



Shop Tech Talk September 2009



Different Types of Submersible Pump Motors



Suitable for handling clean water and fluids.



Submersible well pumps used for fresh water pumping



Smaller residential type sewage pump



Submersible Chopper pump



Large submersible sewage pumps

Submersible Pump: Theory of Operation

A submersible pump is a centrifugal pump which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is usually submerged in the fluid to be pumped. The pump motor uses a vertical shaft to turn the impeller and generate the velocity needed to create the discharge pressure. All centrifugal pumps use an impeller and volute to create the partial vacuum and discharge pressure necessary to move water through the casing. The impeller and volute form the heart of a pump and help determine its flow, pressure and solid handling capability. The impeller is a rotating disk, with a set of vanes, coupled to the motor shaft that produces centrifugal force within the pump casing. The volute is the stationary housing in which the impeller rotates, that collects, discharges and re-circulates the fluid entering the pump. As the impeller churns the fluid it purges air from the casing creating an area of low pressure, or partial vacuum, at the eye (center) of the impeller. The weight of the atmosphere on the external body of water pushes water rapidly through the pump inlet and pump casing toward the eye of the impeller. Centrifugal force created by the rotating impeller pushes water away from the eye, where pressure is lowest, to the vane tips where pressure is the highest. The velocity of the rotating vanes pressurizes the water forced through the volute and discharged from the pump.

Submersible Sewage Pumps

Sewage pumps are necessary to move sewage from a building to the sewer system; and in many cases, from the sewer system to a treatment plant.

Sewage wet wells are known to routinely contain explosive gases and vapors. Such locations are defined by the National Electric Code as Class 1 ;Division 1,Hazardous Locations and the NEC requires that motors be designed for the location e.g. explosion proof.

Types of Submersible Sewage Pumps

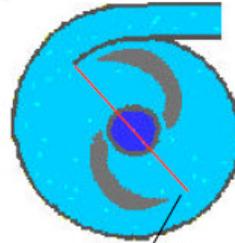
1. Non-Clog pumps are specifically designed to accommodate the pumping of solids by providing larger than normal passage ways through the impeller and volute, minimizing the number of impeller vanes and volute cut-waters. In addition the leading edges of the impeller vanes and the volute cut-water are well rounded to promote the shedding of long fibrous material.

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No pump, however, can ever be described as being completely resistant to clogging.



Bladeless and two-port impellers



CUT WATER Dia.

2. Grinder Pumps are typically used for light weight sewage sludge applications and they grind the waste into a fine slurry. They can have a number of semi open vortex impeller diameters to generate dependable performance over a wide range of flow and head conditions.



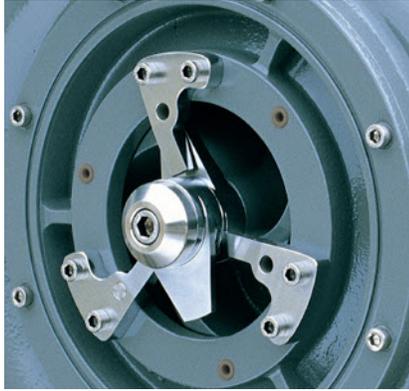
As an example Hydromatic Grinders use an exclusive “dual cutter” design that prevents clogging, binding, and roping in a wide range of operating conditions. These cutters cut waste twice to reduce it to an even finer slurry. The first cut is performed by the radial cutter; the second by the axial cutter that “recuts” the waste in a perpendicular direction to the radial cutters. This creates even smaller-particles, making for better sewage flow.

3. Chopper Pumps are centrifugal pumps, which are equipped with a cutting knife system to facilitate chopping/maceration of solids that are present in the pumped sludge liquid. The chopper pump was invented in 1950 by the Danish company Landia. The main advantage of this type of pump is that it prevents clogging of the pump itself and of the adjacent piping, as all the the solids and stringy materials are macerated by the chopping system. A chopper pump is able to handle larger and tougher solids than a grinder pump, including hair balls, diapers, sanitary napkins, clothing etc. It also keeps grit, scum and grease suspended in the pumped liquid.



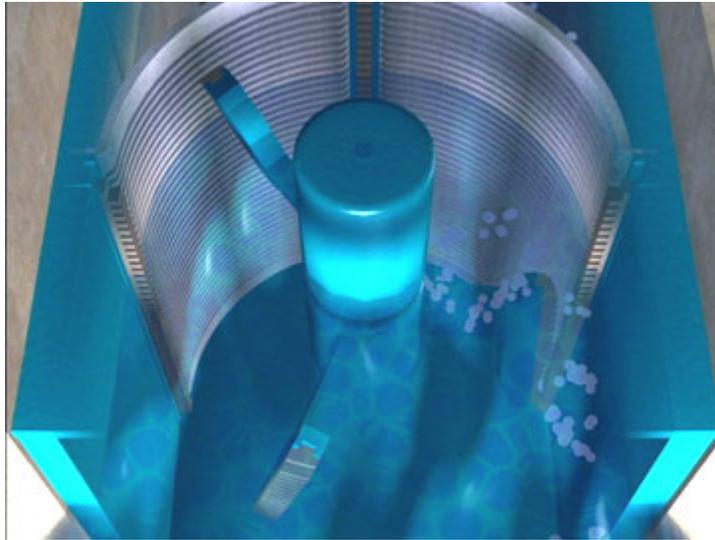
Landia Chopper Pump

In larger sewer pump stations the clogging problems are often solved by installing a chopper pump in the tank. Lift stations can experience an unusually high concentration of solids such as hair, rags, or plastics that cannot be reliably handled by the conventional non-clog pumps. If heavy solids loading is anticipated during the engineering stage, many of the larger lift stations include a comminutor ahead of each pump. Chopper pumps have solved many lift station plugging problems and eliminated the need for comminutors. In some instances chopper pumps have directly replaced existing pumps without the need for re-piping.



More detail on Landia Chopper Assembly

4. Comminutors are just grinders that have no pumping ability.



Summary

Grinders, choppers and comminutors all provide particle size reduction of waste water solids. Their device technology has been evolving quite rapidly in response to the increasing burden entrained solids have placed on wastewater treatment facilities. When handling difficult liquids like sludge, restaurant grease or solids-laden fluids, the challenge is continuing flow through the entire operation. When debris or large solids clog a pump or pipeline, the entire process can stop within minutes. The shutdown, clean out and restart are time consuming, and the costs frightening. It's a nightmare scenario.

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