

Do a dirty, but worthy job: Install a Marine Head

By Jack and Alex Wilken

Marine sanitation systems have had their own process of evolution over the years. The present state of this part of your vessel should be easy to use, low maintenance, and odor free. In this article, we will cover the installation of manual marine toilets, but some of these can be easily converted to electric.

Any toilet installation begins with choosing which toilet works best for you. There are different designs in toilets, but they all perform the same function - take whatever is in the bowl and send it on its way to the Marine Sanitation Device (MSD) or overboard.

There are several styles of toilets, the most common of these being a piston in a perpendicular, side-mounted cylinder pump (Figure 1). These all look similar, but it is somewhat an example of 'you get what you pay for,' in the sense of reliability and longevity. This is specifically the case in the range of plastic ones. There are some classic, bronze British-built toilets which are handmade and exceptional both in

how they function and how much they cost. Also, there are two US-built, bronze, in-line, piston toilets (Figure 1) that cost about four times as much as their higher-end plastic, side-mounted pump cousins do. But, they will move a lot of stuff, if you get our meaning.

The common variety side-mount pump can be as simple as a handle screwed to the end of the piston rod, or may be a lever-actuated piston that allows you to exert more force with less effort (Figure 2, page 44). Either of these (and, in fact, all the toilets on the market) will do pretty much the same job. The question is how easy it will pump and how long before it needs rebuilding or jams up. None of them are going to pass undigested large objects or lots of 8-ply toilet paper.

There is one toilet that deserves special mention, if for no other reason than its uniqueness: that is the "Lavac," which is a bowl with a lid that seals, has a 1½" outlet at the bottom of the base, and a ¾" inlet at the top of the

bowl. A manual diaphragm bilge pump is plumbed to the outlet, and, when pumped with the lid down, a vacuum is created which both empties the bowl and pulls water in to flush the toilet. The discharge side is the same as other toilets where you use a vented loop, but the intake hose is fitted with a loop having a small hole in it instead of a one-way valve. A story from the past when a young family member came to visit: while sitting on a Lavac, she stuck the handle into the pump and moved it up and down, thereby sealing herself to the toilet. It was some time before she realized that if she kept moving the handle she was not going to be released by the toilet!

No matter which toilet you choose, the next step is to locate where all the hose-runs will work and where the base can be securely thru-bolted with large washers, or the equivalent.

The hoses are sized by their inside diameter (ID) which should be a little tight on the fitting that has the same dimension. The discharge side of this operation needs to be concerned with being odor-free. All of the hoses on the market will eventually smell if the stuff coming out of the toilet is left sitting in it, so it is important to make as much of the system as self-draining as possible after each flush. It is impossible to make all the hose-runs go downhill in the out direction, so we use hard PVC pipe in those sections where water and digested stuff will sit. This should keep you odor free for a long time. The PVC pipe connections can be made by using a short length of hose with only the PVC to PVC connections being glued (Figure 3, page 44). The hose-runs that have bends in them need to be reinforced with a metal or plastic helix to keep them from collapsing. Be careful not to exceed the recommended bend radius, and it should have a



Figure 1: "A" is a side-mounted piston pump plastic toilet and "C" is just above the arrowed line indicating the pump suction direction. "B" is an in-line, bronze piston pump toilet, and "D" is next to the arrowed line indicating its direction. Note the difference in the intake distance to the piston.



Figure 2: These two toilets are side-mount piston pump style, but "A" indicates the lever that will make it easier to pump. "B" has a handle screwed to the end of the piston rod with no mechanical advantage.

smooth interior wall to maintain maximum flow.

Look at the manufacturer's warranty period, which will give an indication of how long they think their hose will be odor free. One manufacturer's warranty period is half the supposed serviceable life of the hose. Check the vacuum rating on the hose because, when pumping out your holding tank, your entire system is exposed to the suction/vacuum from the pumpout station. Normally, the rating should be 20 or more.

When putting the hose on the fittings, they should fit snugly. Two things you can do to make this go easier: lubricate the hose and/or hose barb with soap, and heat the hose end by immersion in hot water. Do not use direct heat or you may damage the hose.

For intake water coming from the seacock, use rubber reinforced hose with wire or a 4-spiral wall, depending on the bend radius, to allow for bends and avoid collapse from suction. Whatever you use, it needs to be recommended by the manufacturer for underwater use. Always double hose-clamp below the waterline.

Every installation requires various hose

fittings for the transition connections between the different system parts: seacocks, vented loops, toilet, Y-valve, solid PVC pipe-runs, holding tank, deck waste fitting, holding tank vent, and vent filter. The hose barb side of the fitting is sized to fit the ID of the hose and should be long enough to have space for two hose clamps. The use of the proper hose clamps is always a big factor in the success of the installation. Use non-perforated 316 stainless steel (See our article in March 2011 *48° North*).

The other side of the fitting may be threaded, typical of tapered pipe,

or with PVC pipe it will be slip-on for gluing. With tapered pipe, you can use Teflon tape, being careful to stay one thread back from the end so you do not wind up with bits of tape loose in the system to clog something up. There are also many thread sealants available (do not use thread lock compounds), but read the product recommendations carefully to make sure it applies to the material you are using. Care should also be taken not to use metal pipe fittings in female plastic threaded fittings as they can easily crack them with the wedging force of the tapered threads.

Something clever that is available in marine hose barbs is transparent fittings. You can see if there is an obstruction or if the water is flowing, especially where you use right elbows because that is the most likely place for things to get stuck. They are made of polycarbonate so they can be used below the water line. In general, avoid elbow fittings whenever possible.

Vented loops are fitted both to the toilet discharge line, normally a 1½" inner diameter (ID) hose, and the flush hose between the toilet pump and the bowl. The flush hose is usually ¾" ID. No matter what size the vented loop is, it is fitted with a one-way valve at the top of the loop to break any suction that would have water continuing to flow or siphon into the boat.

Vented loops are also known as anti-siphon devices. The one-way valve closes when water is pumped through the loop and opens when the pumping action stops. It is important that the loops are mounted above the heeled waterline level so that when the boat is at her maximum level of heel, water will not be forced into the lines and flow for as long as the boat is at that angle (Figure 4). The situation with the flush line on the Lavac is different because the water is being drawn into the bowl by vacuum, so a one-way valve would

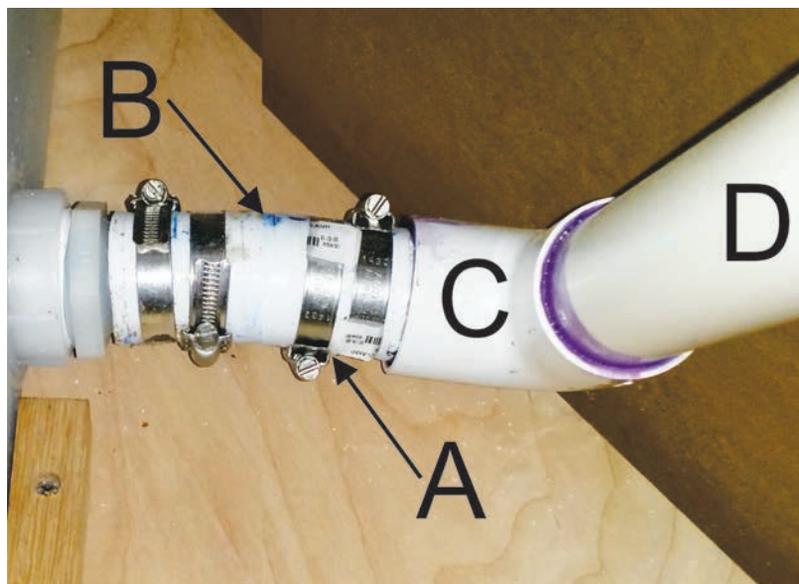


Figure 3: "A" shows the double hose clamps that should be used to secure all sanitation discharge hoses. "B" indicates the short hose used to connect two hose barbs, one from the MSD, and the other from a hard PVC pipe that allows a soft connection, but eliminates the odor problem from sewage sitting in this section of the discharge line. "C" is a slip fit PVC elbow with the hose barb glued in place. "D" is PVC pipe that can be exposed to standing sewage. The use of hose in this part of the system would mean eventual odor.

never close and therefore is of no value. In the case of the Lavac, where the loop has a small hole to break the vacuum, this lets in some air, but it is of no consequence. It may, however, be the source of odor.

The last device in the system we are going to write about is the Y-valve, or diverter valve. The Y-valve is used to direct the discharge from your toilet to either a MSD or overboard. Y-valves are made in different configurations. Some will make it easier to operate or mount - features like a handle that mounts through a bulkhead, or the in and out ports at different angles. An important thing to watch for is a way to secure the Y-valve in "no discharge" position. This is required by the USCG.

One of the biggest factors having to do with problems with marine toilets is what you try to flush down them, but having said that, the bronze inline and then higher end plastic side pumps will give you longer, trouble-free sailing and pumping. Good marine sanitation hose will remain odor free for many years if sewage is not allowed to sit in it. Double-clamping all the discharge hose connections helps ensure this will

remain true.

Saltwater used to flush the bowl can smell a lot, especially if it sits in the intake hose for long periods of time, like during the winter months. If you can afford the consumption of fresh water, using it to flush will help to reduce odor and gives some more choices in toilet pumps. The fresh water pumps only pump things out of the bowl because your pressure water system supplies the flush water.

R e m e m b e r, Washington has a proposal in the works right now to make all or part of Puget Sound a 'No Discharge Zone.' This would make the most important part of any installation the size of the holding tank. When we cruise in the San Juans, our limitation is always the size of our holding tank, not our water tanks, because we do not discharge overboard.

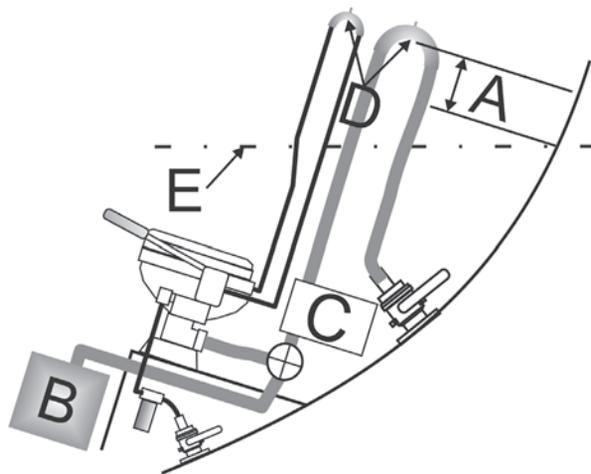


Figure 4: The minimum distance between the bottom of the vented loop and the heeled waterline "A" is 12 inches. "B" is the holding tank, and "C" is a MSD because raw sewage cannot be legally discharged within 3 nm of the shore. "D" indicates the vented loops in both the discharge and the flush water hoses. "E" indicates the heeled waterline.

We will not end with a toilet joke, we'll just say happy sailing.

Jack and Alex Wilken are experienced boat builders and have cruised extensively. They each hold a 100-ton USCG Captain's License and are the owners of Seattle Boat Works LLC in Seattle.



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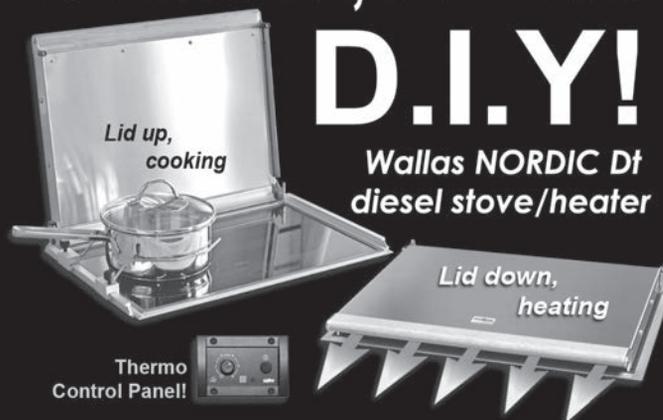
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