1 - \frac{(P1 \text{ cut in} - 2) + 14.7}{(P2 \text{ cut out} + 14.7)}
\]

TABLE IV.1.2

<table>
<thead>
<tr>
<th>PUMP CAPACITY (GPM)</th>
<th>MINIMUM DRAWDOWN (1)</th>
<th>SWITCH SETTING (Pounds Per Square Inch)</th>
<th>TOTAL TANK VOLUME (GALLONS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20-40</td>
<td>30-50</td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>4</td>
<td>A*</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>5</td>
<td>B*</td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>6</td>
<td>C*</td>
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</tr>
<tr>
<td>420</td>
<td>7</td>
<td>A*</td>
<td></td>
</tr>
<tr>
<td>480</td>
<td>8</td>
<td>B*</td>
<td></td>
</tr>
<tr>
<td>540</td>
<td>9</td>
<td>C*</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>10</td>
<td>A*</td>
<td></td>
</tr>
<tr>
<td>660</td>
<td>11</td>
<td>B*</td>
<td></td>
</tr>
<tr>
<td>720</td>
<td>12</td>
<td>C*</td>
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</tr>
<tr>
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<td>A*</td>
<td></td>
</tr>
<tr>
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<td>14</td>
<td>B*</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>15</td>
<td>C*</td>
<td></td>
</tr>
<tr>
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<td>C*</td>
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<td>C*</td>
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<td>1680</td>
<td>28</td>
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<td></td>
</tr>
<tr>
<td>1800</td>
<td>30</td>
<td>B*</td>
<td></td>
</tr>
</tbody>
</table>

A* – Bladder or Diaphragm Tank Design  B* – Rotating Water Tank Design  C* – Plain Steel Tank Design

(1) NOTE: Actual values may vary somewhat with field conditions.

See VDF pump manufacturers for tank sizing.
When the Well or Pump Cannot Meet Peak Demand

In cases where the well cannot meet the peak system demand, additional pump protection may be required in the form of floats or power monitors. For more information on low-producing wells, reference the *Water Systems Handbook*.

In cases where the pump cannot meet the peak system demand, a supplemental drawdown may be obtained from the pressure tank. (See figure above). Supplemental drawdown can be added to the pressure tank by adjusting the tank and system pressures in order to supplement the system during times of peak demand. When the pump can meet the system demand, it will operate between the pressure switch settings. When the pump cannot meet the system demand, the pressure will drop below the cut-in pressure. The supplemental drawdown is supplied by the tank at a pressure between the tank precharge and the cut-in pressure.

The supplemental drawdown required is determined from peak demand:

\[
\text{Supplemental Drawdown (Gallons)} = (\text{Peak Demand (gpm)} - \text{Pump Capacity (gpm)}) \times [\text{Peak Demand Time (minutes)}]
\]

The total required drawdown is determined by referring to Table IV.1.2 to obtain the minimum drawdown:

\[
\text{Total Required Drawdown (Gallons)} = [\text{Minimal Drawdown} + \text{Supplemental Drawdown}]
\]

\[
\text{Total Tank Volume} = \frac{\text{Total Drawdown}}{\text{Acceptance Factor}}
\]

where the

\[
\text{Acceptance Factor} = 1 - \frac{(P1 \text{ pressure tank precharge} + 14.7)}{(P2 \text{ cut out} + 14.7)}
\]

Consult the manufacturer for additional assistance in determining proper tank sizing and pressure settings.

For more information on sizing a pressure tank see our *Water Systems Handbook*.
For More Information on Sizing a Pressure Tank

Contact your licensed well contractor, the tank manufacturer, or the wellcare® Hotline.

Information to help maintain and protect your water well system:

wellcare® is a program of the Water Systems Council (WSC). WSC is the only national organization solely focused on protecting the health and water supply of an estimated 23 million households nationwide who depend on private wells (according to the U.S. EPA).

This publication is one of more than 100 wellcare® information sheets available FREE at www.watersystemscouncil.org.

Well owners and others with questions about wells and well water can contact the wellcare® Hotline at 1-888-395-1033 or visit www.wellcarehotline.org to fill out a contact form or chat with us live!

JOIN THE WELLCARE® WELL OWNERS NETWORK!

By joining the FREE wellcare® Well Owners Network, you will receive regular information on how to maintain your well and protect your well water.

Contact us at 1-888-395-1033 or visit www.wellcarehotline.org to join!