Sump Pumps, Submersible Pumps and Bilge Pumps Basic Selection, Installation and Use Guide.

The 'Sump Pumps, Submersible Pumps and Bilge Pumps Basic Selection, Installation and Use Guide.' gives you a thorough checklist of the important factors to consider with these pumps, their installation and operation to get a long, failure-free, low-maintenance operating life.

The information in this guide is based on years of practical engineering experience with pump operation, fault finding, failure analysis and pumping system design. It provides you with a good checklist of what to do to get many years of trouble-free service. Use it as a means to select the right equipment and to fault-find existing equipment.

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1. Overview of Sump, Submersible and Bilge Pumps

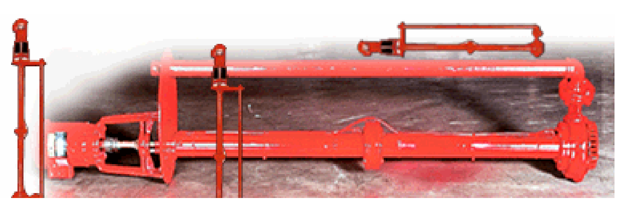
Sump pumps, submersible and bilge pumps perform a similar duty. They sit in the liquid, suck it in and push it up a discharge line to a new place. They are usually driven by an electric motor mounted directly to the pump. There are alternate designs with the motor mounted at the top of a pipe column and the pump at the bottom. Known as 'column pumps', the pump is driven by a long shaft running through the center of the pipe column from motor to pump.

With these pumps the suction inlet sits under the liquid surface. When the pump runs it draws in liquid through the suction port and out through the discharge port. Typically there is a hose or pipe connected to the discharge port that directs the liquid to a new location.

The pictures on the right are of a sump (top), submersible (second from top), bilge (second from bottom) pumps. You will see that they all look alike. They suck from the bottom and send liquid upward, away from them. A column pump (bottom picture) also draws from the bottom but its motor is mounted at the top.

For liquid to get to the inlet on the pump bottom, the base of the pump must be under the liquid surface. Usually the entire pump is fully immersed under the liquid. Depending on the design of the pump the discharged liquid may be used to cool the electric motor.

A mercury float switch, as in the top picture of a sump pump, is often used to control the on/off for pump. The float cable is fixed to the side of the pump near the top, or on the wall of the sump. When the liquid level is high the float is facing upward and the pump runs when power is supplied. The switch pivots about the fixed point as the liquid level drops and tilts downward. This makes the switch contact and triggers the pump to turn off.



level must be above the pump manufacturer's minimum recommended net positive suction head required (NPSHr) at the maximum operating temperature.

8. The motor power requirements are calculated from the maximum pump service flow and lift. This is the hardest duty the pump must perform and it must comfortably be up to the job.

You can see from the list of requirements above that the correct pump you want for long, trouble-free service life will only be found if the engineering is first checked. Anytime you see a pump selected without the above list being calculated correctly by qualified people, you can guarantee the installation will have problems and will possibly not work properly.

It will cost a little bit of time and money to get the calculations done. In doing so you will be sure you get the right information to make a great pump selection! Without the information from these calculations you are completely in the dark and your choice will be a guess that is most likely wrong.

Check whether there are galvanic corrosion circuits set up with the material selections in the pump and attached pipe work. An example of such problems is carbon steel pumps attached to long lengths of copper pipe. The copper will corrode the carbon steel pump.

What power supply will be available? Find out the pump's electrical voltage and current capacity.

3. Setting-Up The Pump In Position.

Typically a sump, submersible or bilge pump sits on the bottom of a hole or depression. This can be in a soak well, a sloped floor, a pit, the bottom of a boat, a trench, a bored hole, a concrete sump, a tank, a road tanker, etc.

If the pump tips over it may not pump out the required volume. It may still run if the float is not caught or damaged. As long as there is liquid above the pump and it has power and the float operates it will remove the liquid. That is, until the liquid falls so low that it no longer fully covers the inlet to the pump. If the pump is not turned off before the suction opening is uncovered then the pump will run dry, overheat and burn out.

- Support the power cable to the delivery line with cable ties so there is a little slack in the cable.
- Check the electrical installation before starting the pump to insure all connections have been made and that there are no nicks in the wires.
- Check the resistance of the electrical and earth circuits when the pump is in place to insure continuity.
- Bump start (quickly turn on – off) and test the pump is going in the right direction, otherwise the delivery pressure will be low if the impeller runs backward.

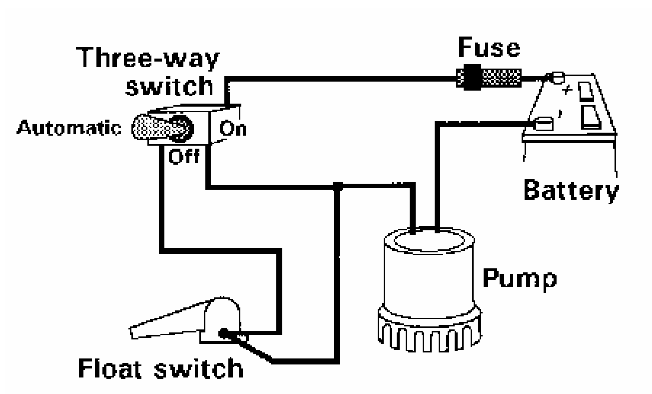
8. Particulars of Installing a Bilge Pump.

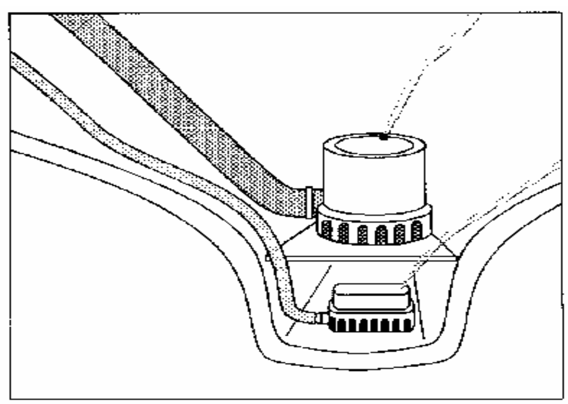
by Don Casey (www.boatus.com)

Bilge pump installation is straightforward, but it is essential not to overlook key details.

Mount the pump

You must not place the pump in the bilge unrestrained. If it falls over it will suck air and burn out. Pumps must be fastened down. Brackets are available that attach to a stringer or other vertical feature, or you can epoxy a couple of bolts to the bottom of the bilge to serve as mounting studs. Float switches must also be fastened.





Use smooth-bore hose

Corrugated hose reduces pump output by as much as 30%, so always connect the pump to the discharge fitting with hose that has a smooth interior surface. Bends and long runs also reduce pump output, so

Shallower settings, 2,000 ft maximum.	Deeper settings. Up to 12,000 ft in oil wells.
Longer installation and pump pull time.	Less installation and pump pull time.
Well must be relatively straight or oversized to accommodate stiff pump and column.	Can be installed in crooked wells up to 4 degrees deviation per 100 ft. Up to 75 degrees off vertical. If it can be cased, it can be pumped.
Impeller position must be adjusted at initial startup.	Impeller position set.
Generally lower purchase price at direct use temperatures and depths	Generally higher purchase price at direct use temperatures and depths.

In some installations, selection of a pump type will be dictated by setting depth, well size, well deviation, or temperature. If not restricted by these, the engineer or developer should select a pump based on lowest life cycle costs, including important factors such as expected life, repair costs, availability of parts, and downtime costs. Power consumption costs and wire-to-water efficiency, although certainly worth evaluating, may not be nearly as important as others factors, such as those above. For most direct heat applications, the line-shaft pump has been the preferred selection.

There are many factors that can affect the relative efficiencies of line-shaft versus submersible pumps: i.e. temperatures, power cable length, specific design of impeller and bowl, column length and friction losses. The wire-to-water efficiency in the particular application is the important factor. The bowl efficiency of a pump with extra lateral will be less than for standard lateral (discussed in the subsection on Relative Elongation) and clearances. The bowl efficiency of a submersible will be higher than a line-shaft of similar design because extra lateral is not required in the submersible. Motor efficiency generally favors the line-shaft design.

Fluid[b] Coupling	Moderate	High	Moderate	N	None	4:1	Y	5 - 10,000 hp
Multi-speed[c] Motors	Moderate	Low	Low	N	None	2:1	Y	Fractional to several hundred
Throttling[d]	Very low	Low	Low	N	None	No limit	Y	No limit

a. Allows motor operation in failure mode. Should use high-temperature rise motors. Minimum ambient temperature 50°F.

b. Poor efficiency at low output speeds.

c. Poor efficiency at low output speeds.

d. Stopped output speed in 2 or 4 increments, must throttle in between, possible problems with shaft and bearings.

e. Refers to older motors--depends on application.

Conclusion.

Among the various drive technologies available, the choice is a function of a host of project specific parameters. The information presented here, along with pump and well information from your project, should permit an accurate analysis to be carried out. The results of this analysis can then be employed in the decision process. Table 2 summarizes the various characteristics of the speed control techniques outlined herein.

LESSONS LEARNED.

Listed below are a number of factors relating to pumps that can lead to premature failure of pumps and other components. Many of these have been noted or alluded to elsewhere, but are restated here. Some seem obvious, but the obvious is often overlooked (Culver, 1994).

1. Pump suppliers/manufacturers should be provided with complete data on all foreseen operating conditions and complete chemical analyses. Standard potable water analysis is not adequate, because they do not test for important constituents, such as dissolved gases.