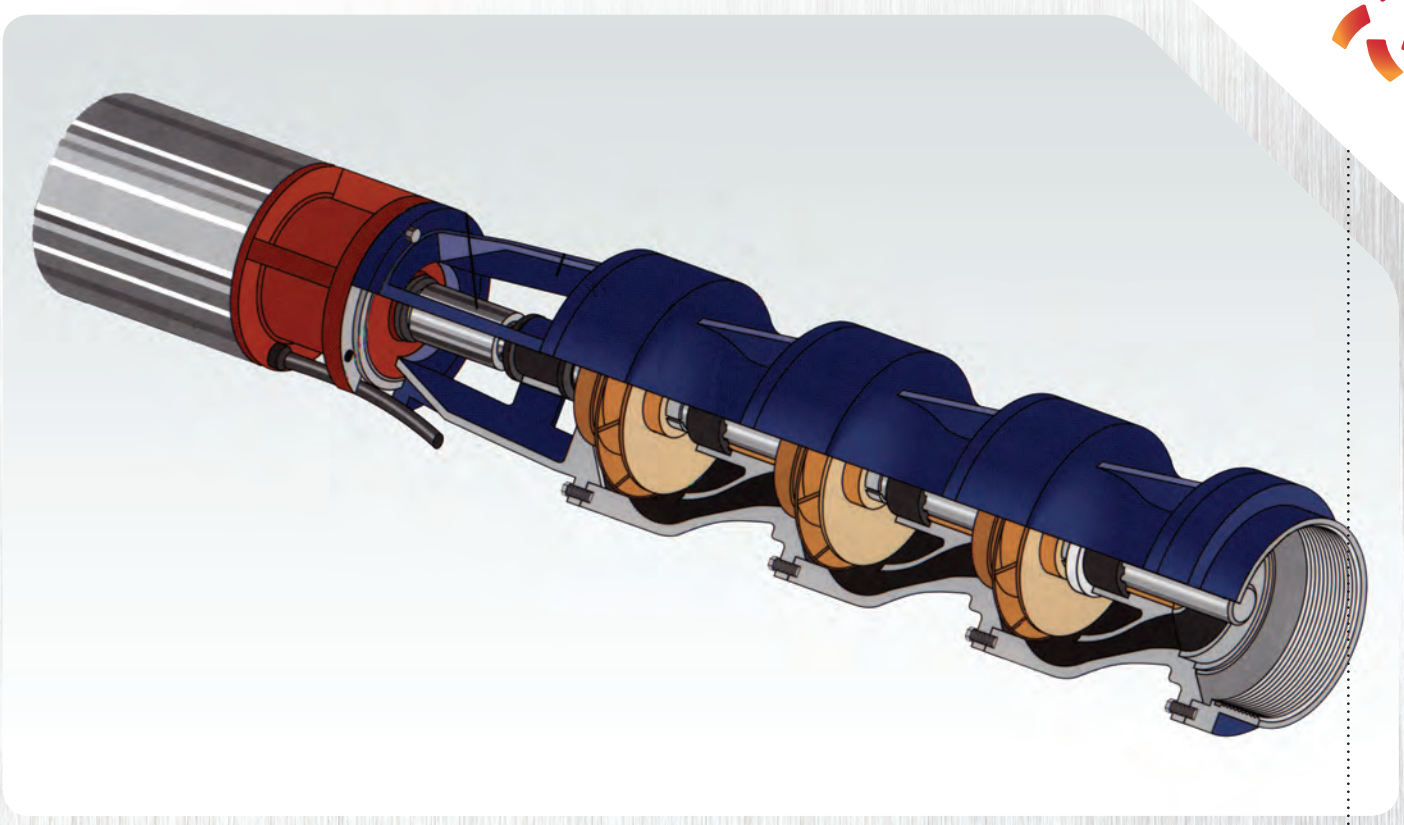

Borehole Submersible Pumps

History

A submersible pump's primary application is to lift useable groundwater from wells, boreholes and aquifers of useable groundwater that is stored in sand, gravel and rock deposits. Early pump models had surface mounting provision but this limited the potential for lift and led to lowering of the pump down the well but retaining the driving motor at the surface. Ultimately the submersible electric motor became the standard allowing the entire unit to be lowered into the bore.

Submersibles are now commonly used by utilities and private / public water supply companies in applications for mine dewatering, underground drainage, oil and gas platform supply, fire and general use. This style can also be used in conjunction with booster applications easily installed in series with the pipework.

Component makeup consists of an electric motor designed to operate with its internals submerged in a contained fluid for cooling and lubrication, this unique feature prevents contamination of the pumped liquid.

A typical submersible pump is suspended on a head piece using a rising main pipe. This style of pumps motor requires continuous flow of water past the unit in order to cool the motor. This is generally achieved by placing the unit above the water entrance to the well. The electrical supply cables are strapped to the outer wall of the rising main and continue down the well to the motor.

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Submersible Motor Cooling

When the pump is set below any screen opening at the bottom of the casing, a top feeding well condition can exist which reduces the rate of cooling water past the motor, a flow inducer shroud should always be used in this situation when the pump is in a large body of water.

Flow Inducer Sleeve (Shroud)

In certain applications it won't be possible to place the motor above the well inlet and a flow shroud should be added to the electric motor to direct cooling water over the motor, this unit should always be mounted clear of the well floor to prevent build up of sludge or sand at the entrance to the shroud as cooling performance can be compromised. The shroud should be closed off above the pump intake and extended over the bottom of the motor, it is important that the shroud material is of corrosion resistant metal (304, 316 Stainless steel or Super Duplex) or engineering grade plastic.

The rising main should be correctly sized to allow for the intended supply pressures and total weight of the unit, to avoid damage to electrical supply cables the flanges can be slotted and the cable should be rated for continuous underwater use. Double acting air valves are generally fitted to the highest point usually at the right angle discharge bend ensuring air is purged to avoid the possibility of surging.

Flow Inducer Discharge Tube

If the casing or well bore is too small for a flow shroud and the pump cannot be raised up above the water entrance to the well, then a discharge tube may be used. This tube is tapped into the pump outlet and clamped onto the body of the pump and motor, the tube is bent around and aimed upwards, so the flow is introduced towards the base of the motor at a minimum distance of around 300mm. The tube should be protected with a shield to avoid damage during installation.

Booster Applications

Another potential use for submersible pumps is in booster applications; the basic structure is fitting the submersible unit inside larger diameter pipe work either horizontally or vertically. This is a rigid and compact package that consumes minimal space and can have exterior controls mounted remote to the installation.

Protection should be applied to prevent the pump running dry and the outer pipe work able to withstand the suction pressure.

NPSH Guide Lines

Centrifugal pumps by nature require certain pressure requirement at the inlet of the pump to prevent cavitation. This required pressure is generally referred to as Nett Positive Suction Head (NPSH) which gives the absolute pressure required in the suction of the pump to prevent the occurrence of air or gas bubbles in the inlet stream of the impeller. These vapour bubbles if allowed to form, will cause rapid erosion of the impellers, reduce the efficiency of the pumping unit and cause excessive vibration and noise.

Submersible pumps can develop additional problems if the dynamic water surface level becomes too close to the pump inlet, surface air can vortex resulting in air entrainment in the pump liquid which will lead to cavitation erosion of the pump impellers. Submersible pumps are also vulnerable to a problem in which the water in the bore becomes aerated due to cascading fluid, a process in which water enters the bore higher up than the bore water level which leads to air entrainment.

Another issue affecting Submersible pumps is 'Water Drawdown' during operation and 'Initial Drawdown' on start up; these symptoms can be problematic as the pump operates with high flow rates until the column of water increases the head when operating. On small submersible pumps minimum 2 metres submergence during operation is generally considered to be adequate but with larger pumps this depth of installation will need to be increased to ensure trouble free pumping.

Please check with PUMP TECHNOLOGY SERVICES for all technical recommendations prior to modifications or changes.