wellcare® information for you about

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 IV.1.1 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 Book I, Chapter 3, of the *Water Systems Handbook*.

TABLE IV.1.1

Average Water Consumption for Home and Farm Use

PRIVATE RESIDENCES

Outlets	Flow Rate GPM	Total Usage Gallons	Bathrooms in Home			
			1	1½	2-2½	3-4
Shower or Bathtub	5	35	35	35	53	70
Lavatory	4	2	2	4	6	8
Toilet	4	5	5	10	15	20
Kitchen Sink	5	3	3	3	3	3
Automatic Washer	5	35	–	18	18	18
Dishwasher	2	14	–	–	3	3
Normal seven minute* peak demand (gallons)			45	70	98	122
Minimum sized pump required to meet peak demand without supplemental supply		Divide peak demand by 7	7 GPM (420 GPH)	10 GPM (600 GPH)	14 GPM (840 GPH)	17 GPM (1020 GPH)

Notes:
Values given are average and do not include higher or lower extremes.
* Peak demand can occur several times during morning and evening hours.
** Count the number of fixtures in a home including outside hose bibs. Supply one gallon per minute each.

YARD FIXTURES

Garden Hose – ½"	3 GPM
Garden Hose – ¾"	6 GPM
Sprinkler– Lawn	3-7 GPM

Alternate Capacity Method:
Calculate the number of bathroooms x 4 gpm = ?
(Note that 1/2 baths are considered as full baths.)

FARM USE

Horse, Steer	12 Gallons per day
Dry Cow	15 Gallons per day
Milking Cow	35 Gallons per day
Hog	4 Gallons per day
Sheep	2 Gallons per day
Chickens/100	6 Gallons per day
Turkeys/100	20 Gallons per day
Fire	20-60 GPM

NOTE: Seven minutes is used here as an example of peak demand time, which may actually be longer or shorter.

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:

$$\text{Total tank volume} = \frac{\text{Minimum Drawdown (from Table VI.1.2)}}{\text{Acceptance Factor}}$$

(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.

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

TABLE IV.1.2

SAMPLE TANK SELECTION CHART – MINIMUM TANK VOLUME FOR PROPER MOTOR LIFE

(based on present industry practices)

PUMP CAPACITY		MINIMUM DRAWDOWN (1)	TOTAL TANK VOLUME (GALLONS)								
			SWITCH SETTING (Pounds Per Square Inch)								
			20-40			30-50			40-60		
GPH	GPM	(Gallons)	A*	B*	C*	A*	B*	C*	A*	B*	C*
240	4	4	10	15	25	15	15	40	15	15	55
300	5	5	15	15	30	15	20	50	20	20	70
360	6	6	15	20	40	20	20	60	20	25	85
420	7	7	20	20	45	25	25	70	25	30	100
480	8	8	20	25	50	25	25	80	30	30	110
540	9	9	25	25	60	30	30	90	35	35	125
600	10	10	30	30	65	30	35	100	40	40	140
660	11	12	35	35	80	40	40	120	45	45	165
720	12	13	35	40	85	40	45	130	50	50	180
780	13	15	40	45	100	50	50	150	55	60	210
840	14	17	45	50	110	55	55	170	65	65	235
900	15	19	50	55	125	60	65	190	70	75	265
960	16	20	55	55	130	65	65	200	75	75	280
1020	17	23	65	65	150	75	75	230	85	90	320
1080	18	25	70	70	160	80	85	250	95	95	350
1140	19	27	75	75	175	85	90	270	100	105	375
1200	20	30	80	85	195	95	100	300	110	115	415
1260	21	33	90	90	215	105	110	330	125	125	460
1320	22	36	100	100	235	115	120	360	135	135	500
1380	23	38	105	105	245	125	125	380	140	145	530
1440	24	41	110	115	265	135	135	410	155	155	570
1500	25	44	120	120	285	140	145	440	165	165	610
1560	26	47	130	130	305	150	155	470	175	180	655
1620	27	50	135	140	325	160	165	500	185	190	700
1680	28	53	145	145	345	170	175	530	200	200	735
1740	29	57	155	160	370	185	185	570	215	215	790
1800	30	60	165	165	390	195	195	600	225	225	835

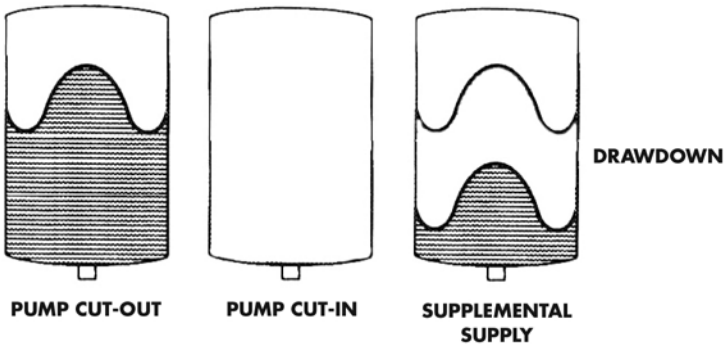
A* – Bladder or Diaphragm Tank Design B* – Floating Water Tank Design C* – Plain Steel Tank Design

(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:

Supplemental Drawdown (Gallons) =
[Peak Demand (gpm) – Pump Capacity (gpm)] * [Peak Demand Time (minutes)]

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

Total Required Drawdown (Gallons) = [Minimal Drawdown + Supplemental Drawdown]

Total Tank Volume = Total Drawdown / Acceptance Factor

where the

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

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

For more information on sizing a pressure tank

Water Systems Council. (2006). Chapter 1: Pressure Tanks. In Book IV of the *Water Systems Handbook* (12th Edition).

Water Systems Council. (2006). Chapter 3: Sizing and Selection. In Book I of the *Water Systems Handbook* (12th Edition).

For more information on your drinking water

The following websites provide up-to-date information on efforts to protect drinking water supplies and steps you can take as a private well owner. In addition, you may contact the wellcare® hotline at 1-888-395-1033.

U.S. Environmental Protection Agency **www.epa.gov**

Other information about wells and well water can be found in the following wellcare® information sheets:

General Information about Wells:

- Determining the Depth of a Well
- Determining the Yield of a Well
- Ground Water
- Selecting a Well Contractor
- Sizing a Pressure Tank
- Sizing a Well Pump
- Wells
- Your Well & Septic System
- Coping with Low Water Levels
- Managing a Flooded Well
- Protecting Your Wellhead
- Protecting Your Well
- Well Maintenance
- Wells and Fire Protection
- Wells: What to do When Power Fails
- What To Do if the Well Runs Dry
- Boiling Your Drinking Water
- Disinfecting Your Well
- Drinking Water Testing
- Drinking Water Treatments
- Home Drinking Water Treatment Devices
- Testing Water for Gardening and Lawn Irrigation
- Understanding Drinking Water Test Results
- Buying a Home with a Well
- Closing an Abandoned Well
- Dillon's Rule
- Ground Water Withdrawals
- Real Estate Professionals: Buying or Selling a Home with a Well
- Sanitarians – Closing a Well
- Sanitarians – Inspecting a Well
- Sanitarians – Wells & Septic Systems
- Shared Well Agreement
- Sharing a Well
- Water Conservation
- Who Owns the Water

Well Components:

- Your Pitless Adapter
- Valves
- Your Well Cap
- Your Well Casing
- Your Well Pump
- Your Well Tank

Possible Contaminants You May Find in Your Well Water:

- Arsenic
- Bacteria
- Benzene
- Chlorine Disinfectants & Their Byproducts
- Chromium
- Copper
- Emerging Water Contaminants
- Hardness in Drinking Water
- Iron
- Lead
- Mercury
- MTBE
- Nitrate and Nitrite
- Perchlorate
- Pesticides
- pH in Drinking Water
- Radium
- Radon
- Sodium
- Sulfur
- Trichloroethylene (TCE)
- Total Dissolved Solids (TDS)
- Turbidity in Drinking Water
- Uranium
- Volatile Organic Compounds (VOCs)

For more information about wells and other wellcare® publications

wellcare® is a program of the **Water Systems Council (WSC). WSC** is a national nonprofit organization dedicated to promoting the wider use of wells as modern and affordable safe drinking water systems and to protecting ground water resources nationwide. This publication is one in a series of wellcare® information sheets. There were more than 60 available at the time this document was published. They can be downloaded FREE from the WSC website at www.watersystemscouncil.org. Well owners and others with questions about wells or ground water can also contact the wellcare® **hotline** at **888-395-1033** or visit **www.wellcarehotline.org**

This publication was developed in part under Assistance Agreement No. X-83256101-0 awarded by the U.S. Environmental Protection Agency. It has not been formally reviewed by EPA. The views expressed in this document are solely those of WSC. EPA does not endorse any products or commercial services mentioned in this publication.