

Completing Your Drilled Well

For many people in rural areas, water wells are necessary to obtain adequate supplies of water for domestic and industrial use. In many cases, a drilled well is the best way to obtain adequate supplies of water. After a well has been drilled, it still remains for either a contractor or the owner to complete the well. This is the actual hooking up of the well to your home or establishment. Many well owners will make arrangements with the well driller or a qualified contractor to do the work rather than do the work themselves. If the well owner decides to complete the well, then he or she should be aware of proper well completion methods.

This pamphlet contains information that a home owner should know to perform an adequate well completion. While the information contained herein is not all encompassing, it does provide the necessary knowledge to do an adequate well completion.

Pump Installation

The well driller is required to give you a well record which lists pertinent information about your well. Your total well depth and the depth below ground level of the water intake will determine what type of pump you will require. All pump installation wiring should be inspected by an electrician or an electrical inspector before the power is turned on. Provisions for lightning protection and proper grounding are generally found in instructions supplied with the pump or you may contact your nearest electrical inspector.

There are three basic types of pumps used for domestic drilled wells in Newfoundland and Labrador. These are piston pumps, centrifugal (jet) pumps, and submersible pumps. Each pump operates differently and is used for different well depths. The following table provides a rule of thumb for pump selection, and lists some of the advantages and disadvantages of each type.

PISTON (RECIPROCATING) PUMP
Maximum depth 6.7m (25')

- ADVANTAGES
• Dependable, low cost
• Yields water at a constant discharge and high pressure
• Easy to prime
• Can pump small amounts of sand

- DISADVANTAGES
• Noisy with vibrations
• Pulsating discharge

CENTRIFUGAL (JET) PUMP
Maximum depth 24m (80')

- ADVANTAGES
• Low Cost
• Can be converted from shallow to deep well jet
• Easy to service because of few moving parts
• Easy to install
• Can be offset from well

- DISADVANTAGES
• Can't handle air in system
• Needs large pipes for deep well setup
• Difficult to prime if there is a leak in system
• Easily damaged by sandy water
• Troublesome if small rocks or dirt caught in ejector

SUBMERSIBLE PUMP
Maximum depth 300m (1000')

- ADVANTAGES
• Very efficient, smooth, even flow
• Has excellent range in capacity and pressure
• Long lines cause few problems
• Constant capacity
• No noise
• Can be used for shallow or deep well
• Once properly installed has long life
• Grade of trench from well to house can be either way

- DISADVANTAGES
• No water in system can cause damage in motor

- More expensive than other pumps
• Sand in water will wear pump parts
• Well must be plumb and free of obstructions
• Usually more expensive to service

A piston or reciprocating pump operates by the movement of a piston that pushes water out a discharge valve while at the same time closing the inlet valve. The operation is reversed on the backstroke. Since a definite quantity of water is moved at each stroke of the pump, it is called 'positive displacement'. Water is practically non compressible and it is possible for this type of pump to develop quite high pressures and break pipe lines unless some provision is made for pressure relief.

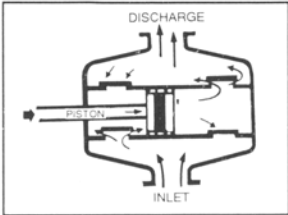


Figure 1 - Piston Pump

Shallow and deep well centrifugal (jet) pumps are the simplest form of pump. A single rotating part called an impeller moves the water by centrifugal force as illustrated. As the discharge valve is closed (or as the pressure in the storage tank goes up), the volume of water forced out the discharge is reduced. The discharge valve on a centrifugal pump can be closed without damage to the pump, and the motor carries less load at the end of its operating cycle (high pressure cutoff) than at the beginning. The deep well jet

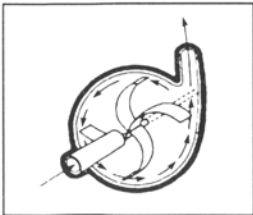


Figure 2 - Centrifugal Pump

pump is a centrifugal pump with a jet or ejector assembly usually down in your well. A high pressure jet of water passes through a venturi (a tapered restricted flow area) of the jet assembly. This high pressure 'jet' of water attracts surrounding water as it passes through the venturi and carries this additional water through the pipe to your home. There are two pipes attached to the pump and jet assembly. The larger pipe is water going into your pump, the smaller is water returning to the ejector assembly. A deep well jet pump can deliver water efficiently up to about 24 metres. Greater depths are possible at the expense of reduced efficiency (at 30 metres, 75% of water pumped is recycled back to the ejector).

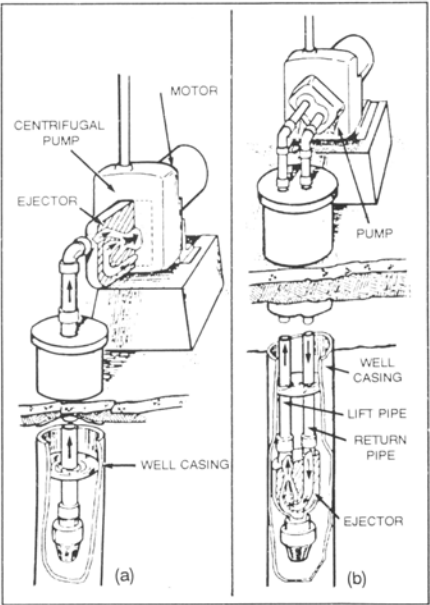


Figure 3 - (a) Shallow / (b) Deep Well Centrifugal Pump

Both the piston and jet pumps have a one way valve at the end of the pipe in the well. This check or foot valve allows water to enter the pipe, but closes when water tries

to flow out of the pipe. A foot valve should be installed 3 or 4 metres above the bottom of the well to prevent material from being sucked up into the pump.

A submersible pump is placed near the bottom of your well and is the recommended pump for water wells deeper than 30 metres. The water surrounding the submerged pump helps keeps the motor cool. Power is supplied by waterproof wires to the surface. This type of pump operates in the same way as a centrifugal pump. Since well diameters limit the size of the pump, a number of small impellers coupled together raise the pressure to 'push' the water to the surface and transport it to the storage tank. Each impeller is considered a 'stage', therefore pumps are listed as 9 or 14 stage etc. The beauty of a submersible pump is that there is no sound when the pump cuts in. When installing a submersible pump, a torque arrestor should be installed on the pump discharge line just above the pump. This is an expandable rubber device that fits snugly against the well bore centralizing the pump in the well and keeping the pump and wires from flexing each time the pump cuts in. Repeated flexing of the pump wires will eventually cause them to fail. This device also keeps the pump in a vertical position as a submersible pump installed out of plumb may fail over time.

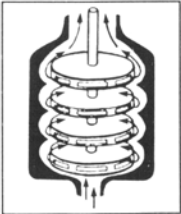


Figure 4 - Submersible Pump

A check valve at the top of the pump prevents water from draining out of the system when the pump stops. On deep wells, an inline check valve should be installed every 60m to reduce the water pressure on the pump connection.

The depth of a well will determine the horsepower rating of the pump motor. When purchasing the pump, the dealer will determine the recommended size motor.

Pressure Tank

The water supply system for your home needs a pressure tank to store water and pressure. Without a pressure tank, every time a tap is opened, pressure would drop quickly in the system and the pump would cut in increasing wear on the pump and wasting energy. The pressure tank contains a certain amount of air that is compressed by the water as the tank fills. A conventional pressure tank will supply only about 15% of the tank's volume before pressure drops to the pump cut-in pressure. However, by either supercharging the tank with air, using a float to separate air and water in the tank, or by the use of a bonded diaphragm or sealed bag in the tank, the tank's draw off capacity can be increased to as much as 36%. These types of pre-pressured tanks cost more but reduce the running time of each pump cycle.

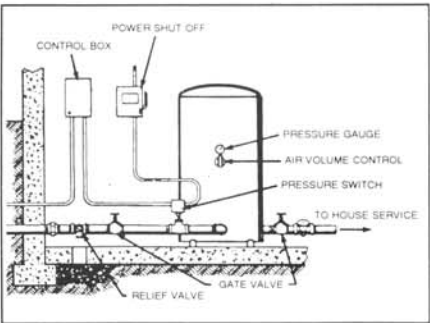


Figure 5 - Pressure Tank

A common problem with some pressure tanks is "water logging". Since air is partially soluble in water, the air trapped in the pressure tank will gradually dissolve in the water over time resulting in rapid cycling of the well pump. To solve this problem an air valve is situated on the tank or on a tee fitting connected to the tank for air recharge. Other tanks will have an air volume control that maintains the correct relationship between the volume of air and the water level in the tank. Tanks with diaphragms in them do not need recharging.

Attached to the piping near the tank is a pressure switch which is set to turn the pump on when pressure in the system falls to a certain pressure and shuts the pump off when pressure reaches a certain maximum in the system. The cut-in and cut-out pressures, as they are called, are set at 140 KPa (20 psi.) and 280 KPa (40 psi.) or 207 KPa (30 psi.) and 345 KPa (50 psi) respectively. The well pump operates between these two pressure switch settings. The switch is factory set, but can be adjusted manually. Situated near the pressure tank should be the power shut off for the system and the control box for a submersible pump. Shut off valves on each side of the tank isolate it for maintenance.

Completion Methods

Choosing the proper well completion method is important. The recommended methods are either the pitless adaptor or drained well pit. Burying a well will make it difficult to locate, service and maintain, and increase the likelihood of contamination from surface waters. The Well Drilling Regulations require that all water wells be accessible for inspection and testing. The pitless adaptor is the preferred method of well completion as it provides easy

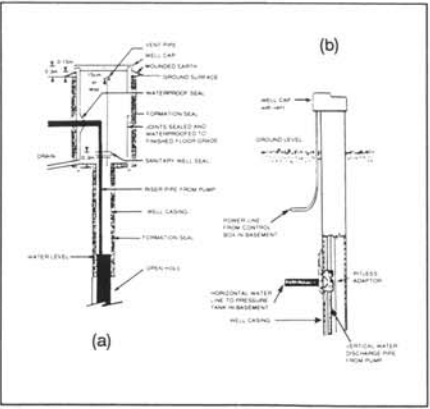


Figure 6 - (a) Well Pit Construction (b) Pitless Adaptor

access to a well and keeps the pipelines from freezing. Pitless adaptors are available with two holes for centrifugal pumps. The air vent for the pitless adaptor well is located in the cap along with a convenient opening for the power connection to a submersible pump.

There are areas in Newfoundland where bedrock is at the surface and a pitless adaptor or well pit is impractical. The waterline from the well to the house in these areas are sometimes contained within an insulated box and hot wired to keep it from freezing.

Never have a well drilled that will be situated in a basement, garage, or other kind of building which will make it impossible for a drill rig to gain access to the well should any problems arise.

Air Vent

An air vent is necessary to allow air pressure to equalize between the inside of your well and the atmosphere. As a well is pumped, the water level in the well drops. The volume of water displaced must be replaced by air at atmospheric pressure. Air flows in through the vent to equalize the pressure difference. As the water level in the well recovers, air is exhausted from the well to the atmosphere. If lighter-than-air, noxious or explosive gases are present in the water, they will also be vented to the atmosphere. The vent opening should be shielded and screened to prevent foreign material or insects from entering the well.

Problems with air vents freezing over have been encountered in Newfoundland. In winter, as air is exhausted from the well to the atmosphere, water condenses around the vent opening due to the temperature difference between the well water and the atmosphere. A solution to this problem is the installation of a spud. This is a water sealed, adaptor that fits in a hole made in the well casing allowing an air vent to be installed from the well to a home where the air is vented in the basement. Water wells that have cap air vents should have any snow removed from the top of the well in winter to allow proper venting.

Things to Consider When Completing Your Well

The following points will help you achieve a trouble free well completion.


- 1.) Immerse plastic pipe in hot water for a few minutes to make it more supple for clamping. Light heating with a propane torch is also effective.
- 2.) Use double clamps at all plastic joints. Stainless steel clamps and joints prevent corrosion problems.
- 3.) Chlorinate your well when finished by using a household bleach to remove any bacteria present on equipment installed in the well.
- 4.) Keep farm and domestic animals away from the well casing to prevent bacterial contamination.
- 5.) Slope the earth away from the well casing to prevent ponding of surface water around the casing.
- 6.) Mark the well location in winter if there is any chance a vehicle will hit it accidentally.

Additional information maybe obtained from a plumbing contractor or from the following:

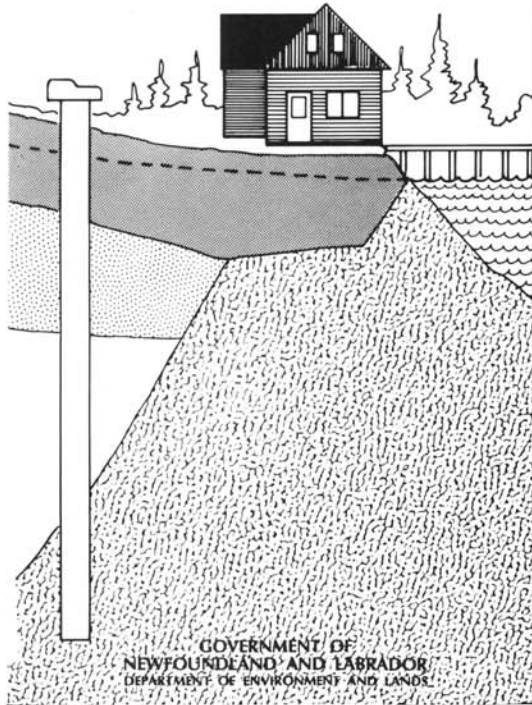
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