



It's always a good idea to have more than one electric bilge pump installed. We recommend a smaller primary pump (1,000-1,500 GPH) to handle day-to-day bilge water and installing a larger (2,000 GPH) backup pump just above the primary.

High-capacity Electric Bilge Pumps

PS tests 8 to see which one gets our simulation tank dry the fastest.

Next to hull integrity, bilge pumps are a vessel's first—and often only—line of defense against sinking. Not only do they serve to clear incidental water from the bilges (minor leaks, rainwater, etc.), but they can also give the crew extra time when taking on water—time that can be spent repairing the leak, donning life jackets, or making a distress call.

Bilge pumps shouldn't be confused with emergency pumps, which provide much greater output. However, having one or more regular bilge pumps installed can prove immensely valuable in an emergency, so long as those pumps are reliable, efficient, properly installed (see page 2), and well maintained (see page 27).

The bilge pump market is crowded with everything from inexpensive hand pumps to high-capacity electric pumps. In the Feb. 15, 2004 issue, *Practical Sailor* reported on our comprehensive test of electric bilge pumps, which covered a range of flow rates from seven manufacturers. In 2000, we looked at dozens of pumps: manual units in the April 15 issue and electric pumps in the June 1 is-

sue. This year, we opted to divide the test field into two groups based on output capacity to enable more of an apples-to-apples comparison and to make the data easier to digest.

WHAT WE TESTED

Four manufacturers—Attwood Marine Products, Rule/ITT Corp., Shurflo, and Johnson Pump—answered our call for the electric bilge pump test, submitting a total of 18 centrifugal pumps for evaluating. In this issue, we report on the eight higher-capacity electric bilge pumps (output rated at or above 1,600 gallons per hour, or GPH) and see how they fared in exhaustive bench testing. A follow-up report in the October issue will examine pumps rated for 1,500 GPH or less.

Editor's Note: Keep in mind that advertised output is usually the flow rate at the outlet, and doesn't reflect real-world capacities. Recently, the American Boat and Yacht Council began stipulating that manufacturers also rate pumps under two more realistic conditions: with a head height of 1 meter and a hose length of 3 meters, and with a head height of

2 meters and hose length of 6 meters. Head height is the vertical height of the hose outlet above the pump outlet. When comparing output specs on two different pumps, make sure the rating criteria are the same.

Attwood Marine is a leading maker of innovative deck hardware and a supplier of navigation lighting, fuel accessories, and other marine accessories. The Michigan-based company provided two pumps for the 1,600+ GPH test field: Model 4030 (1,700 GPH) and Model 4060 (2,000 GPH).

Rule is one of ITT Corp.'s Flow Control companies, which also include Jabsco and Flojet. The company, which is headquartered in White Plains, N.Y., provided two pumps for testing: a 2,000-GPH Model 10 and a Rule-Mate 2000, the only automatic pump in this category.

Founded in 1968, Shurflo is a leading supplier to the marine and RV markets. Part of the Flow Technologies Group of Pentair Inc., the company's main facility is in Cypress, Calif. We tested Shurflo's 2,000-GPH bilge pump, Model 358-010-00.

Photos by Frank Lanier

AS VALUE GUIDE		BILGE PUMPS, 1600 GPH and up						
MAKER	RULE		SHURFLO	ATTWOOD		JOHNSON		
MODEL	10 (2,000)	Rule-Mate 2000	358-010-00 (2000) ★	4030 \$ (HD 1700)	4060 (HD 2000)	1600	2200	4000
PRICE	\$93	\$173	\$90	\$84	\$93	\$54	\$63	\$124
OUTLET PIPE SIZE	1 1/8 in.	1 1/8 in.	1 1/8 in.	1 1/8 in.	1 1/8 in.	1 1/8 in.	1 1/8 in.	1 1/2 in.
WEIGHT	2 lbs., 14.9 oz.	3 lbs., 13 oz.	4 lbs., 13.8 oz.	3 lbs., 4.1 oz.	3 lbs., 11 oz.	2 lbs., 15.7 oz.	5 lbs., 1 oz.	5 lbs., 7.9 oz.
FUSE SIZE	15 amps	15 amps	15 amps	10 amps	12 amps	10 amps	15 amps	20 amps
WIRE SIZE AWG	16	16	16	16	16	16	16	14
LEAD LENGTH	29 in.	46 in.	60 in.	32 in.	32 in.	68 in.	68 in.	68 in.
WARRANTY	3 yr. limited	3 yr. limited	3 yr. limited	3 yr. (rec.); 1 yr. (comm.)	3 yr. (rec.); 1 yr. (comm.)	18 mos. limited	18 mos. limited	18 mos. limited
OUTLET OPTIONS	2 positions	2 positions	360 degrees	4 positions	4 positions	2 positions	2 positions	2 positions
DRY RUN MAX TEMP	177 degrees	153 degrees	115 degrees	115 degrees	149 degrees	103 degrees	101 degrees	103 degrees
CLAIMED GPH 3.35 (1 M.) @ 13.6 v / 12v	1620 / 1450	1620 / 1450	2000 / NA	1,300 / NA	1,500 / NA	1550 / 1400	1900 / 1750	3100 / 2600
TESTED GPH @ 13.6v / 12.2v	1,334 / 1,200	1,242 / 1,059	1,800 / 1,637	1,242 / 1029	1,385 / 1200	766 / 642	1,125 / 1,027	1,637 / 1,566
AMP DRAW @ 13.6 v / 12.2v	7 amps / 6.8 amps	7.3 amps / 6.3 amps	8.8 amps / 7.2 amps	5.6 amps / 4.7 amps	7.4 amps / 5.5 amps	5 amps / 3.9 amps	7.5 amps / 6.4 amps	9.8 amps / 8.2 amps
PUMPING TIME (10 GALLONS) @ 13.6 v / 12.2v	27 seconds / 30 seconds	29 seconds / 34 seconds	20 seconds / 22 seconds	29 seconds / 35 seconds	26 seconds / 30 seconds	47 seconds / 56 seconds	32 seconds / 35 seconds	22 seconds / 23 seconds
COMMENTS	Hottest pump during break-in; couldn't keep hand on case.	Automatic with built in float.	Noticeably heavier than others; labeled as a 2000, but claims 2200 at open flow; unique 360 mount.	Has twist-and-lock style mounting base.	Has twist-and-lock style mounting base.		Also provides fitting for 1 1/2-inch discharge hose; tested with 1 1/8 in. hose.	Also provides fitting for 2-inch discharge hose; tested with 1 1/2 in. hose.

★ Best Choice \$ Budget Buy

Johnson Pumps, which fielded three bilge pumps in this group (1,600; 2,200; and 4,000 GPH), has been one of the world's leading marine pump makers for over 30 years. In 2006, the company became part of SPX Flow Technology.

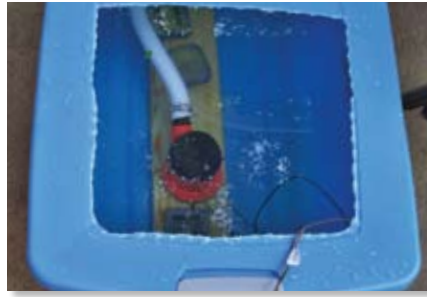
HOW WE TESTED

Following the procedures of the 2004 bilge pump test, testers measured flow rates and power ratings on all pumps at

two voltages while pumping fresh water into a tank set 4 feet above the pump. We also conducted a test to confirm compliance with the American Boat and Yacht Council's (ABYC) standards that state a bilge pump should be able to dry run at design voltage (13.6 volts for a 12-volt pump) for at least seven hours without failure. In the final analysis, we picked the top-rated pump based on performance, warranty, wiring and price.

Testers began with the dry run. To avoid any possible issues with our 50-amp CSI Speco PSR-50 power supply running all eight pumps at the same time, we operated them in two shifts. All pumps passed the dry-run test.

We mounted each pump to a test bench, added crimp-on ring connectors to the factory leads, and then connected them to a fuse panel with a fuse sized as close to specifications as we could find.



Testers measured each pump's power usage with supplied power set at 12.2 and 13.6 volts. The supply tank (above right) allowed testers to calculate the time it took each pump to empty a known volume so they could draw performance comparisons.

Two feet of No. 14 wire connected our power supply to fuse blocks energizing the pumps. We monitored the supply voltage with a Fluke 77/BN multimeter and the pumps' temperatures with a Craftsman Model 82327 non-contact infrared thermometer.

Testers warmed up the pumps with one hour of running time at 12.5 volts. We then increased the voltage to 13.6 (standard for a 12-volt pump) for the following seven hours. Total continuous dry running time on each pump was eight hours.

Flow testing was conducted at 12.2 volts and 13.6 volts. Testers used the Fluke multimeter to monitor supply voltage and a Craftsman 82062 DC/AC clamp-on ammeter to record power usage; voltages and current draw were both measured at the power supply. Testers timed how long it took each pump to fill a container of known volume, then used this to calculate each pump's flow rate. Each pump was tested twice at each voltage, and outputs listed in the Value Guide on page 25 are the average.

The pumps were tested using standard bilge pump hose sized to fit the pump discharge, which in all but one case was 1 1/8-inch diameter hose. The two larger Johnson pumps can be fitted

Rule Model 10



Rule-Mate 2000



with adapters to accept larger diameter hoses. The Johnson 2200 also comes with a 1/2-inch diameter hose adaptor, while the Johnson 4000 comes standard with adaptors for 1/2-inch and 2-inch diameter hose. Both were tested with the smaller of the compatible hose sizes.

As noted in the Value Guide, some of the test pumps can be rotated so that the outlet positioning can be adjusted after the pump is mounted. If the table lists a pump's outlet mounting options as having two positions, that means the pump has the typical two-prong mount and can be rotated 180 degrees. Those with four options can be rotated in 90-degree intervals, and those listed as being 360-degrees can be swiveled so that the outlet can be set in any position.

SETUP DETAILS

The test setup incorporated two plastic tanks, a 45-gallon supply tank and an 18-gallon receiver tank. Prior to each pump run, approximately 30 gallons of water was put into the supply tank. Each test pump was temporarily mounted onto a half-inch-thick piece of wood, placed at the bottom of the supply tank, and held in position with lead weights. Centrifugal pumps are not self-priming, so they must always be installed below the level of water they will be pumping, at all angles of heel.

For discharge hose, we used appropriately sized Shields VAC XHD Series 148 hose connected to each pump with a single clamp. It is smooth bore tubing and is recommended for use as bilge pump discharge hose. The test hoses were 6 feet long.

The other end of the hose was attached using a single clamp to a plastic hull fitting mounted in the receiver tank, which was marked in two-gallon increments and located 4 feet above the level of the pump.

This allowed us to have a set amount of head pressure so that our output findings were comparative.

Head (also referred to as static head) is the resistance that a pump has to overcome when pumping water up and out of the boat. It includes the resistance generated by the vertical distance the pump has to move the water up and any resistance generated by the discharge hose (kinks, ribbed interior). (For information on figuring head and vertical resistance, stay tuned for part 2 of this test in the October issue, or check out Nigel Calder's "Boatowner's Mechanical and Electrical Manual.")

Electricity was supplied to each pump from the power supply through 15 feet of No. 14 wire to the fuse panel and then on to the pumps.

The wiring for all pumps was 16-gauge, tinned copper wire, with the exception of the Johnson 4000 unit, which used 14 gauge. One aspect of the wiring that is of most concern to an installer is the length of the leads, which in our opinion, can't be too long. If the leads are too short to reach the bus bar you'll be forced to add more wire with a butt connection or junction box, either of which provides an opportunity for corrosion. That being said, the longer the leads provided, the further away you can keep the connectors from bilge water and the corrosive environment of the bilge in general.

RULE

We tested the Rule Model 10 and the Rule-Mate 2000, the only automatic pump in this test field. Both pumps were well made and are a common sight on recreational boats the world over.

Tested with 1 1/8-inch hose at the outlet, the 2,000-GPH Model 10 was a moderate performer, but the fact it reached

Bilge Pumps: The Rodney Dangerfield of Marine Gear

When boat owners muster the nerve to reach in the questionable waters of the bilge, it's typically not to maintain their bilge pumps, but to find out why they're not working. Although they rarely get the respect they deserve, bilge pumps (like anything else onboard) require regular maintenance to keep them running smoothly. Here is some guidance for establishing a good bilge-pump maintenance routine:

≈ Start with the bilge itself. No pump can overcome a bilge choked with trash, so a good old-fashioned cleaning is the first order of business. Even the bilge of a brand-new boat can be littered with wood shavings, bits of fiberglass, and globs of adhesive. Oil in the bilge combines with dirt to form a sludge that can clog pumps and stymie float switches.

≈ Larger back-up pumps and their associated float switches should be mounted higher than the primary pump. This lets the smallest pump take care of normal seepage (with less battery drain) and leaves the larger ones to kick in when needed. Make sure all pumps, float switches, and strainers are easily accessible for easier maintenance and emergency repairs.

≈ Remove, disassemble, and inspect the pumps at least twice a year for broken or worn parts. This is just good preventive maintenance, but it also gets you familiar with disassembling



Periodic cleaning will keep your bilge pump from choking under a slurry of ick, unlike this one (above left). Regular inspection of your pump setup should include a look at fittings; notice this pump is missing a hose clamp (above right).

and reassembling in case it's required in an emergency.

≈ Check that all pumps are firmly mounted, paying particular attention to the mounts, which may develop hairline cracks. List each pump by type, location, and size for future reference—don't forget shower and galley sumps—and make sure you have sufficient spare parts onboard for each. Check that each of the intake strainers is securely fastened in place, and while you're at it, clear them of any gunk that may have accumulated since the previous check.

≈ Check that float switches are securely mounted and clear of wires, hoses, and other obstructions that could impede operation of the float arm or flapper.



Shurflo 2000

177 degrees during the dry run concerned testers. The fear here is the potential for overheating (and possible fire risk) should the pump be left on by accident or if a float switch gets stuck and the pump is allowed to run dry.

The Model 10 also had the shortest leads of any pump tested.

Automatic pumps are preferred for many installations; however, the feature does add to the cost of the pump. At \$173, the Rule-Mate 2000 was the most expensive pump tested, yet it wasn't one of the top performers.

The Rule-Mate also features a mounting base strainer and a removable mesh strainer that help keep debris from clogging the pump. (See photo, page 28) This additional protection is a plus, but once

the unit is removed from the base, the loose screen could be easily lost.

Bottom line: Both pumps, although they are quality products, were outperformed by other units in our test.

SHURFLO

Shurflo had a single entry in the 1,600 GPH and above group: the model 358-010-00 unit. Testers liked the quality of construction and "heft" of the 2,000-GPH Shurflo, which was one of the heaviest pumps of its size. We also liked the unique 360-degree swivel mounting option, as well as the 60-inch leads.

The best testimonial to the Shurflo, however, was its pumping capacity. The Shurflo filled our test tank faster than any other pump in the group (at both test voltages). While it drew a considerable amount of power compared to the other pumps, it also delivered in terms of water moved. It came closest to matching its advertised output (2,000

GPH, using its rated hose size) and pump model labeling with 3 feet of head.

Bottom line: Based on output, pricing and construction, the Shurflo 2000 is the top pick for this test group.

ATTWOOD

Attwood was represented with two test pumps, the 4030 and model 4060. Both pumps are well made and performed well during our tests. And both feature a clever twist/lock mounting that provides four different positions for the output once the base is installed. That being said, we were somewhat



Attwood 4030

Attwood 4060

So Just How Much Power Do You Need in Your Pump?

Important factors to think about when selecting an electric bilge pump include the size of your boat and bilge, pump output capacity, output positioning options, and warranty.

Pumping capacity is probably one of the most important, but just how much you should have is a good question with no clear or easy answer, mainly because boats are so different. Any compartment that's essentially watertight should have its own pump. The American Bureau of Shipping recommends one 24-gallon per minute pump (roughly 1,440 GPH) plus one 12-GPM pump for boats shorter than 65 feet. The Lloyds of London standards relate to vessel length and volume, recommending a 50-GPM pump for a boat about

50 feet in length.

Based on size alone, a good rule of thumb is having a minimum of 5,500-GPH pumping capacity for a 40-foot boat. A mix of various size electric pumps or a mix of electric and manual pumps could accomplish this, but we recommend using manual pumps solely as backup, added capacity.

In our opinion, a good mix in an electric bilge pump setup would comprise a smaller primary pump (1,000 to 1,500 GPH) to handle the everyday pumping needs using minimum power and a couple of 2,000-GPH backup pumps (or better yet, an engine-driven emergency pump) with a quality automatic bilge switch like the Water Witch (PS Gear of the Year 2006).



Johnson 4000

puzzled and concerned about the warranty: Attwood guarantees the pump for three years on recreational boats but only for one year in commercial applications. We understand that the policy addresses the increased

demands of a pump in commercial use, but none of the other manufacturers make any qualification regarding warranty and how the pump is used.

Testers were not impressed with the Attwoods' short leads, which measured 32 inches, the second shortest in the test group.

Bottom line: The 1,700-GPH Attwood Model 4030's output was close to its advertised output, and it is reasonably priced. Although we'd seriously consider spending a few more bucks to upgrade to the Shurflo 2000, the Attwood 4030 performed well for its size. It's the Budget Buy in this group.

JOHNSON

Johnson Pumps fielded three pumps in this group: models with GPH rated at 1,600, 2,200, and 4,000. All three were well constructed and reasonably priced; the 1600 and 2200 models were the least expensive of all those tested.



Johnson 1600

All three pumps ran the coolest during the dry-run. The Johnson 4000 ran 12-percent cooler than the Shurflo 2000, but pumped about 4-percent less water. Although the 1600 model used less power than any other pump tested, performance of all three Johnson pumps was among the lowest of the test group. Even the 4000 unit's output—which had our testers giddy with the anticipation of blasting the test supply tank dry—was less than expected. We tested the 2,200 with 1 1/8-inch hose but used the smallest hose that is compatible with 4000, which is 1 1/2-inch hose.

Bottom line: Although very reasonably priced, the Johnson pumps showed lackluster performance as compared to their advertised output.

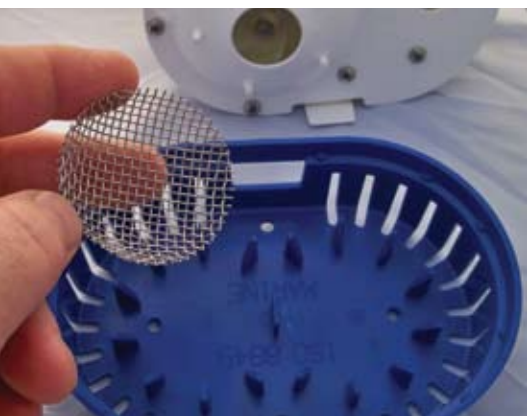


Johnson 2200

CONCLUSION

When selecting the best overall pump from such a diverse group, several factors have to be considered to make the choice meaningful as it relates to the real world. In other words, just because a pump can move X amount of water with no head pressure or hose attached, that's no indication that it will be the best performer when it's actually installed. Performance output specs that include head and lower battery voltages—like those used in our testing—help consumers make a more informed decision. The top performer in our real-world bilge simulation was the Shurflo Model 358-010-00, the Best Choice. The Attwood 1700 performed well for the money and is our Budget Buy.

For guidance on bilge pump installations and the results of our test of bilge pumps rated at 1500 GPH or less, stay tuned for next month's review of lower-capacity electric pumps. ▲



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The Rule-Mate 2000's removable base and screen strainers help keep debris from clogging the pump.

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