MODULE 2: WELL COMPONENTS

INSPECTION CERTIFICATE ASSOCIATES

Common Well Components

- Well Casing
- Well Caps
- Well Screens
- Pitless Adapter
- Jet Pumps
- Submersible Pumps
- Pressure Tank
- Check Valve
- Pressure Switch
- Pressure Gauge
- Relief Valve
- Electrical Disconnect
- Pump Saver
- Lightning Arrestor
- Ball Valve
- Drain Valve

The Water Well Head

- The wellhead consists of:
  - Pitless adapter
  - Well casing
  - Well cap

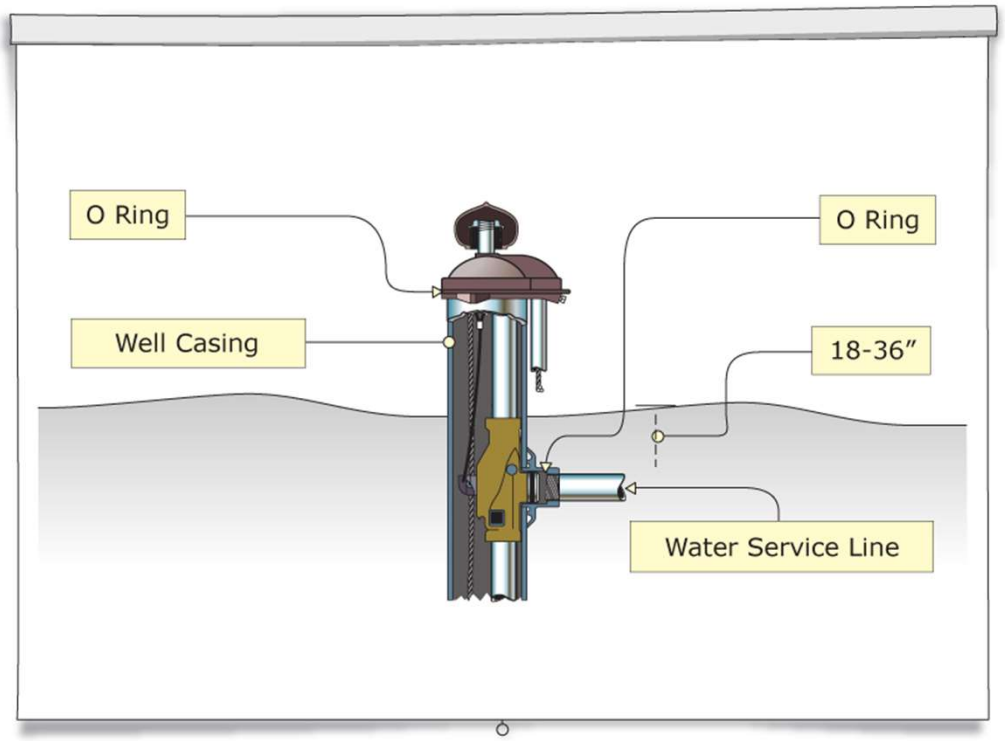
- The wellhead is your first line of defense to prevent pollutants from penetrating the drinking water system.

Well Casing

- This is the tube-shaped structure placed in the well to maintain the well opening from the target ground water to the surface. They keep contaminates out of the water as it gets pumped to the surface. Common materials are carbon steel, plastic, and stainless steel. Geology usually dictates the material used.

Well Caps and Casings

- The well casing and well cap should extend at least 12 inches above the ground. If the well is near a river or stream, it should extend at least higher than historic flood levels to prevent overflows from contaminating the drinking water.



Pitless Adapter

There are three basic types of pitless equipment for your well: units, kits and adapters

The Pitless Adapter

- A pitless adapter is attached to your well casing to provide a sanitary and frost proof seal between the casing and the water line running to your home. This device protects the water from freezing and permits convenient access to the well and well components without having to dig around the well.

- The adapter is connected to the well casing below the frost line, which is the depth at which the ground does not freeze. Water from the well is diverted horizontally at the adapter to prevent it from freezing.

Well Caps

- Well Caps are placed on top of the well casing to prevent debris, insects, or small animals from getting into the well. Well caps are usually made of aluminum or plastic. They include a vent to control pressure during well pumping.

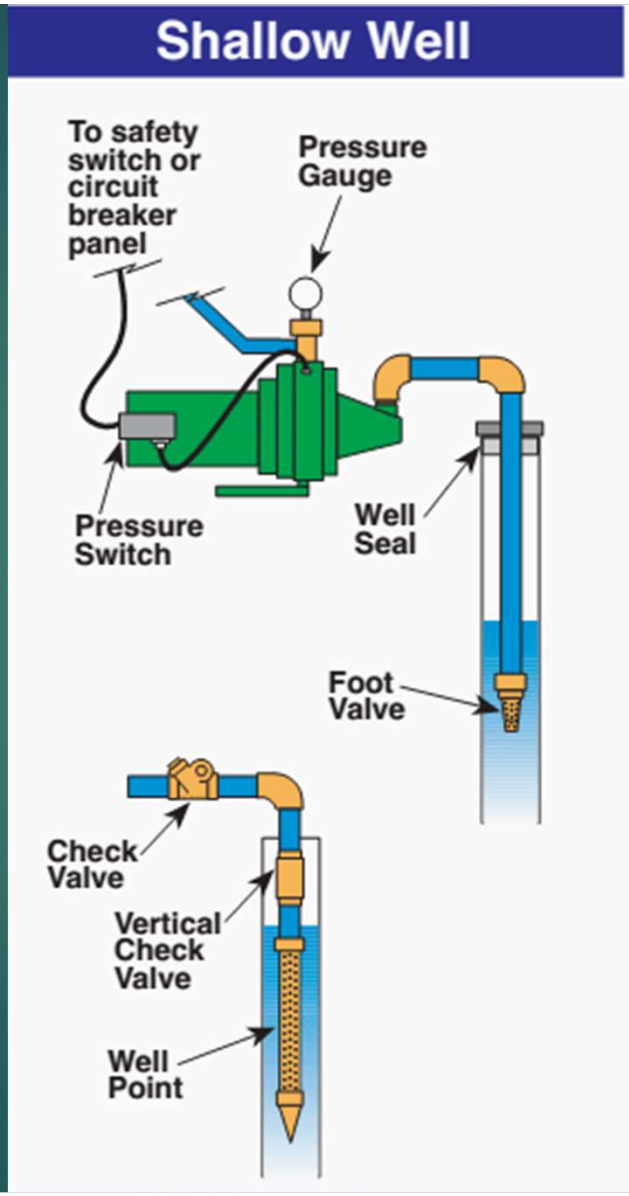
Well Screens

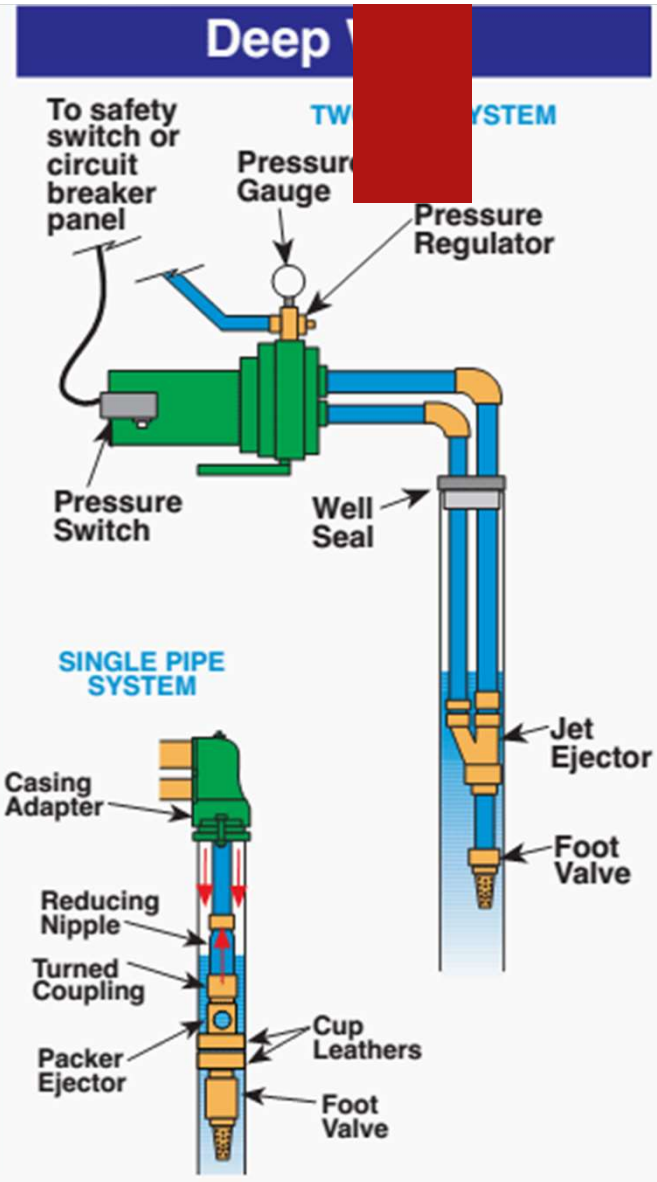
- Well screens are attached to the bottom of the casing to prevent too much sediment from entering the well. The most common well screens are continuous slot, slotted pipe, and perforated pipe. Other types are available depending on local geology.

Pitless Adapter

- This is a connector that allows the pipe carrying water to the surface remain below the frost line. It ensures that a sanitary frost-proof seal is maintained.

Jet Pumps

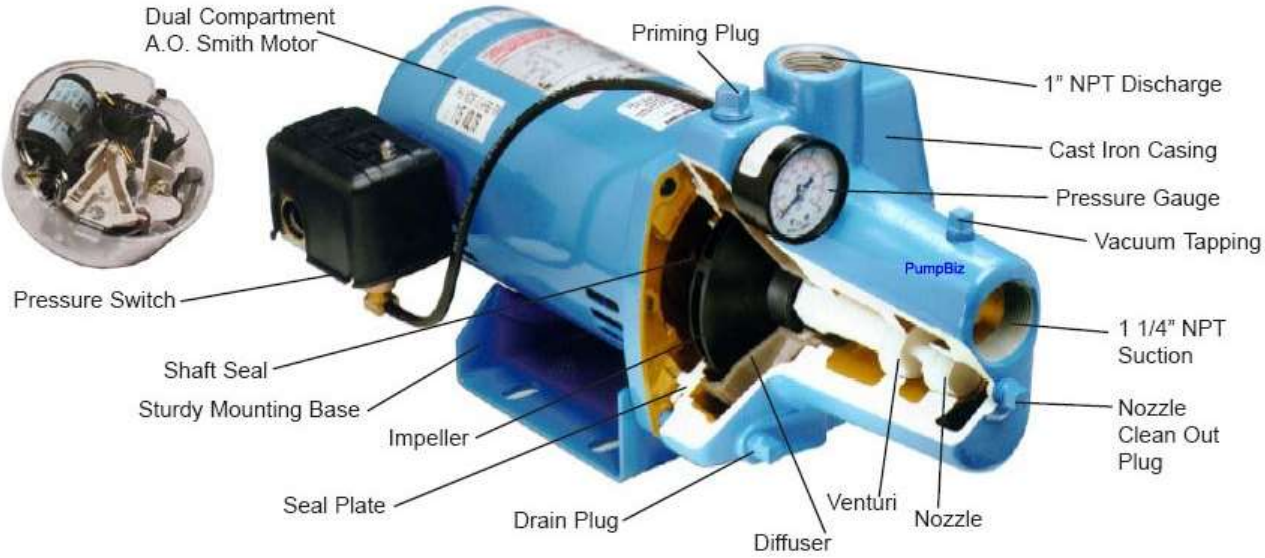

Shallow Well
To safety switch or circuit breaker panel
Pressure Gauge
Pressure Switch
Well Seal
Foot Valve
Check Valve
Vertical Check Valve
Well Point


Deep
To safety switch or circuit breaker panel
Pressure Gauge
Pressure Regulator
Pressure Switch
Well Seal
SINGLE PIPE SYSTEM
Jet Ejector
Foot Valve
Casing Adapter
Reducing Nipple
Turned Coupling
Packer Ejector
Cup Leathers
Foot Valve

Jet Pumps

- Jet pumps are the most common used pumps for shallow wells (depth 25 feet or less). They can be used on deep wells but require a special setup. Jet pumps are mounted above ground and use suction to draw water from the well.

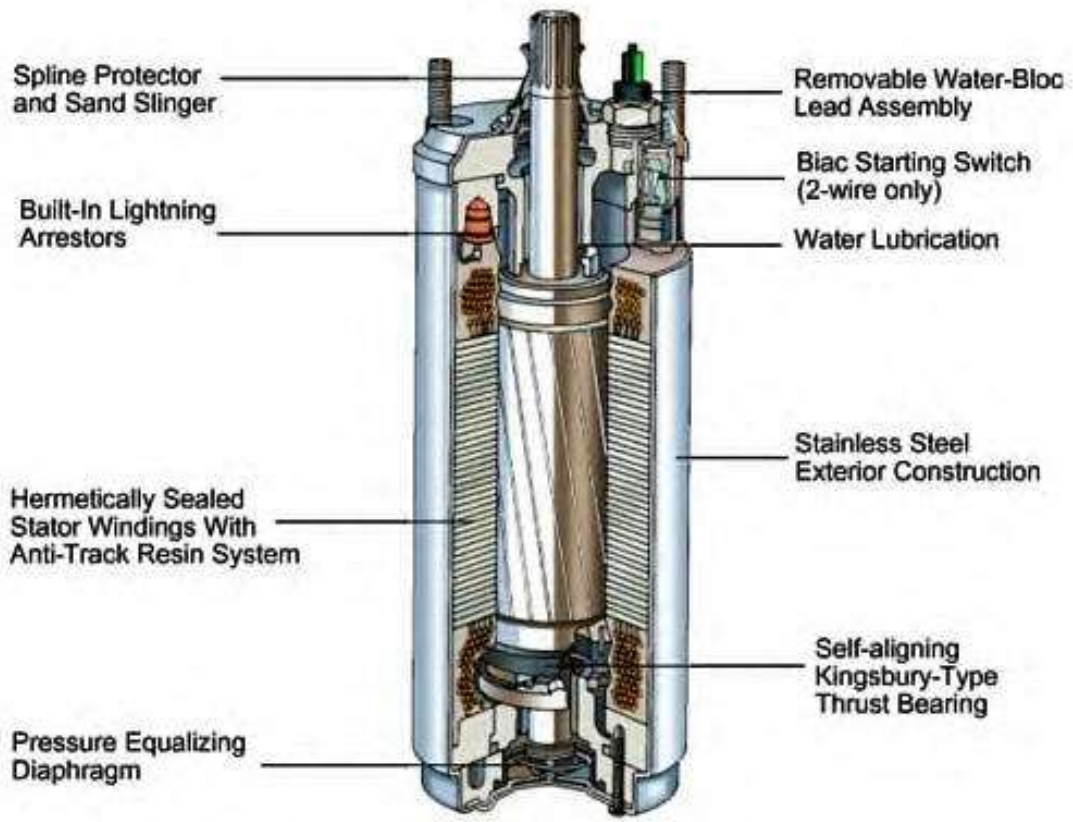
Jet Pumps


Dual Compartment
A.O. Smith Motor
Priming Plug
1" NPT Discharge
Cast Iron Casing
Pressure Gauge
Vacuum Tapping
PumpBiz
Pressure Switch
1 1/4" NPT
Suction
Shaft Seal
Sturdy Mounting Base
Nozzle
Clean Out
Plug
Impeller
Seal Plate
Drain Plug
Venturi
Nozzle
Diffuser

Submersible Pumps

- These are the most common pumps for deep private wells. The pumping unit is placed inside the well casing and connected to a power source on the surface.

Submersible Pumps



Choosing the Right Pump

Each type of well pump has advantages and limitations. In working with your water well professional, review some of the following factors before making a final selection:

- Adequate capacity (gallons per minute) for present and future use.
- Adequate pressure for present and future use and for the possibility of a lower water level in the well.
- Cost of the pump.
- Cost of the labor to install the pump.
- Cost of materials to install the pump, such as piping, fittings, accessories, well pit, etc.
- Power supply.
- Area needed to install the pump. Is there enough space available? Reliability of the pump.
- Cost and ease of servicing the pump.
- Cost of operating the pump, including power and parts.

Pressure Tanks

A pressure tank is a storage vessel containing air and water that:

- provides storage of water under pressure for delivery between pump cycles
- allows for reserve capacity for periods of peak demand
- protects and extends the life of the pump by reducing the number of on/off cycles
- helps reduce overall system maintenance

Selecting a Pressure Tank

SYSTEM DEMAND

PUMP CAPACITY

WELL CAPACITY

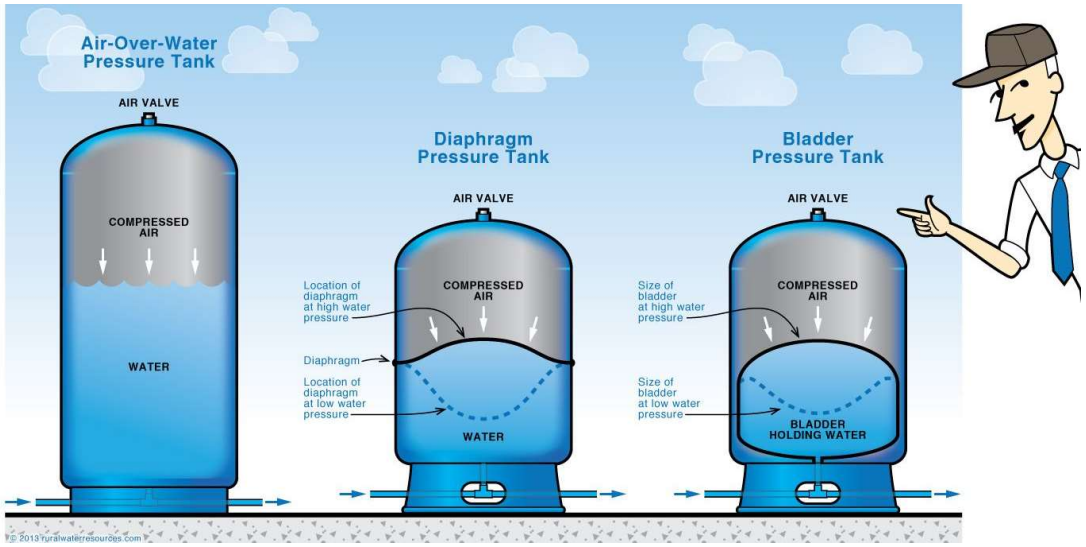
SAMPLE TANK SELECTION CHART – MINIMUM TANK VOLUME FOR PROPER MOTOR LIFE

(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 Wafer Tank Design C* – Plain Steel Tank Design

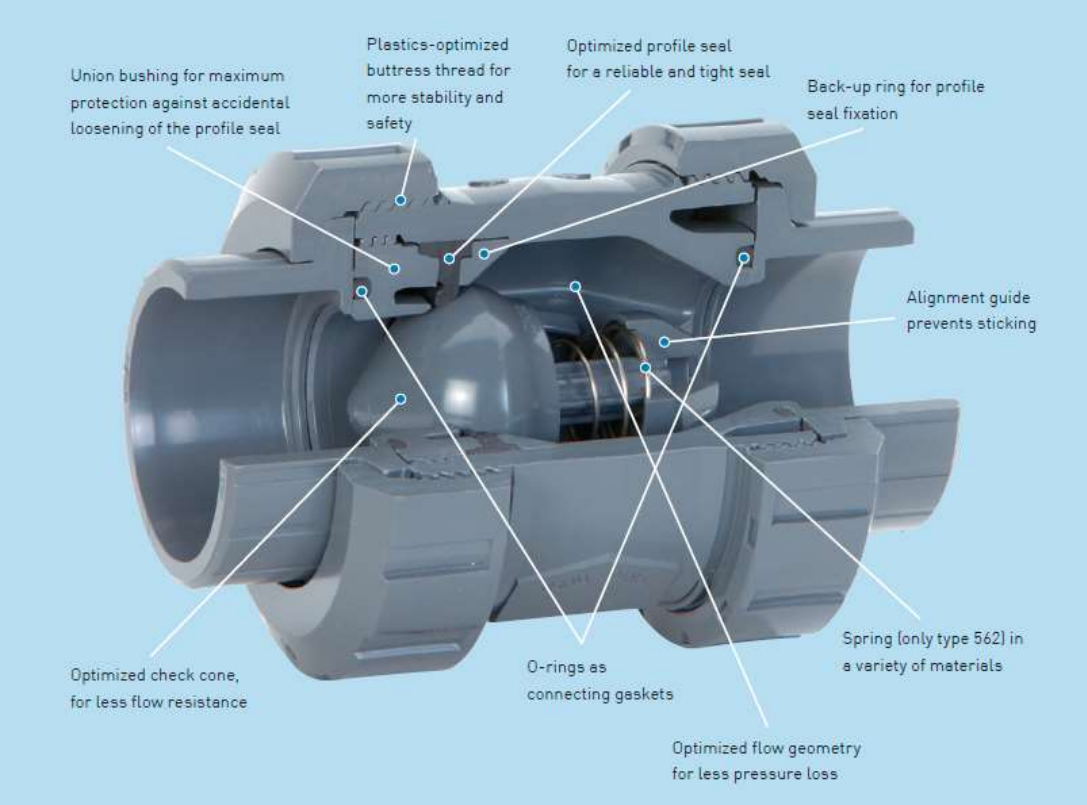
(1) NOTE: Actual values may vary somewhat with field conditions.



Types of Pressure Tanks

Check Valve

- A check valve is a device that only allows flow in one direction. It is installed near the tank inlet to hold water in the tank during pump installation when the pump is idle.



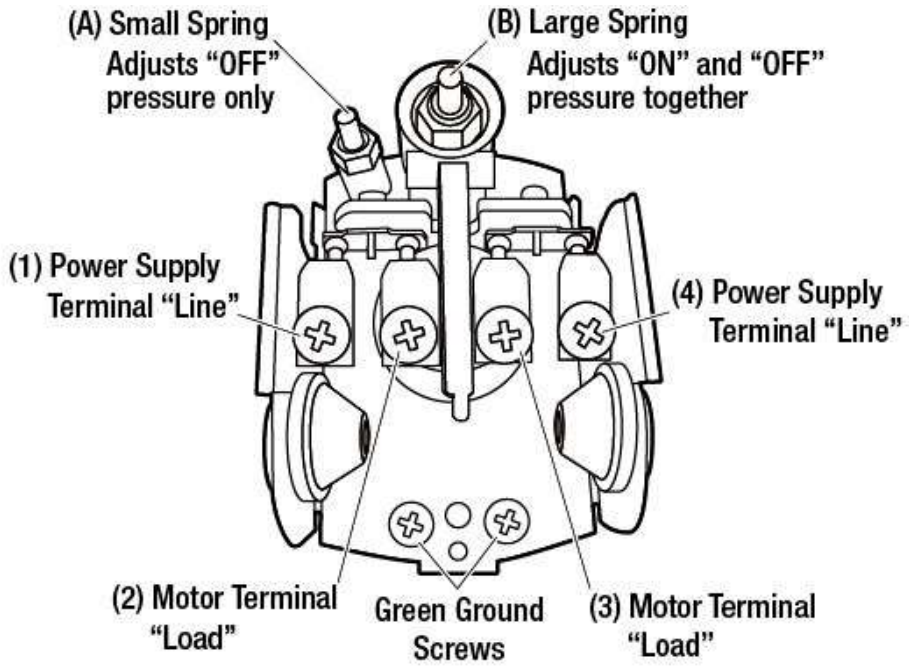
Check Valves

Pressure Switch

▶The pressure switch signals the pump to start when the water system drops to a pre-set low-pressure, and to stop when the high-pressure mark is reached. The preset settings are typically with the lower limit at 40 psi and higher at 60 psi.

Pressure Switch

The pump's power is directly connected to switch. A line carrying the systems pressure is fed from the bottom controlling the switches activation and deactivation.



Choosing a Pressure Switch

Pressure switches can be either electro-mechanical or electrical/solid state. When choosing a pressure switch, you need to know your pump's "cut-in" and "cut-out" pressure (the low number is the "cut-in" pressure, and the high number is the "cut-out" pressure), tank precharge pressure and the pressure connection size (usually 1/4"NPT or 3/8" NPT). Look for a pressure switch that is:

- Tested by a Nationally Recognized Testing Laboratory (NRTL)
- Quick to install
- Easily adjusted to your pump's "cut-in" and "cut-out" pressure.

The difference between the "cut-in" and "cut-out" pressure is called the "differential." Typically, pressure switches have a range of pressure up to 100 psig and "differentials" of 10-40 psig. Pressure switches are set at the factory with a 20 psig differential pressure and can be adjusted at installation as desired. Refer to the manufacturer's instructions.

Pressure Switch Wiring

Most well pumps need more current and require more than a single phase. This means that it is only a conductor system with 2 hot 120v wires and one ground like the picture shown.

Pressure Gauge

The pressure gauge measures the systems pressure. This is important when setting the pressure settings on the pressure switch.

Relief Valve

The relief valve protects against pressure build-up. It should be used to prevent the pump from increasing the pressure over the exceeded system rating. These are typically set at a relief pressure of 100 psi.

Electrical Disconnect

This will allow for emergency disconnection of power and a disconnect for maintenance. The minimum breaker size for a well system would be a 20 amp at 240v.

Per NEC Article 430 – requires all motors to have a lockable disconnect within site and within 6' from the ground.

Pump Saver

This is an adjustable, solid state control that monitors system load conditions to protect pump motor from dry well, flow loss, rapid cycling, slow recovery, air lock and locked rotor problems.

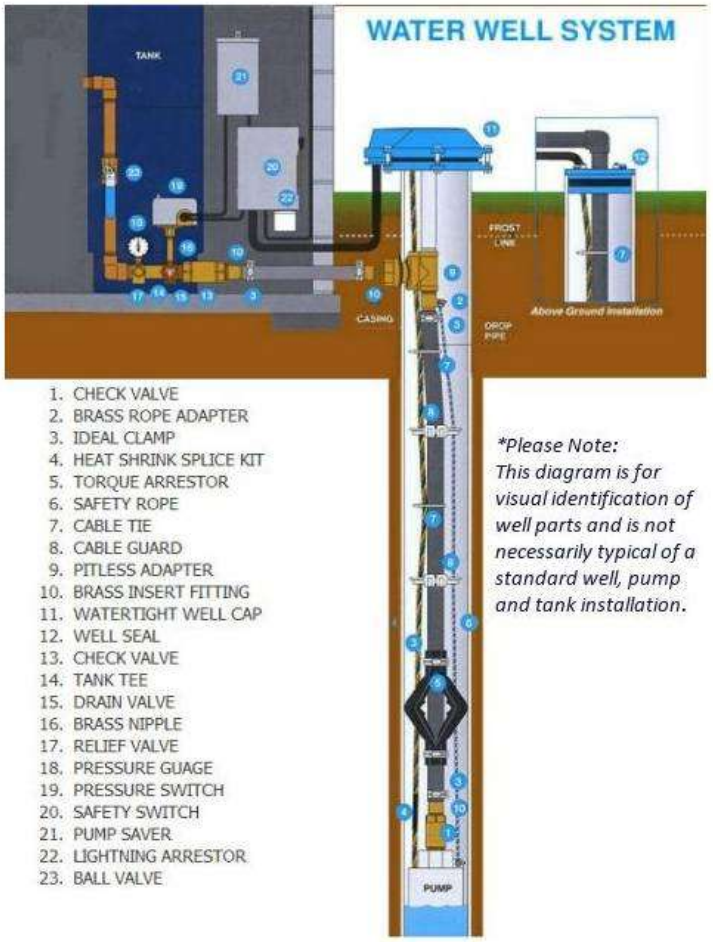
Ball Valves

Ball valves are necessary to quickly shutoff the supply line from the tank to the house, or any other pipe to isolate the flow.

Drain Valves

A drain valve allows for easy draining of the system for maintenance or replacing components.

Common Component Layout

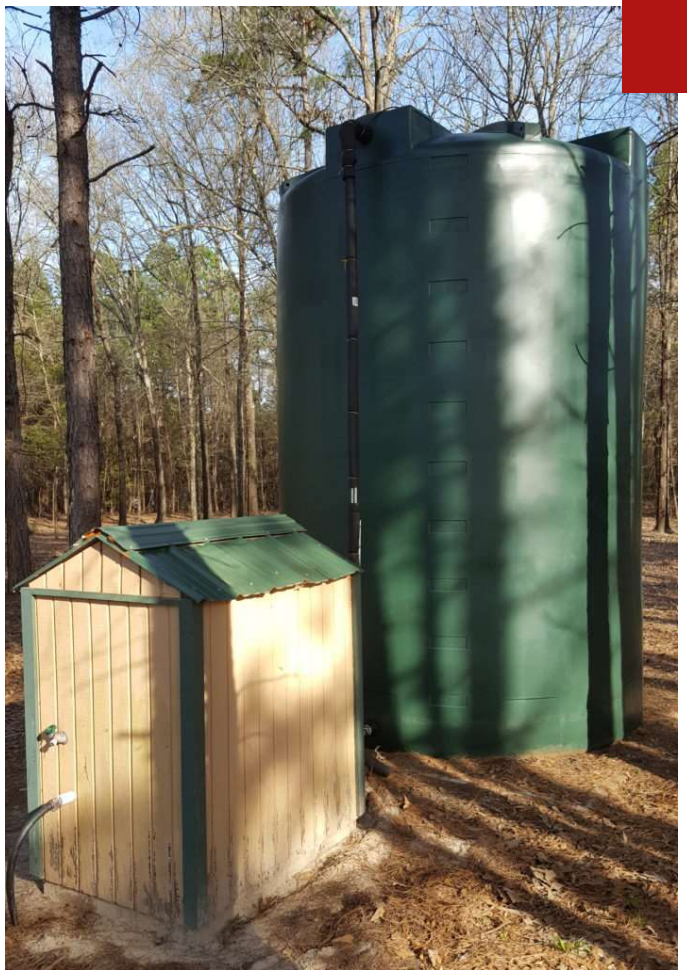


1. CHECK VALVE
2. BRASS ROPE ADAPTER
3. IDEAL CLAMP
4. HEAT SHRINK SPLICE KIT
5. TORQUE ARRESTOR
6. SAFETY ROPE
7. CABLE TIE
8. CABLE GUARD
9. PITLESS ADAPTER
10. BRASS INSERT FITTING
11. WATERTIGHT WELL CAP
12. WELL SEAL
13. CHECK VALVE
14. TANK TEE
15. DRAIN VALVE
16. BRASS NIPPLE
17. RELIEF VALVE
18. PRESSURE GUAGE
19. PRESSURE SWITCH
20. SAFETY SWITCH
21. PUMP SAVER
22. LIGHTNING ARRESTOR
23. BALL VALVE

**Please Note:*
This diagram is for visual identification of well parts and is not necessarily typical of a standard well, pump and tank installation.

Storage Tank

Some well owners may consider additional water storage tanks. Additional water storage is useful when there are power outages and other emergencies. Treatment of the water might be required along with protection from the elements.



Sizing a Well Pump

The capacity of the pump system in gallons per minute should equal the number of fixtures in the home. This must take into account all use for the kitchen, bath, appliances, outside irrigation, a pool and special fixtures, such as a hot tub.

Sizing a Well Pump

A second model, using the same fixtures and plumbing as the previous example, calculates capacity based on a seven-minute peak demand. The peak time for household water use is normally in the morning, when the family rises, or in the evening, when all are home. Seven minutes is the average high water use timeframe for a shower or automatic washer.

Addressing Low Water Capacity

In the best and most economical water system, the needs of the household are less than the rate at which water can be drawn from the well. If the peak demand exceeds the maximum rate of water available, the pump must be sized within the well capacity and the peak demand reached through added storage capacity.

Usually a large-size pressure tank can perform this function. In fact, a larger water storage tank can prolong the life of the pump, as it reduces the need for the pump to cycle as often. Most wear and tear on the well pump occurs when it stops and starts.

There are times, however, when the well capacity is so low that a two-pump system is needed. In a two-pump system, the well pump supplies water to an atmospheric storage tank. A second pump, a shallow well unit, takes water from the atmospheric tank and discharges it into the pressure tank or directly into the system. Its operation is controlled with a pressure switch.