

Rule Submersible Bilge Pumps Electrical Installation Advice



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Document to provide helpful and practical advice relating to proper, safe and efficient electrical installation of DC submersible bilge pumps.

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Part 1 - Bilge pump electrics basics

Electric bilge pumps are designed to remove nuisance water from your boat. The pumps are available in a number of flow rates and can operate automatically (sensing water levels or by a separate float switch) or manually (operated by a control panel switch). Electric bilge pumps are relatively simple to install providing correct manufacturer and regulatory guidelines are followed. *If in any doubt, seek professional guidance from a qualified marine technician.*

Bilge pumps must be installed correctly to ensure they can operate as designed, if and when unwanted water enters the boat. Failure to follow correct procedure can result in a pump failing to operate. This guide will discuss important points to consider when installing a bilge pump.

Bilge pump motor life. At the heart of the electric bilge pump is the DC motor which spins the impeller, removing water from your boat. In optimal operating conditions the motor will last for many hundreds of hours, however, bilge pumps must be maintained just like any piece of equipment on-board. Maintenance includes, checking and cleaning the strainer base, visual checks on pipework, clips and valves, electrical wiring and connectors.

The motor is protected by a rubber shaft seal preventing water intrusion into the motor housing. Causes of premature seal failure can be due to environmental factors including, but not limited to, chemical exposure, excessive heat and sediment in the water. All of which can affect the life of the pump.

Part 2 - Choosing correct wire gauge

An important factor when installing a pump is selecting the correct size wire gauge, not only from a safety standpoint, but to also ensure the pump receives the correct power when operating. Installing a pump with an insufficient wire gauge could cause the wires to overheat when the pump is running. In addition, installations with long wiring runs will require heavier gauge wire to prevent voltage drop, allowing optimal pump performance.

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Wire gauges are displayed in the user manual supplied with the pump. Wire length is calculated by measuring the total length of positive and ground wiring to the battery. For example, a pump that is 10 feet from the battery will be a total wire length of 20ft.

A wire gauge table is usually displayed like this:

Wire Size Table

Total Wire Length (positive to pump) - feet (meters)

0-15 ft 0-4.5 m	15 - 20 ft (4.5 - 6 m)	20 - 30 ft (6 - 9 m)	30 - 60 ft (9 - 18 m)	60 - 90 ft (18 - 27 m)
16 AWG (1.5 mm ²)	14 AWG (2.5 mm ²)	12 AWG (4 mm ²)	10 AWG (6 mm ²)	8 AWG (10 mm ²)

If the total length of wire is 25ft, you would choose to install 12 AWG.

Part 3 - Installing correct fuse size - location of fuse

The fuse is an important safety measure to protect your pump and vessel. Every pump will display fuse requirement guidelines found on the device and in the user manual. It is the responsibility of the installer to ensure the correct fuse size is fitted in accordance with the manufacturer's installation guidelines.

There are several reasons a fuse may open (blow) which include, but are not limited to the following:

- Locked rotor due to debris - The motor shaft is no longer able to rotate freely due to an obstruction within the impeller housing.
- Water intrusion due to a worn or damaged shaft seal - Fluid has passed the seal causing damage to the motor.
- Worn or damaged wiring and/or pump cable grommet.
- Physical damage to the pump.

Under these conditions it is highly recommended that the pump is replaced.

Spare fuses should be carried on-board at all times; pumps should never be run without the correct fuse in good working order.

Part 4 - Cable routing and connections.

As well as deciding on appropriate wire gauge size, you will need to consider the routing of the electrical wiring. All wiring and wire connections should be anchored above the maximum bilge water level. Wiring connections should be joined with water tight connectors (heat shrink butt connectors or heat shrink sleeved

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connectors with sealant inside). All electrical wiring, connections, and installation shall be in accordance with the requirements of ABYC E-11, AC and DC Electrical Systems on Boats.

Part 5 - Potential hazards of ignoring advice

Ensuring points 1-4 are followed will ensure your bilge pump is able to operate efficiently when required. It is important to remember that routine checks should be made regularly to ensure the pumps and systems are functioning appropriately. Simple visual inspections within the bilge area include;

- Is the pump and float switch free from debris?
- Is the pump strainer clear?
- Is the wiring in good working order with no loose connections?
- Test the pump using the master switch, with and without water to ensure the pump is able to pump over-board. If the pump runs but no water is removed check for a blockage, air-lock or damage to the pump impeller.

In section 3 we discussed the importance of installing the correct fuse for the pump. Let's look at a scenario where no fuse is installed or the fuse has been removed with the pump connected directly to the battery. Water has entered the boat, the float switch has triggered the pump but some debris has snagged the impeller, this has resulted in a locked rotor situation. As the motor tries to spin the locked impeller, the current draw will rise, in a good installation the fuse would now trip alerting the owner that there is a problem. With no fuse installed, the excessive current draw will create heat resulting in a failure of the pump and/or wiring. In extreme cases this could cause a fire on-board.

In summary, bilge pumps will give hours of trouble free operation if installed and maintained in the correct way, if you are unsure about your boats bilge pump installation you should contact a qualified marine engineer for advice.

Part 6 - FAQ Section

How long will my pump last?

This is a difficult question to answer as many factors can affect pump life such as:

- Ambient temperature: Hotter conditions can decrease the life of the motor.
- Duty cycle: How long the pump runs for and the frequency of operation.
- Age of pump: Pumps that have been installed for many years but get very little use could potentially be susceptible to seal degradation (see Part 1) even though the motor has had little use.

How long can the pump run for?

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Submersible bilge pumps are designed to expel water quickly and efficiently. However, depending on the temperature of the fluid, they are capable of running for long periods of time if needed due to the way in which the motor is cooled by water passing through the pump chamber.

Pumps can be *run dry* (impeller spinning but no water present) for short periods, this could occur if the float switch failed to turn off the pump having expelled all of the bilge water. If the pump continues to run dry for extended periods it could cause damage to the water seal that protects the motor.

How often should I service the pump?

Bilge pumps do not require servicing as they are sealed units. You should however check the strainer basket and impeller housing for debris and ensure the sensor (for automatic pumps) is clean. The float switch should also be checked to ensure it is clean and free from debris, ensuring it can rise and fall freely during normal operation. The pump should also be tested using the master switch, with and without water to ensure the pump is able to pump over-board. If the pump runs but no water is removed, check for a blockage, air-lock or damage to the pump impeller. These measures should be carried out as part of every pre-voyage safety check.

When should I replace the pump?

As a preventative measure, it is recommended the pump is replaced every 3-5 years depending on usage and conditions. You should also replace your pump if you believe it has run dry for an extended period of time as the seal may have been damaged. Pumps should also be replaced if fuse opens (blows) for reasons described in Part 3.



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