

## Marine Heads

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**T**he oaken bucket has a revered place on many small boats, and legally can still be used as long as it is not fixed or attached to the boat in any way. But for owners who have gone a step further in the quest for efficient, sanitary, and legal onboard sewage management, it's necessary to understand a little about marine heads and Marine Sanitation Devices (MSDs).

An installed head (toilet) must be connected to an approved Type I, II or III MSD. Federal law prohibits discharge of raw sewage from an installed head into state waters (within the three-mile limit), and Types I and II treat the sewage before discharge (more details later). However, some states are creating no-discharge zones where all sewage must be contained and pumped only into approved receiving stations. California and British Columbia already have some no-discharge zones, and Washington is reportedly considering establishing some. Furthermore, many boat harbors prohibit sewage discharge.

Heads themselves are not MSDs, with the exception of Porta Potties and similar devices, which have a built-in holding tank and are designed to be dumped ashore or, in some cases, have pump-out fittings. Most marine heads are of one of four basic designs: manual pump (or sometimes electric pump), electric macerator, vacuum, and jet.

**Jet action heads**, such as the Royal Flush and Raritan's Jet Head, are not common on fishing vessels, but reportedly work well and have the advantage of no restrictions in the plumbing to be the locus of clogs. They use a blast of water to clear the bowl, but gravity takes the contents to the holding tank and can't overcome the back pressure of below-the-waterline discharge.

**Vacuum heads**, such as the Sea Land Vacu-Flush, likewise lack constrictions in the outlet plumbing, and are popular on charterboats where passengers may not know proper marine head operation. They operate like a jet head, but in reverse, employing an electric pump to create a vacuum

in the system, sucking clean water into the bowl and the waste out. They are more tolerant of foreign objects and are easier to clean than either of the following two types of heads.

**Manual pump heads** are popular on both commercial fishing and recreational vessels due to their low cost (in the low-end units) and high reliability in the expensive models. The bargain price units use a push-pull pump with a plastic barrel, and can be purchased for under \$200. In applications where they get limited use and are treated well they serve faithfully. The top-end units with bronze cylinders and long stroke pump handles can cost upwards of a thousand dollars but are powerful and reasonably trouble-free.

Also common on fish boats is the **electric macerator head**, which has, at the base of unit where the pump attaches, an electric motor with a small set of blades that simultaneously pump and chop up the goods coming from the bowl. As long as no prohibited objects—that is, nothing that wasn't eaten first—are put into the bowl, the macerator pump heads are reliable and convenient. The first hard object to contact the blades will stop them, and might burn up the electric motor to boot, but this can be avoided through proper user training.

**M**anuals are generally more reliable than electrics, although more expensive to repair. Most standard marine toilets with the four-bolt mounting base can be converted back and forth between manual and electric. Jet and vacuum heads are reputedly even more reliable.

Like all mechanical devices, heads wear out and need repair or replacement. It's better to install a pump rebuild kit in a clean unit before the season than in a clogged or leaking one during, and it will surely need one every couple of years.

The head is just a porcelain bowl with a mounting bracket and some sort of pumping device, and virtually any head can be

plumbed to virtually any MSD. Heads are not regulated or Coast Guard approved; it's the MSD that has to meet standards.

**Type I** units treat sewage, either by adding chemicals, killing bacteria with heat or, like the Lectra-San, by introducing electrical current which converts seawater to hypochlorous acid, which then kills most of the bacteria in the effluent. Type I units also macerate the discharge.

**Type II** units handle higher volumes of wastes and produce a more sanitary effluent, but are too large (1,000 lbs. and up) and expensive (\$5,000 and up) for applications where they are not required, which is on larger vessels. Neither Type I nor II MSDs can be used in no-discharge zones.

Most **Type III** MSDs are holding tanks. A few larger boats have Type III composting toilets, but their size and cost are prohibitive for smaller vessels. Every boat manufactured in the U.S. since 1978 with an installed head is required to have a holding tank. The tank may be rigid or flexible, and may be plumbed to empty only into dockside pump-out stations or have an overboard discharge option.

Since many of the more remote ports lack pump-out stations, and since it remains legal to discharge in federal waters (beyond three miles from the coast), a Y-valve may be located either between the head and the tank or between the tank and the pump-out deck fitting. One side of the Y-valve can carry sewage to a below-the-waterline through-hull discharge outlet. While operating in state waters the Y-valve is supposed to be wired or locked in the position which prohibits overboard discharge. Some holding tanks have a built-in macerator pump that empties the tank into the discharge line. An electric tank monitor can be used to alert the skipper when the tank is nearly full.

Some Type III MSDs are integral with the head, such as the Sani-Potty and Marine Traveler, which makes for a simple, compact installation. Otherwise, holding tanks usually are remotely located and require a hose to transfer waste from the

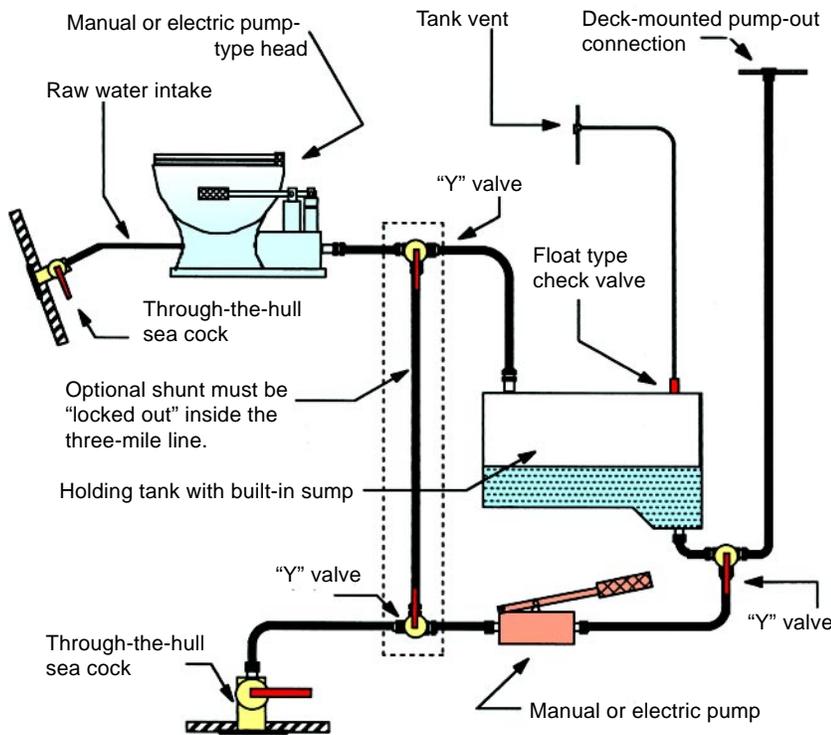
head, plus inlet water and vent lines. Except for a few models of heads that use the ship's pressurized freshwater system, all installed head and MSD setups require a through-hull to bring seawater in to operate the toilet. At as much as three gallons per flush, these systems fill holding tanks pretty quickly, which means either a large tank or a convenient method of pumping it out, or both.

All through-hulls should have shut-off valves, of course, and through-hull fittings should be plastic. Tank vent lines should be as short and direct as possible, without bends, filters, or traps, but should include at the base a float valve to ensure that sewage doesn't enter the vent line. Select a tank with the thickest walls possible, plastic only—no aluminum—and remember that a taller, narrower tank can be emptied more completely.

Holding tanks and their attendant plumbing can pose several problems. One is clogs, which often occur in the small, 1.5-inch-diameter lines, particularly where there are tight bends or joints. Another is odors. Unsavory smells emanate from MSD systems in part because seawater sitting in the hose and bowl gets stagnant and smelly after a week or two.

But most of the odor comes from products of anaerobic bacteria active in the tank and hoses. Sewage odors eventually will permeate even the best hose; only the best sewage hose should be used, and the hose should be changed every couple of years or sooner if odor is detected. Some people use schedule 80 rigid PVC pipe for their sewage lines because it is less permeable than hose, but rigid pipe is subject to cracking from motion and vibration, so if it is used it must be "soft connected" with short pieces of hose. ♦

## Head Installation Ideas



## Keeping Odors Down

Want to avoid odors in your boat's head? After ensuring proper installation of good quality components, you can prevent odors three ways:

1. Flush the hose to the holding tank thoroughly to prevent waste from standing in the hose. It's not enough simply to clear the bowl—keep pumping water long enough to ensure that sewage has been flushed all the way into the tank. Also, after each pump-out, rinse the system from the head or the pump-out fitting with fresh water.
2. Ensure that the tank is adequately ventilated so that the "good" aerobic bacteria can do their job and can suppress the stinky anaerobic bugs. According to sewage authorities (and I'll just have to take their word on this) sewage being decomposed by aerobic bacteria doesn't smell, so if air can reach all the contents of the tank (not just the top layer), it doesn't smell. This would also suggest that keeping the tank as empty as possible would be an advantage.
3. Consider adding some live aerobic bacterial treatment to the tank. Bacteria treatment is not chemical treatment. Chemical treatment either masks the odor with a strong perfume, or it kills the bacteria, good and bad, with a poisonous chemical. In either case the benefit is partial and brief. Bacterial treatment, on the other hand, enhances the natural decomposition.

A word on marine toilet paper: The experts say that it does break down more rapidly than the household stuff, and doesn't have the dyes and perfumes of some bathroom tissues. Remember that in addition to the head itself, your system may have a macerator on the pump that empties the holding tank. But the cheap, single-ply household tissue is just as flimsy, and costs a lot less.