How does a deep well pump work?

Deep well pumps are usually modular and consist of two main components:

Engine and hydraulic part (pressure stage). The electric motor is usually located at the lower end of the Deep well pumps and converts the supplied electrical energy into a mechanical rotary motion.

This rotation drives the hydraulic pump shaft via a coupling.

The hydraulics of modern deep well pumps consists mostly of individual impellers and Diffusers connected by a pump shaft. The inflowing water is accelerated by the rapid rotation of the motor in the first impeller and transported by the centrifugal force by means of the diffuser in the next impeller.

Through each stage, the discharge pressure of the pumped medium is further increased, which makes it possible with this technique to promote water efficiently even from great depths.

The maximum suction height of suction pumps, for example, is physically limited to 10 meters (geodetic suction height).

Is a 3-inch or 4-inch deep well pump useful for my well?

4-inch deep well pumps are ideal for wells with a diameter of at least 100mm and have significant advantages over 3-inch models.

Often wells are drilled for cost reasons with a diameter of only 80mm. In this case, only the choice of a 3-inch pump remains, including the associated disadvantages such as lower flow rates with higher power consumption. Pumps with a diameter of 3 inches should therefore only be used if the well has a smaller inside diameter than 100 mm. To compensate for this disadvantage, some manufacturers rely on a speed increase, which increases the pump power but reduces the service life of the hydraulic system. Abrasives such as sand act at higher speed significantly aggressive on the wheels and use them faster.

What should my deep well pump do?

For the performance of a deep well pump, two characteristics are crucial, which are specified by the hydraulic part of the pumps:
The maximum delivery rate The maximum pressure or delivery height
In order to reach the given values, a suitable motor is needed. It does not matter whether the engine is operated in 1-phase or 3-phase, as long as engine power (kW) and torque (daN) are suitable.
The delivery rate and the working pressure are reduced the higher the water has to be pumped. The height that must be overcome when pumping is therefore one of the important criteria for selecting the appropriate deep well pump.

How much pressure does my deep well need?

The pressure in bar is equal to the maximum head. The pressure of a Deep well pump is reduced by 1 bar per 10 meter head.

Thus, a pump with a maximum head of 50 meters has a working pressure of 5.0 bar.

However, if this pump has to overcome a height of 30 meters to the sampling point, the working pressure remaining at the water outlet is only 2 bar.

What should my deep well pump do?

Normally, a 4-inch deep well pump has a capacity approximately twice as high as a self-priming centrifugal pump of the same engine power. The decisive performance parameters of the pump are:

1. The engine power in KW

2. The capacity in m^3 per hour or liters per minute

3. The maximum pressure in bar (per bar corresponds to the 10 m head) that a pump can produce.

How much power does a pump need if it is used as home or Garden water supply system should be used?

To answer this question, some important factors must be considered:

The first step is to set the appropriate minimum water pressure that must be built by the pump to achieve the desired application. By means of an example it can be shown which simple calculation steps are necessary for this.

If the water level in the well's well is at 10 meters depth and the water is to be delivered to the second floor of a house (that is about 6 meters above ground level) with a maximum pressure at the water outlet of 4 bar, then the total head is (6 meters + 10 meters,) that are then 16 meters together. This head is divided by 10, which results in a pressure loss alone through the 1.6 bar height to be overcome. In addition, in practice, an additional 30% of 1.6 bar (= about 0.5 bar) additional pressure loss caused by bends, friction on the pipe, etc. Together, the pressure loss in this example then amounts to about 2.1 Bar (1.6 bar + 0.5 bar). At the upper head of the pump deep in the well about 6.1 bar pressure has to be built up to reach 4 Bar pressure at the highest tap on the 2nd floor. By comparison, the public water supply network in Germany has a pressure of 4 to 6 bar.

However, it is not recommended if pumps always have to work up to their maximum pressure in the long term. The best efficiency is achieved when the required pressure is around 70-80% of the maximum pressure. For our calculation example this means: We add another 20% to the 6.1 bar and then come to about 7.5 bar.

The result is then clear: The ideal pump for this application should be able to build a maximum pressure of about 7.5 bar.

The next point is the flow rate: A garden faucet, which receives its water from the public water network, depending on the distance to the main terminal of the house and the pipe thickness promotes between 2 000 l and 3500 l of water per hour. A garden irrigation needs, depending on the Sprenger model, between 300 and 1500 liters per hour.

Each deep well pump has a graph that shows how many liters of water are delivered per hour at a given head.

Caution: This flow rate from the diagram is only correct if the pipe from the pump to the Tap is not narrowed and the diameter of the conveyor tube the same strength, as well as on

Water outlet of the pump is. If a 1 in. Pipe is used to transport water from the pump to the tap, but the pump has a 1 1/4 in. Port, then the chart values will be incorrect and the pump will not fully reach the chart values.

How can the pressure of the pump be regulated?

If the well pump only works with an always open outlet of the water, then you need no pressure control. In this case, the pump is only operated via an on-off switch.
If the pump should always switch on automatically as soon as a tap is opened and stop automatically when it is closed again, this is referred to as an automatic water supply system.
This requires some additional components, but at least one electronic pressure switch.

What is better, a mechanical pressure switch or a press-control (electronic pressure switch)?

For many years, the mechanical pressure switch in the most diverse

Proven pump systems. This type of switch is connected via a spring-mounted rocker and conducts power to the pump via two poles, but only when a previously set minimum pressure is exceeded. To change the pressures, the spring tension is changed by means of a wrench and thus the pressure is changed. In practice, this may mean that the pump is switched on as soon as the pressure falls below 3 bar and is switched off again when the pressure is reduced to e.g. over 4 bar rises.

When installing a mechanical pressure switch, it also makes sense a pressure gauge, too Manometer called to install. As a result, the pressures are visible and can be easily changed.

For some years electronic small pressure switches have become more and more common in small simple systems

(Press-Control) installed. These switches have the advantage that the pumps are switched off automatically as soon as no more water is pumped. This prevents dry running of the pump in case of lack of water. Especially with wells that have only a limited supply of water, such a switch may be useful.

However, these pressure switches are not adjustable and turn the pump always fixed at 1.5 bar or depending on the make and 2.2 bar. If the sensor no longer registers flow for several seconds, the pump is switched off. In this case, the pump has reached its maximum pressure. Thus, with each pumping cycle, the pump forcibly runs to its maximum pressure before being stopped by the pressure switch.

Please note: The electronic pressure switches are not adjustable and are not suitable for high pressure pumps above 6 bar at the water outlet!

For example, if a pump reaches 10 bar maximum pressure, the electronic switch will switch it off at 10 bar. But hardly any moving part in a water system can withstand this extremely high pressure. This means that high-pressure pumps should be limited to a maximum of about 6 bar by a mechanical pressure switch in any case. An electronic pressure switch is not suitable for this.

Is a membrane pressure tank (expansion vessel) required?

If you work well pumps against an always open water outlet, then you do not need a pressure tank.
For all other models, a diaphragm pressure tank is required because it absorbs damaging pressure surges and prevents damage to moving parts. Such pressure surges also occur through air in the system during a restart, which can easily reach three times the normal maximum pressure.
In addition, a membrane pressure tank is a water reservoir that prevents frequent switching on and off of the well pump. This means that the pump will only be switched on when the pressure tank is completely empty. When the faucet is closed, the pump still fills the pressure tank first before shutting off.
If a well has little capacity, then pressure tanks of up to more than 1,000 liters can also be used as water supply. Incidentally, the dispensing capacity from a filled pressure tank is usually several times the pump capacity when it is pumping directly. As a result, several faucets can be turned on at the same time for a short time without the pressure of the system decreasing.

Is frequent switching of the pump harmful?

Relative to the respective pump make, the motors of the pumps can tolerate in the long run only 20 30 on and off operations per hour without damage. When a pump motor is started, especially when the backpressure is high, it briefly requires up to ten times the current (starting current) compared to the rated power of the motor. This creates a high thermal and mechanical load on the engine components. The durability of the engine is shortened with frequent starts in the long run.

On which form should the membrane pressure tank be set?

Unfortunately, even well-trained well builders do not have a really well-founded opinion about the pressure conditions or the preload in the pressure tank. Systems without the right form but work either not at all or not optimally.

Each automatic water system should have a certain cut-in pressure. That's the one Minimum pressure at which the pump is switched on. An electronic pressure switch has a constant switch-on pressure of 1.5 or 2.2 bar depending on the make. As mentioned above, the switch-on pressure for the mechanical pressure switches is individually set manually by the user. A pressure tank must always be filled with exactly the same pre-pressure (air) as the pressure of the pump. At each switch-on time of the pump, the tank should be drained from the water and only 100 percent full of air. The air is in the tank room. The water is pressed into the membrane when the pump is switched on. When the pump is operating, the pressure at which the water flows into the membrane of the tank is increased up to the cut-out pressure. Then the pump stops automatically. If the faucet is turned on again, then the water comes out of the membrane of the pressure tank until the membrane is empty and the pressure tank is thus filled only with air. Only then does the pump switch on again to fill up. If too much or too little form prevails in the memory, then only part of the Available capacity.

At what depth should the pumps hang in the water?

It is very important that the pump is never positioned in the area of the filter tube. The filter is the area of the well pipe which is slotted sideways and whereby the water enters the well pipe. Partial flow in the small area of the filter tube can cause turbulence in the groundwater.

This can lead to precipitation of the water constituents of lime, manganese and iron. For this reason, the pump should always hang about one meter above the area of the filter tube. Thus, this area is evenly loaded over the entire length and it is additionally ensured that the groundwater flowing past the pump flows around and cools the motor.

If the pump is to be installed under the filter tube area, then definitely one Suction guard be installed. This then provides a forced flow around the underwater engine.

It is ideal to hang the pump as high as possible in the well pipe. The minimum amount of water that is above the pump is, however, to be observed in any case. A pump located at the bottom of the wellbore heaps much more sand. When the engine touches the ground, cooling of the engine shell is no longer ensured. If a pump hangs too high, then there is the possibility that during pumping the water level near the well sinks (suction funnel) and so air is sucked in. This can lead to damage at the pressure stage, as there is no longer sufficient lubrication and cooling of the turbine stage.

Oil cooling or water cooling of the pump motor?

In oil-cooled engines, the electric motor is constantly flowed around by oil. The deeper the pump is submerged in the water, the higher will be the water pressure that presses from outside on the engine seals to the oil chamber.

Most oil-cooled deep well pumps are therefore only suitable for a limited depth of about 30 meters.

For large diving depths, water-cooled engines are required. There the well water flows around the engine directly and there is no sealing problem.

How should the pipeline be designed?

We recommend a flexible PE pipe, with a diameter of at least one inch (32mm). The best is a tube which corresponds in diameter to the upper port of the pump. PE pipe up to 2 inches (63mm) can be found in the country trade. DIY stores usually only carry PE pipes up to 1 inch (32mm). Laying is very easy. There are a variety of types of glands. The tube is stiff enough to withstand the torque of the pump at startup. A water hose is not suitable, no matter what material. These hoses twist too easily with the pull rope and the cable.

What type of safety ropes should be used for a well pump?

Mostly, the pump head has two eyelets to which the rope is fixed. For some time, stainless steel cables have been offered to secure the pump. However, this is not recommended, since the attachment points in the pumps are often made of brass. Over the years, electrolytic corrosion can occur between the brass and the stainless steel of the rope. This is where the rope suffers and it can be so weakened that it breaks. Steel ropes are also unsuitable for your own hands if, for example, a pump with a PE pipe and a cable over 30 kg weighs and has to be pulled up by hand. We recommend braided plastic lines, from 6-8 mm diameter with a breaking load of ca.500-700 KG which are also used for maritime purposes.

Can the cable of the well pump be extended?

If cables that are permanently in the water are to be connected, then this must be done either by a cast resin sleeve, or by a waterproof sweatband. In the method with the welding band, the two cable ends are first knotted together to provide a strain relief for the seam. Then the wires are twisted individually. This tape is about 1 mm thick and is pulled to twice the length before use, piece by piece. As a result, the waterproof adhesive that is in the band exits, and then the band is welded to itself. The band is wrapped around the individual wires and finally the complete seam. In this way, up to 10 bar of sealed submarine cable connections can be produced. However, this connection must definitely harden for at least 12 hours before the cable is put into the water.

How much sand can a deep well pump handle?

Submersible pumps with several stages are basically permanently damaged by sand. The grains create a friction and thus grind down the centrifugal discs more and more. As a result, depending on the running time of the pump and the amount of sand, the pressure and the delivery rate of the pump continue to decrease. Most manufacturers state a conditional sand resistance of, for example, 50 grams per 1000 liters of water. But this only means that if the sand load is low, the pump will be damaged only after many years. Every single grain of sand acts like a grinding wheel and damages the pump with increasing quantity and Duration.

How is the cable fixed to the pipe?

For this purpose, under no circumstances should adhesive tape be used as it may dissolve. If the residue then falls into the pipe, then there is a possibility that the water inlet of the well pump clogged. A fixation is only possible with the appropriate cable ties.

Is there also a possibility that a deep well pump from a brick well or a cistern promotes?

Since the deep well pumps are tube pumps, and must be cooled by the water flowing past the engine. For this purpose, this so-called "jacket flow cooling" can also be easily produced yourself.
For a 4 inch pump, a plastic pipe with a nominal width of about 100 mm is needed. The pipe should be about 10 cm longer than the engine. This tube is then pulled over the lower part of the pump, so the engine including the water inlet, and closed at the top with silicone. So then all the pumped water flows past the motor of the pump and cools it. Basic knowledge of membrane pressure tanks (expansion vessels)
The pressure vessel is an essential part of the self-water supply system. Mostly this is in the today a diaphragm pressure vessel. This protects the system from pressure surges and the pump from frequent startup requirements. If the system is operated without this vessel, then major damage to the pipe network, to pumps and valves can be caused not only by the sometimes very high-energy pressure surges, but also by frequent on / off (cycling) of the pump.
The use of a sufficiently sized container avoids wear-inducing starting of the pump in the case of small-volume removal. In addition, the dispensing capacity of a diaphragm pressure vessel is several times higher than the dispensing capacity of most pumps. This allows several consumers to simultaneously remove water without the pressure dropping.

How do the membrane expansion vessels work?

The membrane expansion vessels have an elastic membrane which is firmly mounted in the pressure vessel. This membrane ideally consists of an EPDM / butyl material, is food-safe and thus ideally suited for drinking water. The outer container is pre-filled with air / nitrogen and compresses the membrane at rest.

The water entering the membrane compresses the air / nitrogen to the maximum pressure of the pump, which then shuts off. When water is withdrawn at the tapping point, the water is again forced out of the container into the water distribution network by the force of the compressed air / nitrogen.

When all the water from the tank has been transferred to the pipe network, if the tank is empty, the pump is switched on again by a pressure switch and the same cycle repeats.

The switch-on pressure of the pump and the pressure of the air / nitrogen filling must always be the same. So then the maximum use of the volume of the container is achieved. Most containers are already filled with a fixed standard form at the time of purchase. Based on the type of application, the pressure is then reduced or increased by means of a standard tire valve.

What must be considered when selecting a well / drinking water expansion vessel?

Such a pressure vessel can never be too big. Especially with domestic water systems prevent tanks with 200 1000 liters a drop in water pressure. This is particularly useful when several users consume water at the same time.

The membrane must be made of a material that can not release any pollutants to the water.

The vessel should ideally be filled with nitrogen and not with normal air. Nitrogen has larger molecules than a common oxygen mixture. As a result, less pre-pressure escapes through the membrane and the pressure does not need to be controlled as often. Nitrogen also protects the interior walls better against corrosion.

Vessels sold in Europe must all be tested according to the pressure equipment guidelines. A rating plate clearly confirms the data of the vessel. Important is the permissible maximum pressure through which the vessel may be used. The listed maximum pressure should be as high as possible. This is the only way to ensure that the wall is thick, stable and will last many years without damage or rust.

Types of expansion vessels

The small vessels are often used horizontally and in addition to the feet often have a foundation for a pump motor. On this example, a suction pump can be mounted. The membrane should be exchangeable. Most of the manufacturers can supply spare parts. Large vessels are arranged vertically in most cases. The connection flange and the connector for garden irrigation can be made of galvanized steel. For drinking water and industrial water in the house vessels with stainless steel flange and connection are recommended. For the hot water systems in heating systems, the expansion vessels must be additionally flowed through with water. Huge expansion tanks. From about 500 liters often has a built-in pressure gauge on which constantly read the form and can be controlled.