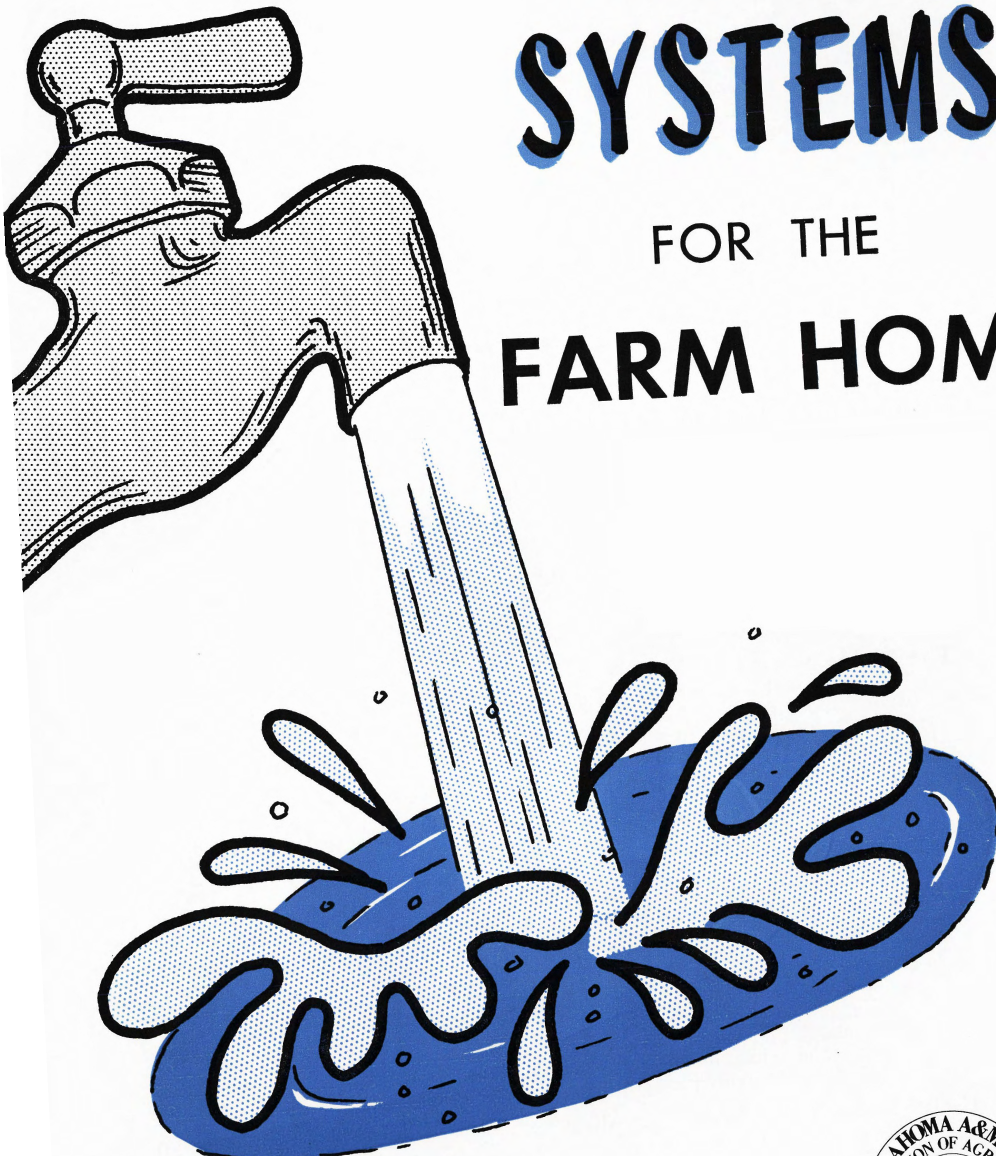
WATER SYSTEMS

FOR THE FARM HOME



OKLAHOMA A&M COLLEGE
DIVISION OF AGRICULTURE
SCIENCE SERVING AGRICULTURE

EXTENSION SERVICE

CIRCULAR 473

CONTENTS

Electric Water Systems

for the farm home

C. V. Phagan
Extension Agricultural Engineer

Running Water Pays Dividends

One killowatt hour of electricity, costing less than a nickel, will pump and carry 1,000 gallons of water. What other farm investment offers so much for so little?

In addition to saving time and protecting health, running water is a money maker when used with good management practices. Livestock and poultry make more economical gains when they have a plentiful supply of drinking water—at the barn, in feed lots, and in poultry yards.

Where the well or other source of supply furnishes enough water for continuous pumping, garden irrigation can increase the quantity and quality of vegetables grown.

Fig. 1—Running water at the kitchen sink—the greatest labor saver in the farm home.

Is Your Water Supply Adequate?

Before installing an automatic electric water system, first check the well or other source of supply to be sure there is enough water. Many wells furnish plenty of water for hand pumping and carrying, because the average usage is seldom more than 5 gallons per person per day. With a completely modernized home, the daily usage of water increases to around 35 gallons per person, besides the amount consumed by livestock and for other farm uses.

The amount of water needed can be estimated by referring to Table I. This shows the amount of water that will be used each day on an average farm, with water under pressure to the kitchen sink, bathroom, and laundry. This information is necessary in selecting a pump of the proper size or capacity as discussed on page 15.

Where a cistern supplies the water, the size needed will be determined by:

(1) The water supply requirements of family and farm;

(2) The annual rainfall; and

(3) The size of roof or other catchment area.

The tables on page 30 will help figure the size of cistern needed, and the amount of water input to be expected from a given catchment area.

Farm ponds may be used as the source of water supply in localities where well supplies are inadequate. Detailed plans and specifications on this subject are given in Extension Circular 580, "Farm Ponds for Household Water Supply."

TABLE I.—Estimated Daily Water Requirements on the Farm.

	Gallons per Day
Each member of family	35
Each milk cow	25
Each beef cow, mule or horse	12
Each hog (per 100 lbs.)	2
Each sheep	2
Each 100 chickens	7
Each 100 turkeys	10

Safeguarding Your Water Supply

Water Can Be Disease Carrier: Since water is a common carrier of Typhoid Fever, Dysentery, and other similar diseases, it is important to make the supply safe from possible contamination.

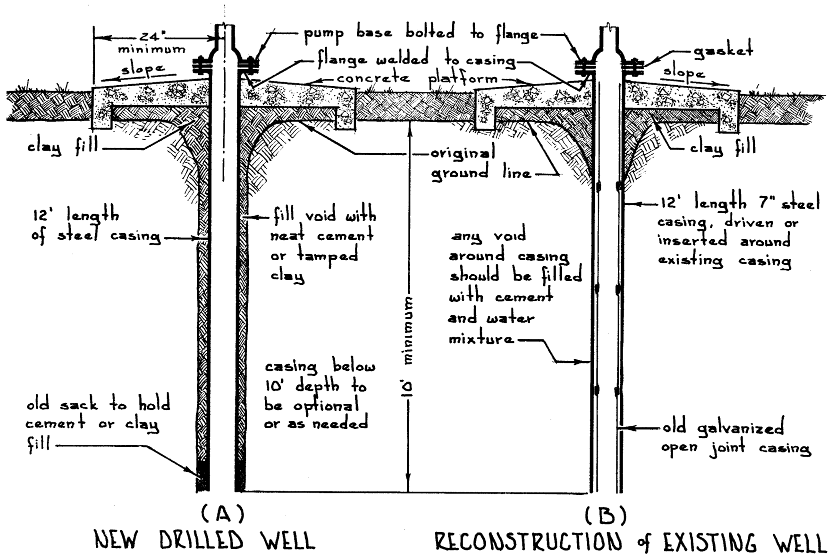


Fig. 2—Here are two methods of protecting drilled wells: (a) new construction, and (b) existing well with old casing.

WELLS

Location: All wells and cisterns should be located at least 50 feet (preferably 100 feet) away from any source of pollution, such as privies, cesspools, septic tanks, hog pens, poultry houses, and barn lots. Wells and cisterns should also have good surface drainage and be on higher ground than any source of pollution.

Testing Your Water Supply for Purity

Directions for taking samples of water for bacterial analysis can be obtained from your local health unit or from the State Health Department Laboratory, 3400 Northeastern, Oklahoma City, Oklahoma.

Construction: The two basic requirements for protecting the well water supply are:

(1) A water-tight well platform, preferably concrete; and

(2) A water-tight casing or curbing to a point at least 10 feet below the surface of the ground, preferably to water-tight strata.

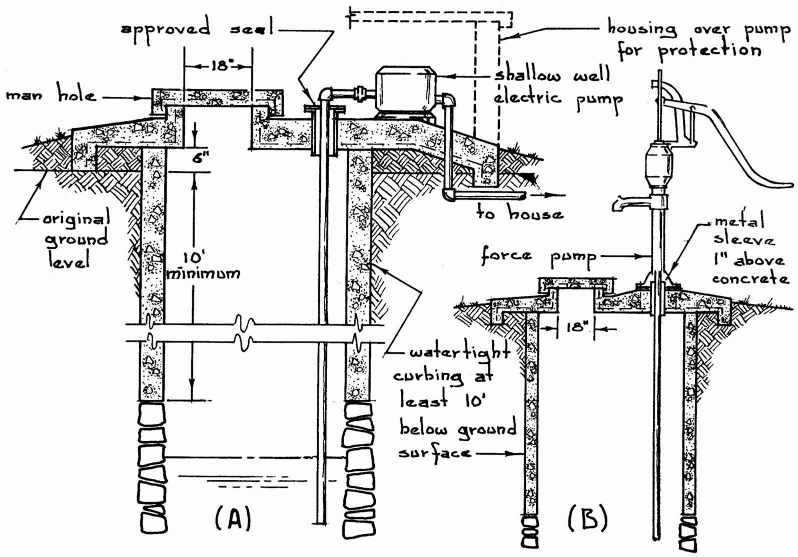
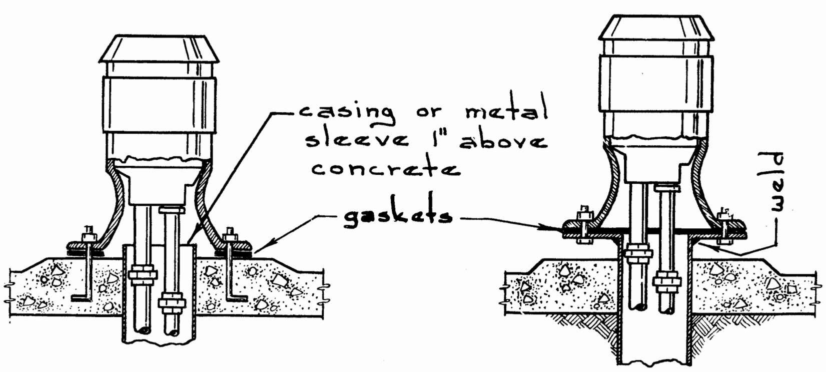


Fig 3.—Here are two methods of protecting dug wells: (a) with electric pump and pumphouse, and (b) using hand force pump.

Drilled wells should be cased with new standard wrought iron or steel well casing, or with other casing that is equally water-tight and durable.

Methods recommended for protecting drilled and dug wells are shown in Figures 2 and 3.

Use Sanitary Seals: In addition to water-tight platforms and



A. B.

Fig. 4.—Tight base pump used for well seal: (a) pump bolted to well platform. (b) pump bolted to a flange that is welded to casing.—from "Construction Details for Sanitary Well Seals and Pump Installations," Oklahoma State Department of Health.

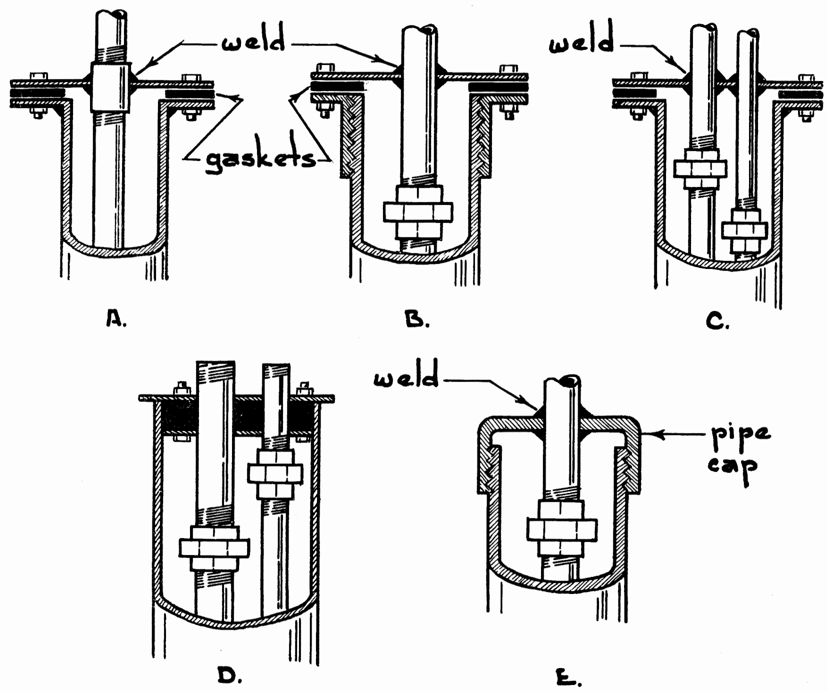


Fig. 5—These are some recommended types of well seals: A, B, C and E are home-made seals; D is a commercial seal available through most dealers.—from "Construction Details for Sanitary Well Seals and Pump Installations," Oklahoma State Department of Health.

casings, all wells should have approved sanitary seals where the pump base or water pipe connects to well casing or platform. Figures 4 and 5 show approved types of seals.

Treating New Wells: All new wells should be treated with a strong chlorine solution (household bleach) just before sealing and after the system of piping is completed. Leave solution in well several hours, then open all faucets until chlorine is detected. Close faucets and wait two hours before flushing chlorine from system.

All old wells unsealed for repairs should be given this same treatment.

SPRINGS

Springs which furnish water for household use need to be protected against contamination from surface water and foreign matter. A concrete enclosure such as shown in Figure 6 helps assure clean, safe water. This box-like enclosure extends several feet below the surface to the

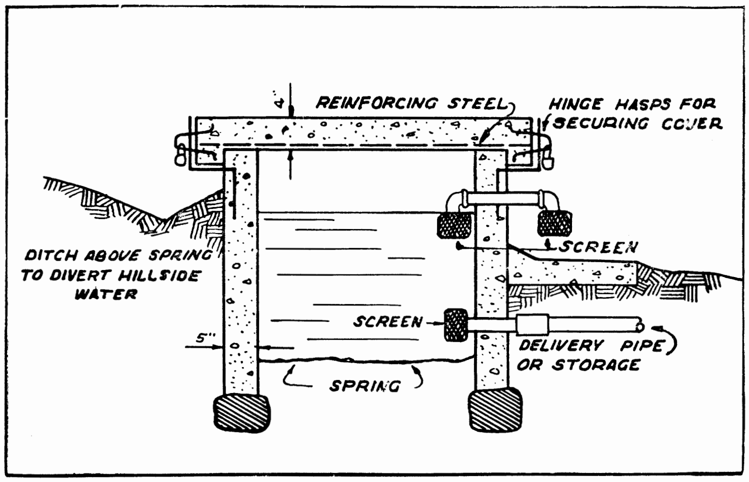


Fig. 6—This shows a spring water supply that is properly protected.

water-bearing stratum. A concrete apron on the uphill side helps carry away surface water and prevents it from entering the spring. The removable cover fits snugly over the top like a shoe box lid. Fencing off the spring will prevent livestock from polluting the water.

CISTERNS

Cisterns need special attention. Rain water, itself, is comparatively pure. But when collected from roofs of houses and placed in cisterns, it often contains polluted matter that is injurious to the health of the family.

Essential Features. The essential features of a cistern for obtaining a wholesome supply of water are:

(1) Water-tight construction with smooth interior surface.

(2) Close screening of inlet and overflow pipes.

(3) Provision for diverting the first portion of each rainfall until roof or other collecting area has been thoroughly washed.

(4) An effective sand and gravel filtering system.

(5) Periodic and thorough cleaning of cistern and filter.

(6) Treating of water after each rain with household bleach (chlorine).

Construction Materials: Underground cisterns can be built of brick, stone, or preferably reinforced concrete. Brick and stone should be laid with full Portland cement mortar joints. Bricks should be wet before laying. Two 1/2-inch plaster coats of 1:3 Portland cement mortar on the inside of brick or stone construction will aid in water-proofing. Concrete or masonry cisterns should be allowed to cure for a month or more before using.

Filters: Cistern filters are designed to remove foreign matter washed from collecting surfaces. Because such filters must operate at high rates during heavy rainfall, they cannot be regarded as dependable for the removal of bacterial contamination. When cistern water is used for drinking purposes, it should be treated after each rain, or at least once a month.

A common method of constructing a cistern filter is shown in Figure 7, which also shows the construction of a typical cistern. This type of filter is designed to filter approximately 100 gallons per day per square foot of surface area. The size of filter to use will depend upon the size of roof area being drained and the intensity of rainfall. Assuming a

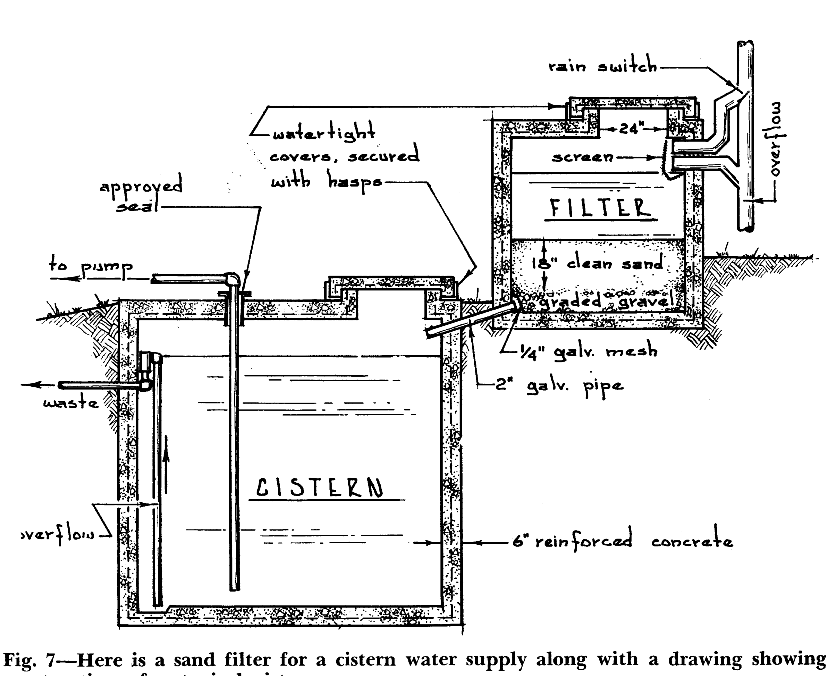


Fig. 7—Here is a sand filter for a cistern water supply along with a drawing showing construction of a typical cistern.

2-inch intensity in 24 hours, it will be necessary to provide 1.25 square feet of filtering area per 100 square feet or roof surface. A 24'x30' roof area would require a filter that is 3 feet square.

Types of Pumps

There are two general classes of electric water pumps. They are known as (1) shallow well pumps and (2) deep well pumps. Shallow well pumps are used when the depth from the pump to the low water level is not more than 22 feet, including pipe friction. When this depth is greater than 22 feet, a deep well pump must be used.

In some wells the water stands within 22 feet of the pump, but when pumping starts the water level may drop several feet, causing the pump to operate very inefficiently. Before buying a shallow well pump as a permanent installation, it's a good idea to have your well test-pumped to determine the low water level and the rate of pumping. This information will help you select a pump that fits your well.

SHALLOW WELL PUMPS

The following types of shallow well pumps are the ones most commonly used on farms in Oklahoma:

Piston Pump: (Shallow Well) The term "reciprocating," is sometimes used to describe the standard piston-type, motor-driven pump shown in Figure 8. A pump of this type is designed to operate at a speed of 200 to 300 revolutions per minute. It is a positive displacement pump, which gives uniform capacity at all discharge pressures. This feature is particularly desirable where water must be pumped at high pressure, as when pumping through a long pipe or to a high elevation.

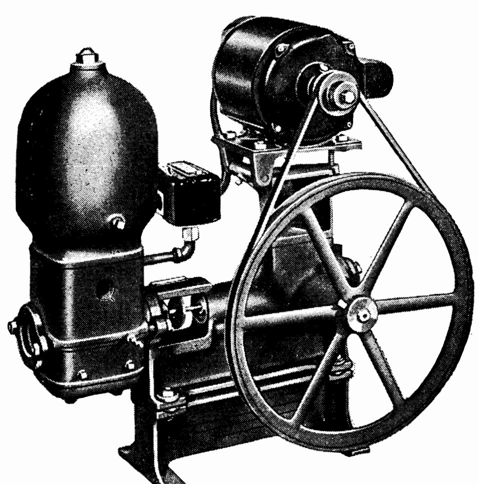


Fig. 8—A shallow well piston pump.

The piston pump is usually noisier than other pumps when operating, and it may require more servicing.

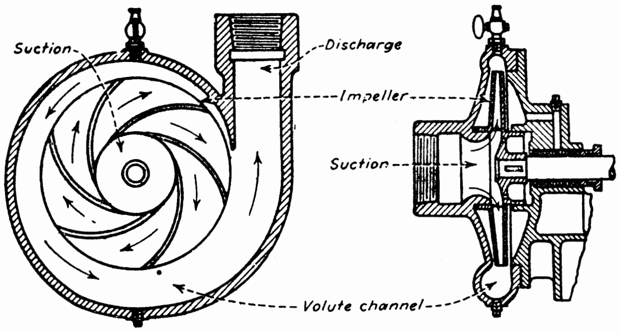


Fig. 9—These cross-sections show the basic parts of a centrifugal pump.

Centrifugal Pump: (Shallow Well) Figure 9 illustrates a simple side-suction centrifugal pump and its method of operation. The impeller rotates in a case or housing and discharges water by direct centrifugal force. This type of pump has a suction limit varying from 15 to 25 feet, depending on the design. It is most effective when delivering large quantities of water under low pressure. Its capacity decreases rapidly as discharge pressure increases or as suction lift increases. This type of pump is commonly used in combination with jet or ejector type pumps.

Centrifugal Jet Pump: (Shallow Well) This type of pump, as illustrated in Figure 10, is a combination of the centrifugal and jet or ejector principle. Part of the water delivered by the revolving impeller is discharged into the jet nozzle and venturi tube. The high velocity at the nozzle forms a partial vacuum which draws more water from the well.

The capacity of the jet pump decreases as the discharge pressure or suction lift increases. The pump is simple in construction, requiring no lubrication except for the motor.

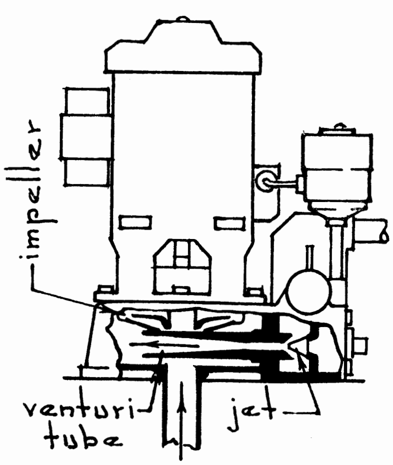


Fig. 10—This is a centrifugal jet pump for use in shallow wells.

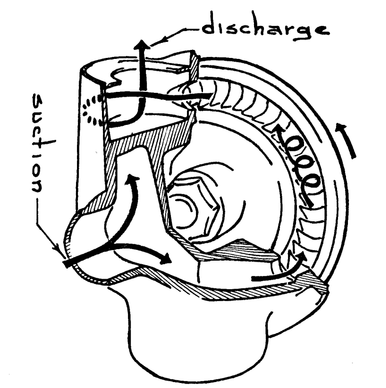


Fig. 11—This cutaway view shows the pumping action of a shallow well turbine pump.

Turbine-type Pump: (Shallow Well) The turbine-type pump is of the centrifugal type, but designed for improved suction for wells where the water level is not more than about 25 feet below the pump. The impeller is designed so that it spins the water several times to get higher pressure (see Figure 11), which improves the suction characteristics over straight centrifugal pumps.

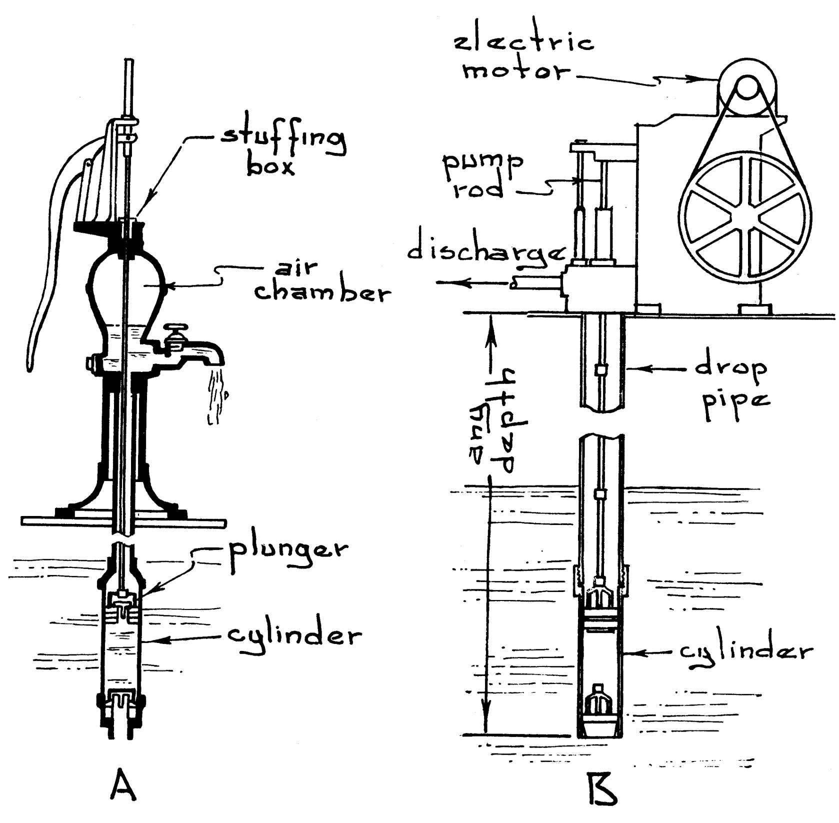


Fig. 12—Here are two deep well piston pumps: (a) hand pump with a closed top cylinder, and (b) a modern deep well pumping head with open top cylinder.

DEEP WELL PUMPS

If the low water level in the well is more than 22 feet below the level of the pump, a deep well pump is required. This depth is beyond the practical suction limits of a shallow-well pump. The following types of deep-well pumps are commonly used in farm water systems:

Piston Pump: (Deep Well) One of the oldest methods of deep well pumping is with the reciprocating or plunger type pump. Figure 12 shows both the old-fashioned hand force pump with closed top cylinder and also the modern type with pumping head and electric motor. Modern deep well pumps will deliver a constant supply of water at high or low pressure. They are designed to operate satisfactorily in wells up to several hundred feet deep.

Open-top cylinders are usually preferred to closed cylinders for deep well pumps. This permits removing the plunger and check-valve for repairs without removing the drop pipe.

Jet Pump: (Deep Well) The deep-well jet pump consists of a pump unit at ground level with the jet submerged in the well water. Figure 13 shows a typical deep well jet system. The pump may be located over the well, or offset from it.

The pump at the surface forces part of the water into the pressure tank and part through the pressure or return pipe that extends to the jet, or ejector. As the water passes through the nozzle or the jet, a vacuum is created which causes water from the well to rise in the suction pipe. The well water mixes with the water coming through the nozzle and the combined stream is forced up the lift pipe to within suction lift of the pumping unit.

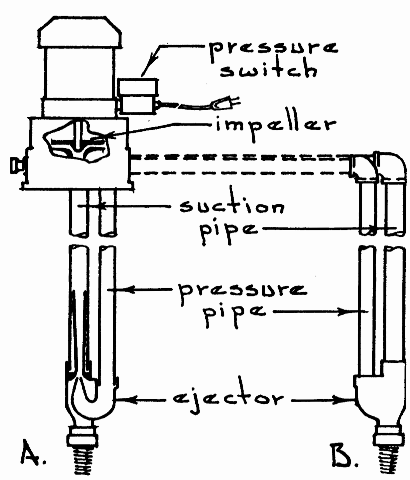


Fig. 13—This drawing of a deep well jet pump shows how the pump is located over, or offset from, the well.

Selection of the proper size pump and jet unit is one of the important factors in obtaining efficient operation of a deep well system. Manufacturers' performance tables should be consulted to obtain system best suited to well depth and pumping conditions.

Submersible Pump: (Deep Well) One of the recent developments in pumping water from deep wells is represented in the submersible pump, as shown in Figure 14. The entire assembly, including both the electric motor and the pump, is submerged under the water level in the well. Therefore the water is delivered by "pushing" it out of the well. The water is under pressure, and there is no suction condition. With this type of pumping assembly, the motor usually is at the bottom and the pump at the top of the assembly, the inlet strainer feeding the pump with water at the middle portion of the assembly. Thus, regardless of the "drawdown" condition of the well, the motor is never out of water.

The electric motor is customarily connected to the control system on the ground level by means of a special submarine-type electrical cable. The pump usually is a multistage centrifugal type. Its conventional impellers and diffusers are so arranged in series that the pump is capable of delivering water against pressure sufficient to force it up out of the well, discharging it against adequate tank pressure at the surface.

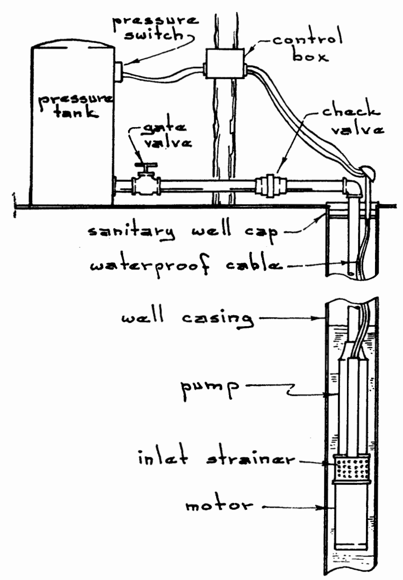


Fig. 14—Here is a typical installation of a deep well submersible pump.

Motors for submersible pumps are made in various ways. Generally speaking they are of two classes, the first being so-called "dry motors," the second "wet motors."

There are pumps made to enter wells as small as four inches inside diameter. Within limits of horsepower and pipe size, they can be set at any pumping depth. There is no limitation on depth from which fluid can be pumped if the well is large enough in diameter to accommodate discharge piping and diameter of the motor.

Presence of sand or abrasives may shorten the life of a submersible pump. Where these are known to exist, they should be considered before using this type pump. Particular advantages of this type of pump including quietness, and elimination of pump pits, pump houses, or other surface structures.

Size of Pump

There are two important things to consider in determining the the size of pump to buy:

(1) The amount of water you will need; and

(2) The amount of water available in the well or other source of supply.

Manufacturers' selection charts should be used in determining the size of pump best suited to your needs and water supply. These charts also specify the size of motor required for the pump job.

The amount of water needed is based on daily water requirements on the farm, which can be estimated from Table 1, page 4. When the water supply is adequate, select a pump that will supply the daily water requirements in not more than 2 hours of intermittent operation. For instance, if the daily water requirement is 700 gallons, the minimum size pump would be 350 gallons per hour.

The pump should also have a capacity in excess of the actual requirements for any given period. A better rule is to have a capacity of 200 gallons per hour for each faucet that will be on at one time. A two-faucet pump would thus be 400 gallons per hour, a three-faucet pump 600-gallons per hour, etc.

The well capacity should be checked, if at all possible, in order to select the size of pump best suited to well conditions. Reliable well drillers and experienced pump men can often assist in selecting the proper size pump.

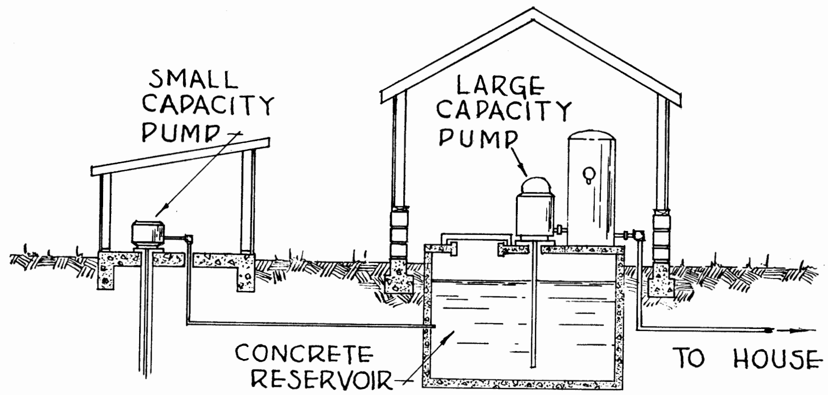


Fig. 15—This two-pump water system is used for a low capacity well.

A two-pump system is often advisable where the well flow is not sufficient to operate the size of pump required to meet farm needs. In this case, a pump of small capacity (see Figure 15) is used to pump the well water to a concrete underground reservoir, and from the reservoir another pump of larger capacity is used to deliver water to various points of use on the farm. In wells of very low capacity, it may be necessary to operate the pump on the well with a time-switch or float-valve control.

The Pressure Tank

HOW A PRESSURE TANK WORKS

A pressure tank is an important part of the automatic electric water system. Air occupies the upper portion of the tank and causes increased pressure on the water when more air or more water is pumped into the tank. Most water system pumps have an attachment for pumping air into the tank, which is necessary in order to replenish the supply which gradually decreases by absorption into the water. Figure 16 shows the pressure tank in relation to other essential parts of the automatic water system.

A pressure switch is provided to make the system automatic. As water is pumped into the tank, the pressure rises to a predetermined point, usually 40 pounds. Here the switch is automatically opened and pumping stops. When sufficient water is used to reduce the pressure to 20 pounds the switch is opened, starting the motor. The motor then operates until the pressure is again brought to a point high enough to throw the switch.

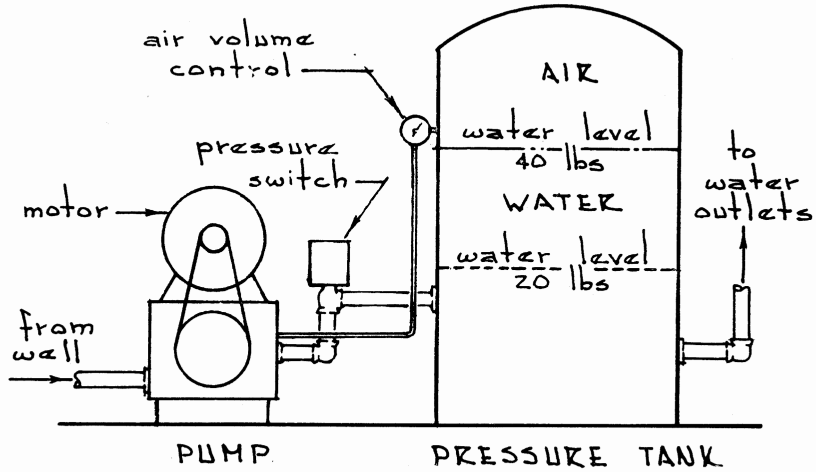


Fig. 16—This drawing shows the pressure tank and the other basic parts of automatic water systems.

SIZE OF PRESSURE TANK

The 42-gallon tank is the most commonly used size in farm water systems. This size allows approximately seven gallons of water to be drawn between the 40- and 20-pound pressure levels. An 82-gallon pressure tank is recommended for large dairy herds. It is also recommended when the size of pump is smaller than required for farm needs, due to a small water supply at well or other water source.

LOCATION OF PRESSURE TANK

It is usually best to locate the pressure tank close to the pump. This is especially desirable for reciprocating pumps as it helps to eliminate pounding or water hammer. If the tank must be located some distance from the pump, the use of an air chamber near the pump will minimize the pounding.

Typical Water System Installations

A complete water system in the house need not be deferred because of insufficient finances. With proper planning, simple installations such as a kitchen sink with drain can be used as the first step of a complete automatic system.

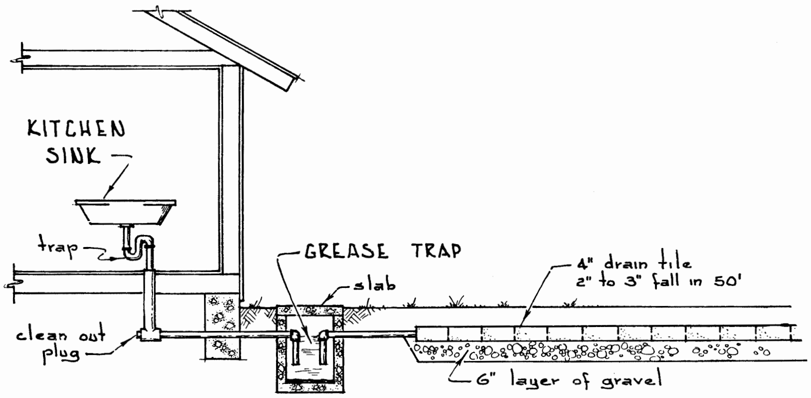


Fig. 17—Here is a plan for waste disposal from the kitchen sink.

KITCHEN SINK WITH DRAIN

A recommended type of installation for the sink is shown in Figure 17. The drain pipe which carries the waste water away from the sink should have a fall of at least one-fourth inch per foot. The grease trap is constructed of concrete, using a 20- to 40-gallon barrel for an inside form. The incoming and outgoing drain pipes enter and leave the trap through ells. This arrangement allows the grease to collect at the top and the coarser material to settle. Failure to provide the trap allows the grease and heavier materials to enter the tile line and cause stoppage. The grease should be removed from the trap at least once a month, or oftener if necessary.

The line of 4-inch tile should be laid from 10 to 12 inches below the ground surface and with a slight fall 2 to 3 inches in 50 feet. For best operating conditions, the tile should be placed on a 6- to 8-inch layer of gravel. A piece of tarpaper must be placed over the top of each tile joint to prevent dirt from silting into the tile line when it is covered. Fifty to seventy-five feet of tile are needed for most installations.

SHALLOW-WELL PUMP AT SINK

A simple shallow-well water system is shown in Figure 18. Here the pump is near the sink, or in some other location such as a back porch or store room that can be heated to prevent freezing in the winter.

SHALLOW WELL WITH PUMP IN BASEMENT

Figure 19 shows a shallow well system with pump in basement, cellar, or insulated pump house. The installation is very satisfactory provided the well or other source of supply is nearby and the total suction lift (including pipe friction) does not exceed about 22 feet.

The pump and pressure tank should be mounted on concrete blocks or other masonry units to a height of 6 to 12 inches above the floor. This height (1) permits easy oil drainage, (2) makes repair work easier, and (3) places the pump above any water that might accumulate on floor.

For Grade A Dairies

When planning a water system for a Grade A dairy, be sure to check with your local milk inspector about any special requirements for sanitation.

DEEP-WELL JET SYSTEM

Jet pumps, like shallow well systems, do not have to be set directly over the well. Figure 20 shows a typical installation with the pump

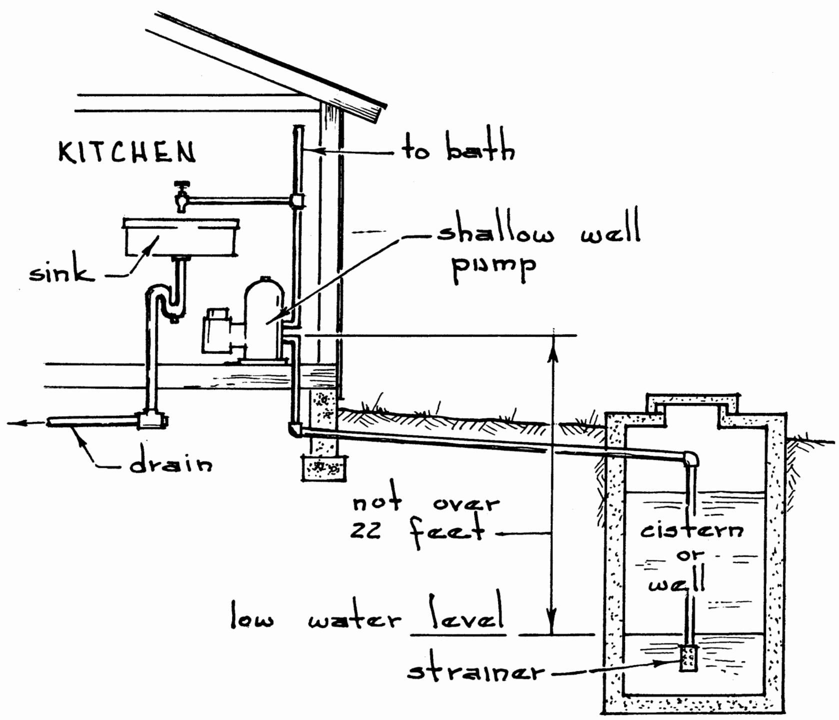


Fig. 18—Here is a shallow well system installed near the sink.

in the basement. A cellar or insulated well house can also be used for locating the pump. The frost-proof pit and sanitary well seal are essential features of this type of installation. Separating the pump from the pit is highly recommended because there is less danger of contaminating the water supply than when pump and well are in the same pit.

The Piping System

In planning your water distribution system, remember these points:

(1) Make the piping as short and straight as possible. Long pipes, elbows, and angles reduce the water pressure and also the amount of flow.

(2) Use pipe large enough to deliver water at the full capacity of your pump to each water-using building (such as house or dairy barn) with not more than 5 pounds of pressure loss.

WHAT ABOUT PLASTIC PIPE?

Flexible plastic pipe, made of polyethylene, is ideally suited for cold-water lines to farm buildings. It is rust-proof, light-weight, and easily installed. The pipe can be cut with a saw or sharp knife. Fittings are attached by means of a clamp and tightened with a screw driver.

Be sure to use plastic pipe according to instructions of manufacturer. Special types of pipes are available for pump installations.

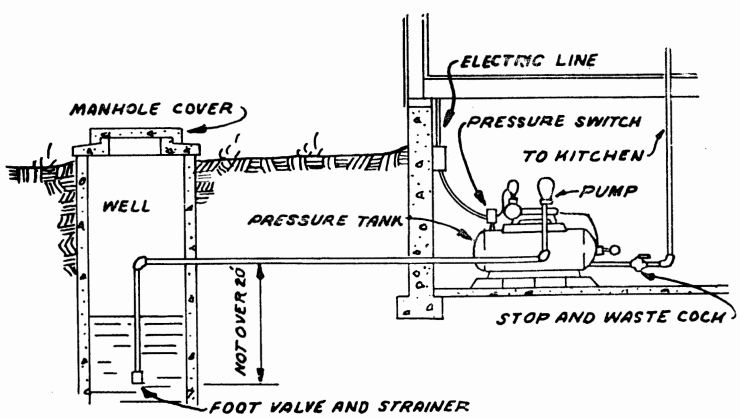


Fig. 19—This shallow well system uses a pump in the basement.

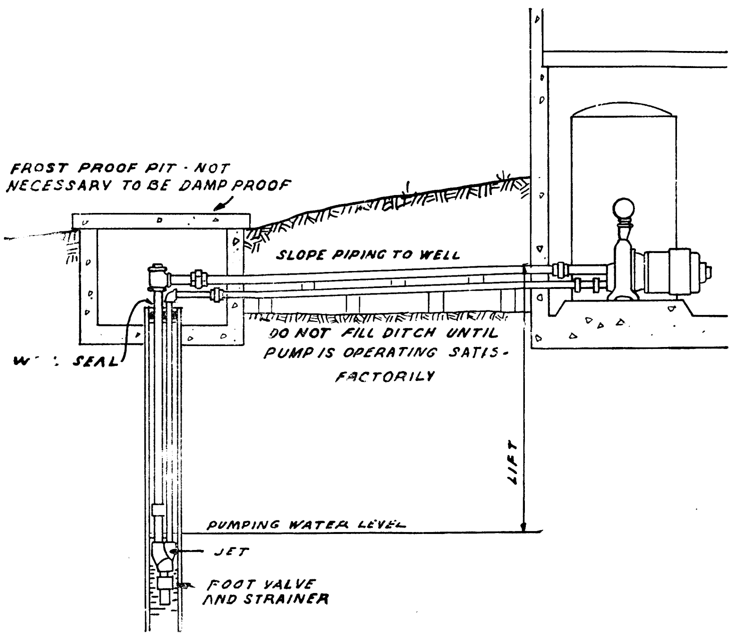


Fig. 20—Here is a deep well jet system with a pump in the basement.

There are also different pressure ratings for plastic pipe. The 75-pound rating is generally satisfactory for most farm conditions. Most types of plastic pipe are damaged by the sun, so place the pipe underground. A shallow trench will do, but putting it below the frost line will permit year-around use.

Plastic pipe also offers less resistance to flow of water than steel pipe.

FIGURING SIZE OF PIPE

Galvanized-iron pipe. Table II gives data on pounds of pressure and equivalent feet of head necessary to overcome friction when different quantities of water are flowing in iron pipe of different sizes.

Figure 21 shows the size of galvanized-iron pipe needed for different capacities of pumps when delivering water through different lengths of pipe. Here is the way to use the chart: Suppose your pump has a capacity of 350 gallons per hour, and there are 200 feet of pipe from the pump to the house. Read across from the "350" in the left hand column until you are in the column directly under 200 feet. You will notice that you are in the part of the chart labeled "1-inch pipe," which is the recommended size for this installation.

Plastic Pipe. Table III gives data on pounds of pressure and equivalent feet in head necessary to overcome friction in plastic pipe of 1/2 to 1 1/2 inches in diameter when different quantities of water are flowing.

Figure 22 shows the size of plastic pipe needed for delivering water through different lengths of pipe. It is used in the same way as Figure 21, as described for steel pipe, above.

KEEPING PIPES FROM FREEZING

Protecting pipes from freezing is one of the important things to keep in mind when planning the water system. Underground pipes should be laid below freezing depth, which varies from 24 inches to 36 inches in Oklahoma.

TABLE II.—Pipe Friction per 100 Feet of Ordinary Iron Pipe, Expressed as Feet in Head and as Pounds per Square Inch for Various Rates of Flow.

Flow (Gallons per Minute)	Size of Pipe: ½-Inch		¾-Inch		1-Inch		1¼-Inch		1½-Inch	
	Feet Head	Lbs. Sq. In.	Feet Head	Lbs. Sq. In.	Feet Head	Lbs. Sq. In.	Feet Head	Lbs. Sq. In.	Feet Head	Lbs. Sq. In.
2	7.4	3.2	1.9	0.82	---	---				
3	15.8	6.85	4.1	1.78	1.26	.55	---	---	---	---
4	27.0	11.7	7.0	3.04	2.14	.93	.57	.25	.26	.11
5	41.0	17.8	10.5	4.56	3.25	1.41	.84	.36	.40	.17
6	---	---	14.7	6.36	4.55	1.97	1.20	.52	.56	.24
8	---	---	25.0	10.8	7.8	3.38	2.03	.88	.95	.41
10	---	---	38.0	16.4	11.7	5.07	3.05	1.32	1.43	.62
12	---	---	---	---	16.4	7.10	4.3	1.86	2.01	.87
14	---	---	---	---	22.0	9.52	5.7	2.46	2.68	1.16
16	---	---	---	---	28.0	12.10	7.3	3.16	3.41	1.47
18	---	---	---	---	---	---	9.1	3.94	4.24	1.83

1 pound pressure=2.31 feet water column
1-foot water column=.43 pound pressure

How to use Table II is shown by the following example:

Example: What will be the friction head in feet and the pressure loss in pounds when 10 gallons per minute is flowing through 400 feet of 1¼ inch pipe? Reading in the 1¼ inch column opposite the 10 gallons per minute is 3.05 feet of head and 1.32 pounds pressure. Multiply each of these figures by 4 to get the values for 400 feet. This will give 12.2 feet of friction head and 5.28 pounds of pressure loss.

TABLE III.—Pressure Drop of Water per 100 feet of Plastic Pipe, Expressed as Feet in Head and as Pounds per Square Inch for Various Rates of Flow.

Flow (Gallons per Minute)	Size of Pipe: ½-Inch Feet Head	½-Inch Lbs. Sq. In.	¾-Inch Feet Head	¾-Inch Lbs. Sq. In.	1-Inch Feet Head	1-Inch Lbs. Sq. In.	1¼-Inch Feet Head	1¼-Inch Lbs. Sq. In.	1½-Inch Feet Head	1½-Inch Lbs. Sq. In.
1	1.50	.65	.32	.14	.09	.04	---	---	---	---
2	5.08	2.20	1.13	0.49	.30	.13	.09	.04	---	---
3	10.51	4.55	2.40	1.04	.60	.26	.18	.08	.09	.04
4	17.81	7.71	3.81	1.65	1.01	.44	.32	.14	.16	.07
5	26.01	11.26	5.61	2.43	1.43	.62	.46	.20	.23	.10
6	36.01	15.59	7.51	3.25	1.94	.84	.64	.28	.30	.13
8	61.00	26.41	12.01	5.20	3.19	1.38	1.03	.45	.51	.22
10	92.14	39.89	18.31	7.93	4.90	2.12	1.59	.69	.76	.33
15	----	----	38.83	16.81	10.11	4.38	3.30	1.43	1.55	.67
20	----	----	----	----	16.51	7.15	5.50	2.38	2.54	1.10

1 pound pressure=2.31 feet water column
1-foot water column=.43 pound pressure

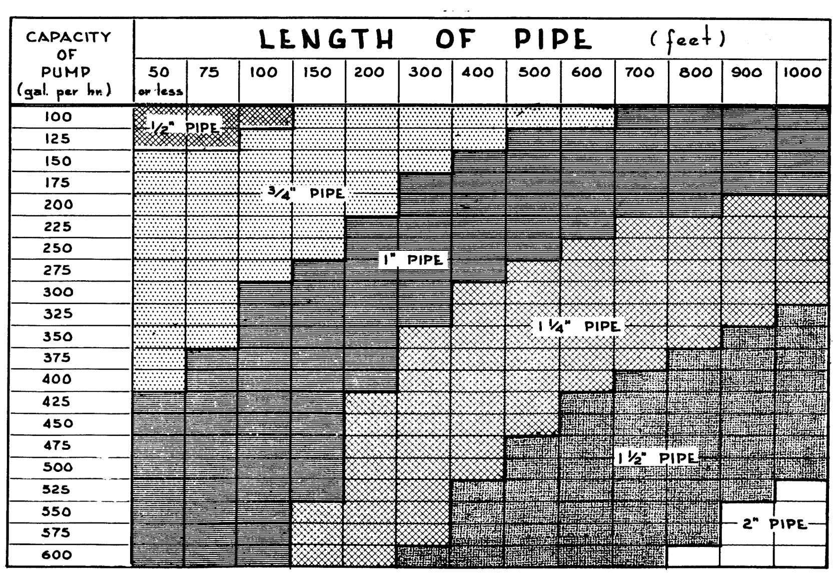


Fig. 21.—This chart shows the size of galvanized pipe recommended, according to the size of pumps and length of pipe.

Stop-and-waste cocks (Figure 23) are recommended for draining exposed piping, such as yard hydrants, or for draining all of the pipes in a building that is not sufficiently heated to prevent freezing. It is important that all sections of the pipe slope from the faucets back to the drain cock to insure complete drainage.

Figure 24 shows a method of protecting a water pipe between the ground and the floor of a building.

Anti-freeze heating tape can be used to a good advantage in many cases to keep the exposed water pipes from freezing. The tape should be installed according to manfacturer's instructions. When used with a thermostat, as shown in Figure 25, the tape works automatically by turning the current on or off according to the temperature setting.

Plans for the Well House

The farm water system should be well protected against freezing. A concrete-block house, as shown in Figure 26, will give adequate protection for the pumping equipment. For added protection during extremely cold weather, it is well to have at least one heat lamp installed so that heat can be directed on the parts of the pump most likely to freeze. A thermostat can be used so the heat can be applied automatically when needed.

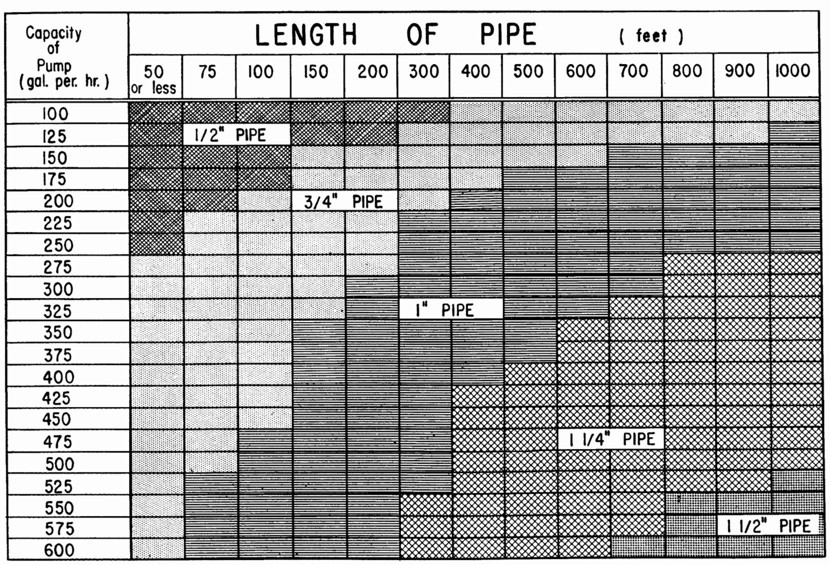


Fig. 22.—This chart shows the size of plastic pipe recommended, according to the size of pumps and length of pipe.

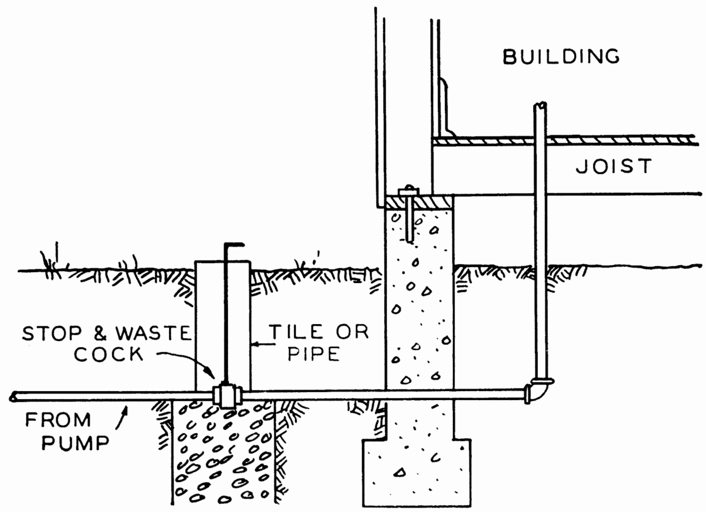


Fig. 23.—Stop-and-waste cock for draining exposed pipe.

A well house is preferabe to a pump pit because: (1) Good drainage can be more easily provided. Most pumps leak a little as water often affords lubrication for some of the bearing parts. (2) The above-ground installations makes it easier to inspect the pump for needed repairs and adjustments. (3) The above-ground house can be well ventilated to prevent excessive dampness, which is especially harmful to electric motors.

Plan the well house for easy servicing of equipment: In building a concrete block well house, be sure to make it large enough to house the pump and pressure tank with enough additional space for work-

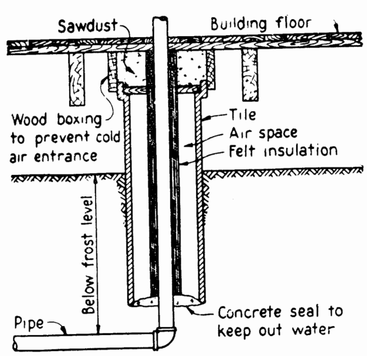


Fig. 24.—Here is a method of protecting exposed pipe under the house.

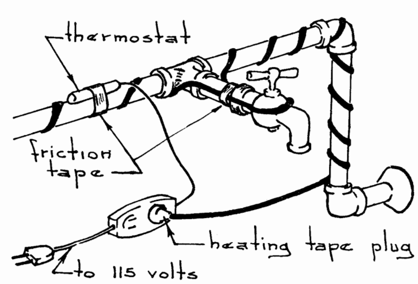


Fig. 25.—Electric heating can be used, as shown here, to prevent pipe from freezing.

men to make repairs. The removable roof, as shown in Figure 26, is a desirable feature for easy removal of well pipe when necessary.

In some cases it may be desirable to build a small insulated wooden house that can be removed from the foundation when servicing pump equipment.

Wiring for the Electric Motor

The well-planned electric water system must be wired to provide for:

(1) Ample power to the motor;

(2) Fire protection is case of emergency; and

(3) Safety from possible electric shock.

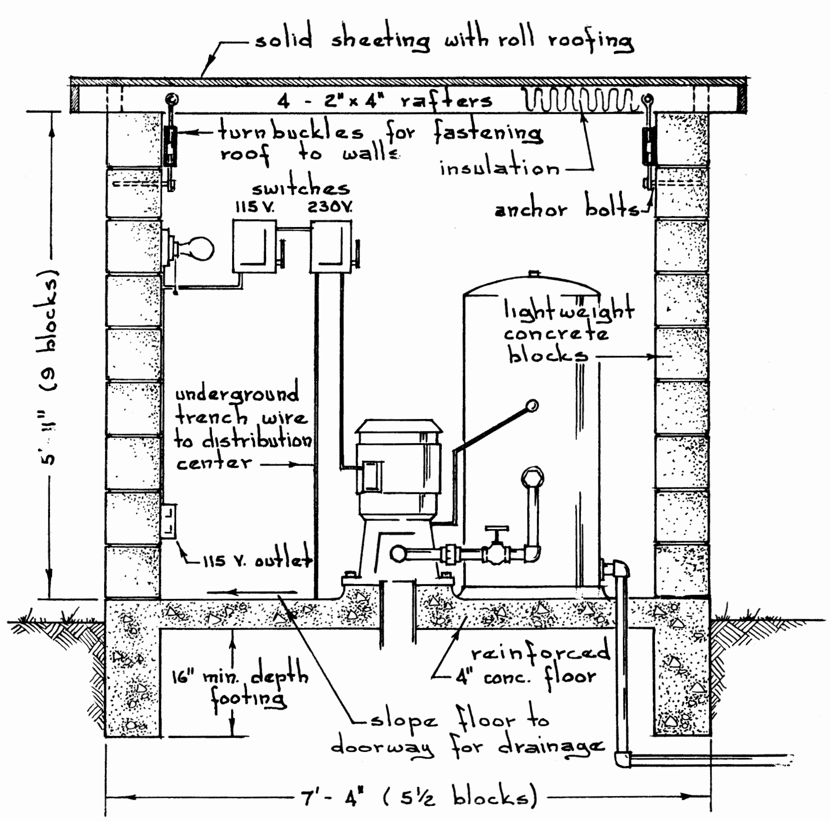


Fig. 26.—Here are plans for a concrete-block well house with an insulated, removable roof.

WIRE SIZE

In determining wire size, first decide what voltage you should use. If your pump motor is ½ horsepower or larger, use 230 volts. With this voltage you can use smaller wire than with 115 volts, and your lights won't dim each time your motor starts. If your motor is 200 feet or more from your meter, 230-volt service will save on the wire size even with motors smaller than ½ horsepower.

Use Table IV to find the proper wire size for the size motor you have and its distance from the meter. If you have greater distances than given in table, consult your local power supplier for correct wire size.

PROTECTION AGAINST FIRES

The farm water system can be of great help in case of fire, provided the pump is on a separate circuit that will not be damaged by fire.

Figure 27 illustrates proper methods of wiring the motor in the pump house to the central meter, which may be on a central metering pole or located on a building.

UNDERGROUND WIRING

Underground wiring is very practical with the new plastic wiring material that has been developed. It is available as single wire or a two or three wire cable. Your dealer or electrician can give you further information on its use in wiring for the electric pump.

SAFETY MEASURES

The moist conditions around your pump can be dangerous if your pump and equipment are not grounded. If your pump is mounted rigidly on a steel well casing and is not insulated with a gasket, it is already well grounded.

If you are using steel underground service pipe, you can easily ground the motor to the pipe with approved connections. If plastic pipe is used and the well casing is not steel, you can ground the pump and equipment by driving a 3/4 inch galvanized pipe to a depth of six or eight feet.

Be sure to use porcelain or plastic sockets. The insulating shell on metal sockets will take up moisture and become a serious shock hazard.

MOTOR AND CIRCUIT PROTECTION

In the case of an overload or short circuit, both your motor and the circuit that feeds it need protection from too much current. The circuit should be protected with a plug or cartridge fuse.

The pump motor should be protected with a separate overload protection device. There are different types—circuit breakers, time-delay fuses, and magnetic switches with overload protection.

Table V gives information for determining the overload protection to provide for electric motors and circuits. By checking the name plate on your motor, you can find the amperage ratings for 115 or 230 volts or both. Select the amperage that matches the voltage you plan to use, and then check that amperage with the figure that comes closest to matching it in the left hand column. The second column gives the size overload device needed to protect your motor. The third column gives the size of fuses or circuit breaker to use to protect the circuit that supplies your pump motor.

TABLE IV.—Circuit-wire Sizes for Individual Single-Phase Motors*

(Based on 3% voltage drop on full-load current)

Motor size (h.p.)	Volts	Distance From Meter to Motor (Feet):**											
		50	75	100	200	300	400	500	600	700	800	900	1000
					Wire Gage Number								
¼	115	14	14	14	14	10	8	8	6	6	6	4	4
⅓	115	14	14	14	12	10	8	6	6	6	4	4	4
¼	230			14	14	14	14	14	12	10	10	10	10
⅓	230			14	14	14	14	14	12	10	10	10	8
½	230			14	14	14	12	12	10	10	10	8	8
¾	230			14	14	12	12	10	10	10	8	8	8
1	230			14	14	12	12	10	10	8	8	8	6
1 ½	230			14	12	10	10	8	8	8	6	6	6

*Condensed from "Handbook of Farmstead Wiring Design," Industry Committee on Interior Wiring Design.

**If overhead wiring is used and span is more than 50 feet-use 8-gage wire for strength; or larger if needed for motor. Spans under 50 feet can use 10-gage wire unless larger size is needed for motor.

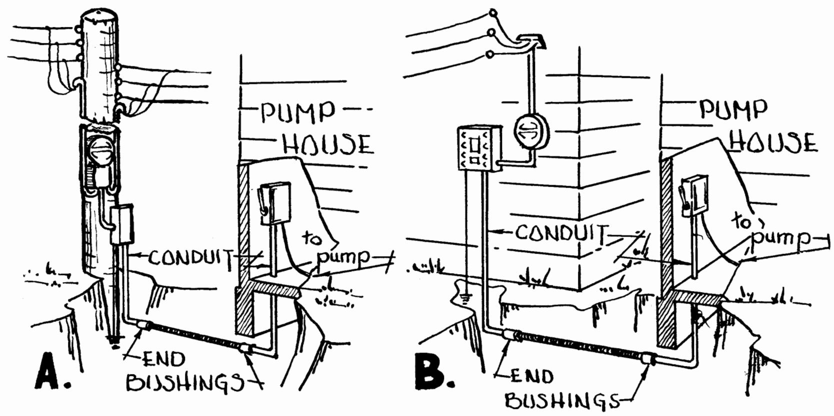


Fig. 27.—This diagram shows the underground wiring for the pump circuit; (a) from central meter pole, and (b) from the meter located on the building.

TABLE V.—Overload Protection to Provide for Motor and Circuit.*

Full-load current rating of Motor (amperes)	Motor Running Protection Max. rating non-adjustable Protective Devices (amperes)	Max. Allowable Rating of Branch Circuit Fuses or Circuit Breaker (amperes)
1	2	15
2	3	15
3	4	15
4	6	15
5	8	15
6	8	20
7	10	25
8	10	25
9	12	30
10	15	30
11	15	35
12	15	40
13	20	40
14	20	45
15	20	45
16	20	50
17	25	60
18	25	60
19	25	60
20	25	60
22	30	70
24	30	80

*Condensed from the National Electrical Code, Table 20.

Useful Rules About Water Supplies

1. **Static Head**—Number of feet of vertical lift from source of supply to point of discharge.
2. **Friction Head**—Feet of head necessary to overcome friction of water flowing in pipe.
3. **Total Head**—Sum of static head plus friction head.
4. To reduce pounds of pressure to feet head, multiply by 2.3
5. To reduce head in feet to pressure in pounds, multiply by .43
6. Doubling the diameter of a pipe increases its capacity about 4 times.
7. A gallon of water weighs 8 1/3 pounds and contains 231 cubic inches.
8. A cubic foot of water weighs 62½ pounds and contains 7.48 gallons.
9. To find the capacity of a round tank or cistern in gallons, square the diameter (in feet) and multiply by .785. Then multiply the result by the height in feet and by 7.48.
10. One inch of water over one acre of ground requires 27,200 gallons.

Useful Data on Cisterns

Net yield of water for cisterns per square foot of roof or catchment area

Minimum Annual Rainfall	**Water Yield Per Sq. Ft.***
(Inches)	**(Gallons)**
10	4.2
15	6.3
20	8.3
25	10.5
30	12.5
35	14.6
40	16.7
45	18.8
50	20.8

*Allows for ⅓ of water being wasted to take care of leakage, roof washing, and evaporation.
EXAMPLE: Size of house 30'x40' where rainfall is 30 inches per year.
Area= 30 x 40=1200 sq. feet. 1200 x 12.5=15,000 gallons per year.

Capacity of Round Cisterns—Gallons

Depth in Feet	Diameter in Feet 5	6	7	8	10	12
6	882	1266	1228	2256	3522	5076
7	1029	1477	2016	2632	4109	5922
8	1176	1688	2304	3008	4696	6768
9	1323	1899	2592	3394	5283	7614
10	1470	2110	2880	3760	5870	8460
12	1764	2532	3456	4512	7044	10,152
14	2058	2954	4032	5264	8218	11,844
16	2342	3376	4608	6016	9392	13,536

Acknowledgement

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Here are Some Other Publications on

WATER SYSTEMS

This booklet is only one of a long series of Oklahoma A. & M. publications that help to make farming more profitable, healthier, and easier. Here are a few that you may want to read. . .

E-580—Farm Ponds for Household Water Supply

E-399—Farm Sewage Disposal

Farmers Bulletin 1978, U. S. Department of Agriculture —Safe Water for the Farm

Ask Your County Agent

He Has These and Many Others

OR WRITE: Agriculture Mailing Room
Oklahoma A. & M. College
Stillwater