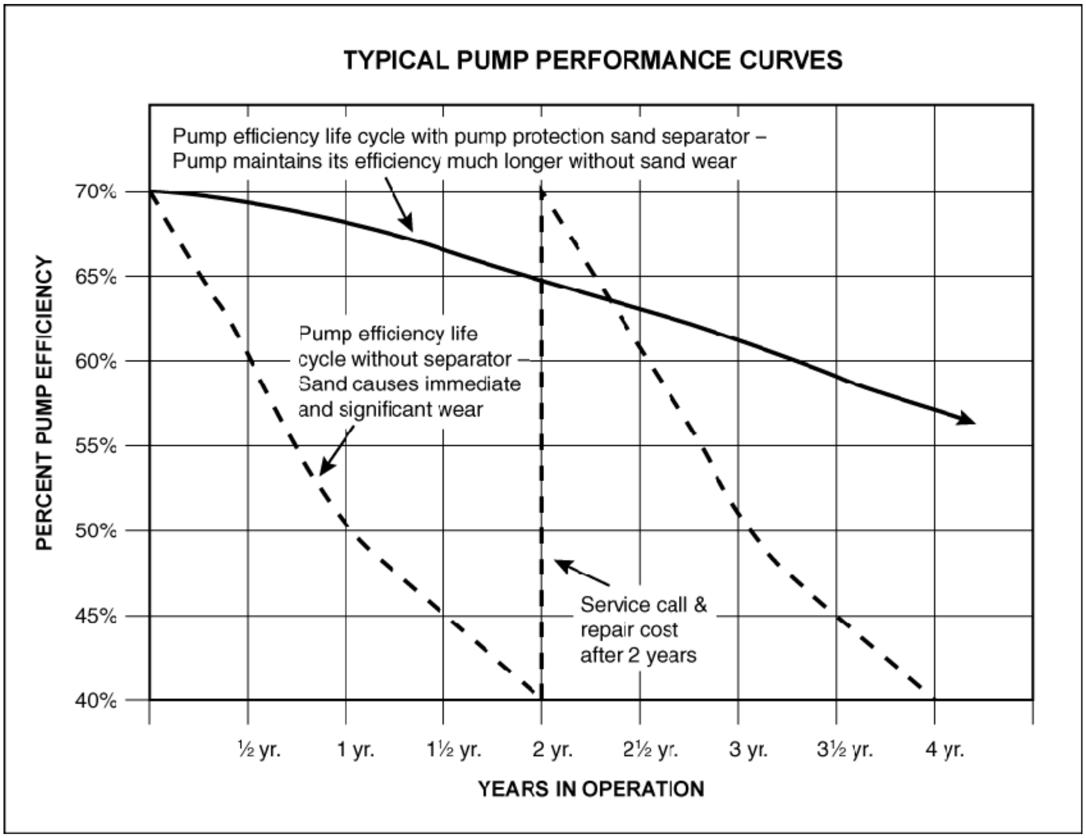
Technologies For Longer Pump Life

Pump manufacturers continue to design and develop impellers, bowls, wear rings and other innovations to curb the abrasive & damaging effects of sand in a water well. The challenge is that these same pump manufacturers are also pressed to design and develop more and more efficient pumps for moving more water from greater depths with less energy draw. It is not realistic to expect the solution to lie solely with the design of the pump … and it is not possible to expect a water well to forever be sand-free.

To be sure, a properly drilled, cased, gravel-packed and developed water well faces many circumstances that can defeat its best designs for keeping out unwanted sand. Pumping in excess of a water well's designed flow increases flow velocity to draw sand into a well. Overpumping an aquifer within a specific region by multiple water wells can also combine to draw more flow and sand into the well. Periodic droughts will lower the water table, and subsequent depth restoration can flush sand into a well. Deteriorating well casings, for sure, allow more sand to infiltrate a well. Earthquakes and major construction also have their affect to damage casings and upset the aquifer conditions, encouraging sand movement into a well. These and other circumstances threaten the best practices for commissioning a water well to long-term, sand-free service.

So, even a good well can become a sandy well. And it is the effects of that sand that signify the value of protecting the pump from the abrasive damage that sand causes. Clearly understood is the cost of repairing and replacing a pump versus protecting the pump for longer service life. Added value comes from prolonging the efficiency of a pump so that the cost of operating the pump to deliver the required water does not become an excessive energy cost. In essence, if a pump must work longer or harder to deliver water, the power cost also becomes a factor in its effective longevity. Worn early by sand, a pump can often operate at its lower efficiency for a long period of time before dropping to a low efficiency point that demands repairs or replacements. In that time, the energy cost can be significant, suggesting that repairs or replacement should have been considered much sooner.

Note the chart, depicting "Typical Pump Performance Curves", plotting a pump's typical loss of efficiency due to sand abrasion, suggests that pump wear does not occur evenly over time, but rather immediately, dropping a pump's efficiency quickly and causing the pump to operate longer at lower efficiency. Alternatively, keeping a pump’s efficiency at higher levels over that same time will logically result in both energy and cost savings.

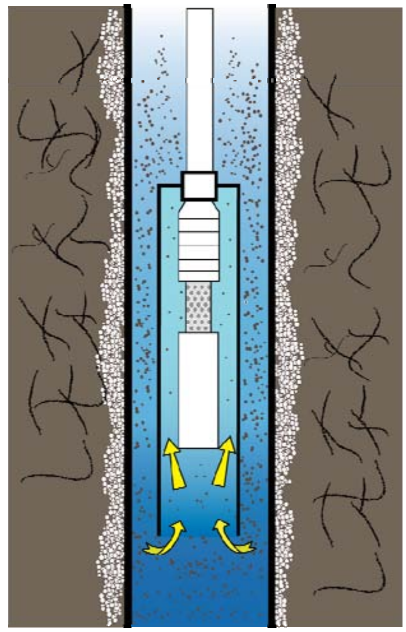


There is obvious and distinct value in protecting pumps from sand. The challenge is to apply an effective solution without the time, costs and restrictions of drilling a new well. Such solutions must take into consideration not only their relative cost, but also their suitability within the well’s environment, their lifespan and, most importantly, their ability to effectively remove the sand that could damage the pump and reduce its potential longevity.

Pump Shrouds

Essentially recognized as a shield around a pump’s intake, the pump shroud directs flow to the pump intake only via an upward movement past the pump’s motor. Initially designed as a pump motor cooling technique, the pump shroud also serves to keep large, unwanted particle matter from getting into the pump. It is widely known and easily applied in many well environments, requiring only that the shroud provides adequate clearance between the shroud and the pump to allow design flow to pass with little or no restriction … and that the shroud fits easily down into the well.

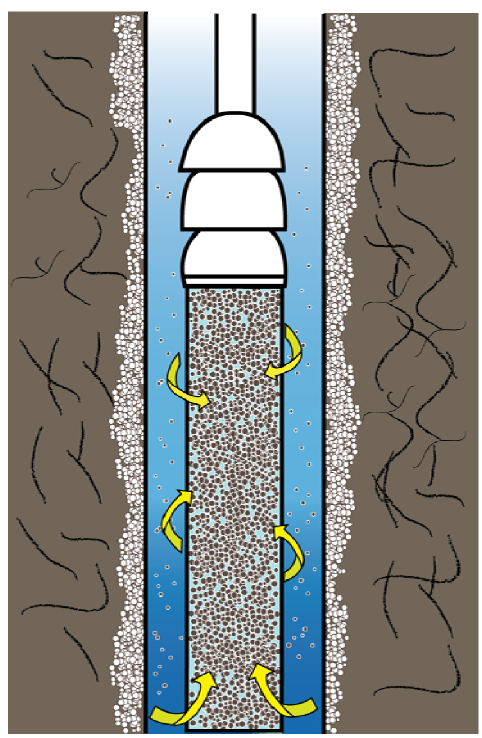
The performance of a pump shroud relies on particle matter in the well to be heavy enough that it will not follow the upward flow of water into a pump's intake, but will instead fall down deep into the well. Consider, however, that today's pumps, with the capability for effecting higher flow velocity, can draw such larger particle matter upward and potentially limit this technique's actual performance results.



There is little or no potential for increased flow restriction beyond any sizing and/or spacing issues imposed by the shroud itself. No maintenance routines are required. The pump shroud can operate with both steady and variable flow pumps, working best at lower flows & velocities.

Suction Flow Control Devices

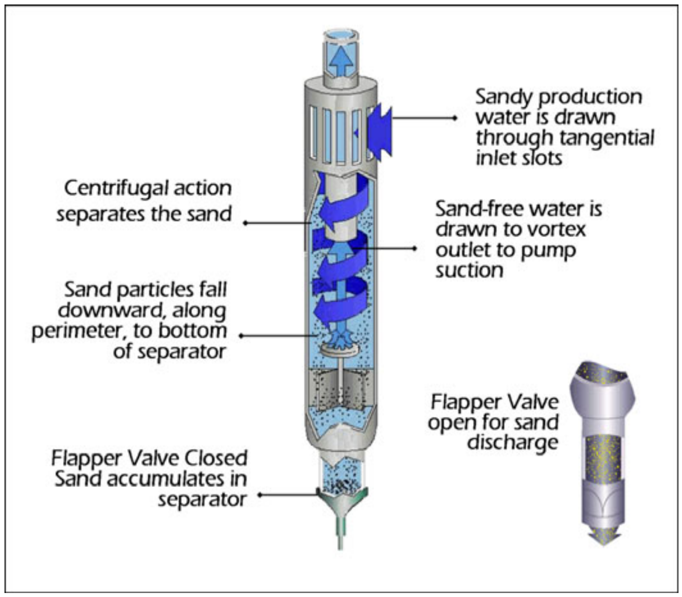
This technology employs an epoxy-coated sand/gravel pack that is layered around a length of casing/screen. The overall device is connected to a pump's intake. The size and diameter of the suction flow control device is determined by the pump's actual flow rate and the inside diameter of the well. The design is meant to diffuse incoming flow over a greater area in order to reduce intake velocity to the pump over a larger area of the suction flow control device. Wells smaller in diameter are accommodated with longer suction flow control devices where possible. Flow simply passes through the epoxy/sand/screen into the pump intake.



The design premise is that flow enters the well via a larger percentage of the water-producing area at an overall lower velocity, thus reducing particle matter from coming into the well. Performance is ultimately achieved by straining out any incoming particle matter that is larger than the openings of the epoxy/sand/screen assembly. It is intended that when the pump shuts off and releases its drawing effect on the particle matter trapped on the epoxy/sand/screen, the particle matter will drop off and fall down into the well. One must consider and expect, however, that at least some particle matter will lodge within the epoxy/sand/screen assembly and not release from the device, at least somewhat restricting the flow through the device over time. If that continues, the pass-through velocity increase will further draw more particle matter to lodge upon its surface and may ultimately restrict flow.

Best results are obtained when flow and velocity are low. There are no maintenance routines while in service. Periodic removal of the suction flow devlce from the well and cleaning of the epoxy/sand/screen may be necessary.

Pump Protection Separators



Employing centrifugal action to remove settleable particle matter from pumped water, the pump protection separator can be installed with either a submersible or turbine pump. It is attached to the pump prior to the intake, either onto the suction casing of a turbine pump or in conjunction with a pump enclosure shell to direct water first through the separator before going to the intake of a submersible pump. As the pump pushes water to the surface, the pump protection separator is fed by head pressure created by submergence. A minimum of 25-30 feet of drawdown head is required to feed proper flow through this technology. Each pump protection separator has a specific flow range that it best operates within.

The pump protection separator’s centrifugal action spins unwanted sand from the flow of water, which then follows a vortex action up to the pump intake. Separated sand drops to the bottom of the separator, collected until either the pump shuts off to allow sand to pass through a flapper-type valve and discharge deep into the well, or until the accumulation of sand pushes its way through the flapper valve for discharge deep into the well.

Sizing of the pump protection separator begins with the actual flow rate of the pump. A widely-variable flow range cannot be accommodated. The well's inside diameter must also be able to accommodate the separator (and pump enclosure shell, if applicable). In addition to the required submergence, a clearance of about 25 feet below the separator is required to allow for separated sand to discharge deep into the well.

Performance is reliable and predictable when operating within the specified flow range for any given model. Pump life increases of four to five times longer are to be expected. There is a head loss attributable to this technology (about 9-14 feet), but no maintenance routines are necessary.

Where does the sand go?

Each of the above techniques for protecting pumps from sand results in the ultimate discharging of sand back into the well. It is the trade-off for not pumping sand and damaging the pump. While it is common to be concerned about filling the well with this sand, it is equally common that the sand does not accumulate to such troublesome levels. In essence, one must remember that underground aquifers are not static bodies of water, but rather moving flows. That movement not only allows sand to flow into a well, but also out of a well. There are also other theories on this subject. Use your own judgment, but know that these technologies have all been successfully employed and that sand accumulation is clearly not a routinely significant issue.

It is, in fact, possible for sand to accumulate and require mechanical removal techniques. Such occurrences are typically the result of only significant sand problems … and the cost of periodically bailing a well is then considered acceptable when compared to pump damage, sand-locked pumps and similarly costly alternatives.

Sand does present a challenge to pumping technology. Sand cannot be completely avoided, even when employing the best equipment and trade practices. Sand, however, can be controlled to reduce operating costs and prolong pumps at greater efficiencies. In this age of information availability, your customers know, are aware, or will come to learn of these technologies … be prepared to professionally apply the solutions that best serve your customers.