From the Editors of

Practical Sailor™

Marine Toilets

Marine Sanitation Systems
Volume One

Table of Contents

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Chapter 1

Electric-flush Toilets

A Primer on MSDs • Electric Marine Heads • Compact Electric Toilets • Deluxe Electric Toilets

This two-volume e-book series offers a comprehensive look at all things marine sanitation—from the head to the holding tank. "Marine Sanitation Systems Volume 1: Toilets" covers the many marine heads available today, including performance tests of electric- and manual-flush toilets, vacuum-flush heads, port-a-potties, composting toilets, and everyone favorite toilet accessory, TP. The companion volume, "Marine Sanitation Systems Volume 2: Plumbing" looks at sanitation plumbing components like hoses and Y-valves, holding tanks and tank accessories, ways to control head odor, and tips on properly maintaining an onboard sanitation systems.

We begin with the most logical starting point, the head, but first, a note about MSDs, or Marine Sanitation Devices.

A Primer on MSDs

If you have a boat with an installed toilet and you sail on inland and or coastal waters, you're required to have a sanitation system on board to control pollution. Regulations covering the certification and use of Marine Sanitation Devices (MSDs) are issued by the U.S. Coast Guard. In general, sanitation systems consist of an installed head, a waste-treating device, and/or a holding tank. Portable toilets are not considered to be MSDs because they are usually not permanently mounted. Nonetheless, they are legal for use on all U.S. waters.

There are three different classifications of MSDs:

Type I systems, such as a head connected to a Lectra-San, are legal on vessels less than 65' that sail in an area not declared a Federal No-Discharge Zone. These MSDs normally discharge treated waste directly overboard because their waste treatment systems reduce bacteria and discharge no floating solids. Type I MSDs are illegal in some states, so check your regional laws before installing a Type I MSD.

Type II systems are more powerful than Type I systems and do a superior job of treating waste. Because they require additional electrical power, these systems are usually installed on larger boats, but they are legal for use on any boat outside of a no-discharge zone.

Type III systems are the least complex and the least expensive. A head connected directly to a holding tank comprise the average Type III system. Some of these systems use Y-valves that allow waste flow to be diverted overboard, but this is only legal outside the 3-mile discharge limit at sea.

Electric Marine Heads

"Head" (the British say "heads") is a clumsy term based on the place in a ship's bow where sailors went to read Shelley. (Percy Bysshe Shelley drowned while sailing.) We've come a way since fancy hotels covered the "water closet" with a wicker chair to avoid looking at the naked unmentionable.

And while sailing purists may shudder, more and more sailboats are eschewing the old, familiar piston-pump, manual flush toilets in favor of deluxe electric-flush models. Yes, Jack Tar has come a long way from using the openings over the bow of a sailing ship—the origin of the word "head"—or the old cedar bucket. The modern toilet is a push-button affair, and this significant shift in technology brings with it advantages and disadvantages.

In the past, *Practical Sailor*'s marine toilet tests have focused on the manual varieties (see Chapter 2), but this year, we resolved to delve into the world of pushbutton flushers: electric marine heads. Once considered a frivolous luxury for larger sailboats

PS testers put more than a dozen electric-flush toilets through their paces.

The bronze Groco Type K (above left) was the only test toilet that could easily convert to manual. The "dogbone" linkage joins the electric motor to the pump handle socket.

and motoryachts, the new breed of electric heads are generally more compact, more reliable, and less expensive than their predecessors.

Manufacturers are offering multiple models and options for both the marine and RV markets. For boats currently fitted with manual heads, an upgrade is not beyond the capabilities of a competent do-it-yourselfer.

Electric toilets have another advantage: The automatic electric macerating pumps do a better job of efficiently eliminating waste, especially for the landlubbers and guests who don't know whether they should pump once, twice, or 16 times.

Any toilet upgrade must take into account plumbing details, but a conversion to electric also entails additional power requirements, wiring details, and over-current protection. Operating for only a few seconds per flush, the electric-pump toilets reviewed here will not add a great deal to the daily amp-hour loads of a cruising boat. However, the momentary loads of the electric pumps and macerators can be as high as 30 amps, a demand-surge that can have consequences if the house battery bank is low or the electrical system is not designed to accept such loads. There is more than a grain of truth to the sea yarn about the autopilot that took a sharp turn to port every time someone flushed the toilet.

Make sure you have ample battery banks to add the pump motors to your system and that the installation uses adequately sized wiring and overcurrent protection in the form of fuses and/or breakers. Use of an inline seawater strainer is recommended to keep out algae, seaweed, organisms, and other material that could clog raw-water pumps and cause unwanted odors. Many of the odors associated with holding tanks come from decaying organisms introduced through the raw-water intake.

The pump motors and switches do not add a great deal of complexity to the system, but these parts are generally not user-serviceable, so owners of manual heads contemplating an upgrade should figure the cost of a spare pump into the equation. Owners of boats with two heads may want to keep a manually operated head in case of electrical failure, and self-sufficient voyagers may be best served by a manual head, which sells for about half the price of the least-expensive electric version.

Ideal plumbing systems will vary greatly among boats, and this article will not delve into the details of a complete marine sanitation system or the pros and cons of various options. Most of the manufacturers of the products tested here offer selection and installation guides, although some are much better than others. Two good resources for do-it-yourselfers contemplating an upgrade are Nigel Calder's "Boatowner's Mechanical and Electrical Manual: How to Maintain, Repair, and Improve Your Boat's Essential Systems," and Peggy Hall's "Get Rid of Boat Odors: A Boat Owner's Guide to Marine Sanitation Systems and Other Sources of Aggravation and Odor."

When installing a new toilet, follow the instructions carefully as to wire size and discharge sanitation hose size and length. Most boats will have a ¾-inch through-hull seacock valve as the inlet for raw-water flushing. For the outlet, a 1½-inch outflow hose will usually lead to a lockable Y-valve that diverts flow to either a holding tank or directly overboard through a seacock. (The Y-valve must be locked or sealed in sensitive areas designated as No-discharge Zones.)

Offshore cruising boats may also have to add plumbing and pumps to clear their holding tanks out beyond the three-mile limit. Discharge of untreated waste is not permitted in the coastal or inland waters of most countries, including the United States. Raritan Engineering makes a range of Type I Marine Sanitation Devices that treat waste for overboard pumpout in coastal areas where discharge of treated waste is permitted.

Some systems can be used with pressurized fresh water, and some bigger boats may have sufficient freshwater capacity to use the pressurized water intake models. Patient instruction to all new hands, and prominently posting stickers covering the proper use of the head can help reduce the need for unscheduled maintenance.

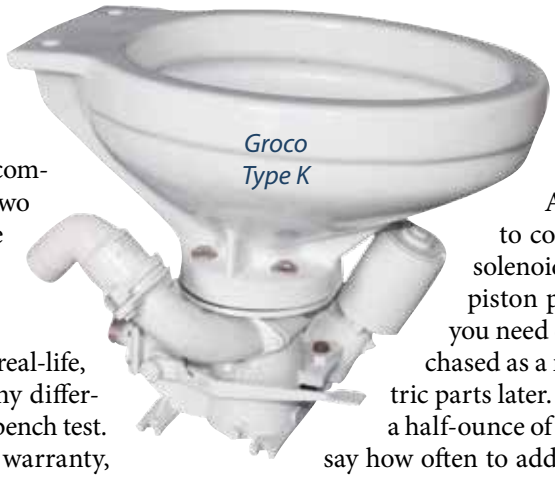
Every skipper will face a clogged head in his lifetime. A good one will work to resolve the problem rather than ranting, cursing, and trying to pass the blame.

There are dozens of different models of electric toilets depending on size, weight, style, voltage, color, function, and features. Several models are available in different iterations. They can come with or without separate inlet water pumps, macerator pumps, solenoids, or electronic control boxes. Some come with a simple push-button or a more elaborate multi-function remote-control panel, with separate buttons for filling and flushing. Some are Spartan compacts; others are very stylish household types. Prices range from $429 to $9,999.

Practical Sailor narrowed its test to 14 toilets representing a good cross-section of the models available from major manufacturers, including Dometic, Groco, Jabsco, and Raritan. These are the types most likely found at marine chandleries in the U.S. or onboard new boats sold domestically. One test unit used a 24-volt pump, but all the others were 12-volt DC. However, pumps with other voltages are available. Some have the intake and flushing pumps separate and remotely mounted; some pumps are integral and located under the bowl; and others operate a combined inlet-flush pump. Seven units used solenoids to control pressurized fresh water. The field included heads with compact typical marine bowls and those with the larger standard-size bowls. Elongated household-type bowls,

and bowls with slanted backs to fit hull shapes in the bow are also an option for some models.

In order to simplify evaluations and comparisons, *PS* divided the test field into two groups: compact electric heads and deluxe electric heads.


Groco Type K

HOW WE TESTED

Practical Sailor could not do an onboard, real-life, long-term test and evaluation of so many different toilets, so we conducted a controlled bench test. We compared size, weight, price, style, warranty, features, and functions. We reviewed packing, instructions, documentation, what parts were included, construction and ruggedness of materials, ease of installation, and installation options.

For performance comparison, we hooked up the pumps to a 12-volt battery, installed the proper hoses for water intake and waste discharge, evaluated ease of electrical and plumbing hookup, noted maintenance issues, and compared functions. We tested for amp draw, noise level during flush, and ease of use. We tested the toilets with equal batches of "faux poo," which comprised a banana, 4 feet of West Marine tissue paper, and 1 cup of dyed water. We evaluated the amount, speed, and efficiency of rinse water input and waste discharge.


Jabsco Deluxe Lite Flush

Most of these units required pressurized water for filling and rinsing. Many came with a pump on the inlet side to deliver the required pressure, usually around 45 pounds per square inch (psi). To test the units without pumps, we hooked up a standard 3/4-inch garden hose with 48 psi. Theoretically, the toilets that used the garden hose had the advantage of a slightly higher water pressure during fill and rinse cycles, but ultimately, testers did not notice any significant performance advantage in those units that used the garden hose over those that used their own inline inlet pumps.

Compact Electric Toilets

This group, compact electric heads, comprises seven sample electric toilets that are smaller, low profile, more compact, and more economical.


Jabsco Quiet Flush

GROCO TYPE K

Gross Mechanical Laboratories has a long history of manufacturing marine- and industrial-grade pumps, valves, seacocks, and hardware including manual toilets and holding tank systems. The Type K series is a no-frills, utilitarian toilet with the oval China bowl sitting on top of an open mechanical base with all the bronze parts exposed and painted white. The Type K 12v we tested had a bronze ¾-inch inlet hose fitting, a 1½-inch bronze outlet hose fitting and just two wires for power to the discharge pump. A foot pedal provides mechanical linkage to control input from pressurized water (no solenoid needed). The motor controls a 3-inch piston pump. To convert to manual pumping, you need only to undo a single bolt. It can be purchased as a manual head and easily retrofit the electric parts later. It has a red tag with instructions to add a half-ounce of oil (provided) to the pump, but does not say how often to add oil after use. It comes with a one-page installation/instruction sheet. Operation is simple. Press the foot pedal to let water in and push a button to pump it out. All parts are heavy duty and easily accessible for service.

Bottom line: This is an old-school, heavy-duty head that will take some punishment. However, it did not do so well with our banana test. It was the noisiest of our samples and was also the most expensive.

JABSCO DELUXE LITE FLUSH (58500-1012)

Jabsco, now part of ITT Corp., has been making marine pumps since the 1930s. The Deluxe Lite Flush is one of its newer compact toilets with interesting construction: a heavy China bowl is surrounded by plastic pieces to form a top, case, and base. It was the only test product made mostly of plastic, and gaining access to pump components and plumbing requires some patient disassembly. The plastic seat and cover is the non-slam type that slowly closes, the only of its kind in this group. The combination motor and pump is offset with a small rubber drive pulley that testers regarded as a weak link. The wiring and hose hookups were easy, although testers did experience some initial leaking. Tracing the source of the leak—a loose plastic hose clamp—required partially disassembling the plastic housing. This unit has an electronic control panel with four buttons that automatically time and control the amount of water for filling and flushing. The panel is marked "Fill," "Quick Flush," "Flush," and "Empty." The quick flush mode uses only about a cup of water, and presumably is to be used only for flushing urine. The regular flush mode uses about a half-gallon and flushes twice. The noise and speed during flushes were average.

Bottom line: The Deluxe Lite Flush was clearly the most unique product in this field, but none of its novel features outweighed testers' concerns about access to plumbing and durability in a rigorous marine environment.

JABSCO QUIET FLUSH (37245-0092)

This compact model has an open base to expose the hose fittings and discharge pump (the pump has a white snap-on cover). The self-priming remote intake pump has a plas-

PS VALUE GUIDE COMPACT ELECTRIC-FLUSH TOILETS

MANUFACTURER	RARITAN		JABSCO		JOHNSON		GROCO
MODEL #	160MF012	220AHF01202	58500-1012	37245-0092	80-47231-01	80-47436-01	KH 12V
NAME	Sea Era $	Marine Elegance ★	Deluxe Lite Flush	Quiet Flush $	Aqua-T	Aqua-T	Type K 12V
PRICE	$500	$630	$949	$670	$572	$532	$1,585
TYPE (AS TESTED)*	1 motor / 2 pumps	Pressurized supply /1 pump	1 motor / 2 pumps	2 motors / 2 pumps	2 motors / 2 pumps	1 motor / 2 pumps	Pressurized supply /1 pump
BOWL MATERIAL	China	Vitreous China	China & plastic	China	China	China	China
SIZE (H-W-D INCHES)	14.5 x 13 x 16	14.25 x 14.5 x 19	14.75 x 13.5 x 15.75	13.75 x 13 x 16.5	15.5 x 13.5 x 16.5	15 x 14.4 x 12.6	16.8 x 15.7 x 18
WEIGHT	27 lbs.	39 lbs.	26 lbs.	28 lbs.	27 lbs.	29 lbs.	47 lbs.
PORT SIZES (IN/OUT)	3/4 in. / 1 or 1 1/2 in.	3/4 in. / 1 or 1 1/2 in.	3/4 in. / 1 1/2 in.	3/4 in. /1 in.	3/4 in. / 1 1/2 in.	1/2 in. / 1 1/2 in.	3/4 in. / 1 1/2 in.
RUGGEDNESS OF PARTS	Good	Good	Fair	Good	Fair	Fair	Good
STYLE & APPEARANCE	Round bowl	Oval bowl	Round bowl	Round bowl	Round bowl	Oval bowl	Round bowl
AMPS PER SPECS	18 amps	18 amps	20 amps	20 amps	18 amps	18 amps	12 amps
RATED FLOW RATE OF SUPPLY PUMP	Not stated	NA	NA	3.8 GPM	2.4 GPM	NA	4 GPM
MAX DISCHARGE HEIGHT	9 feet	9 feet	Not stated	Not stated	Not stated	Not stated	Not stated
WARRANTY	1 year	1 year	1 year	1 year	2 years	2 years	1 year
TEST RESULTS							
SOUND LEVEL	81 decibels	75 decibels	75 decibels	83 decibels	86 decibels	85 decibels	88 decibels
CONSTRUCTION	Good	Good	Fair	Fair	Fair	Fair	Good
TIME TO FLUSH 1 GALLON OF WATER	14 seconds	12 seconds	16 seconds	14 seconds	25 seconds	11 seconds	23 seconds
BANANA & PAPER EFFICIENCY	18 seconds	9 seconds	19 seconds	30 seconds	28 seconds	10 seconds	47 seconds
EASE OF INSTALLATION	Good	Good	Fair	Good	Fair	Good	Good

★ Best Choice $ Budget Buy

tic replaceable pump mount and replaceable insert bushings. It comes with a 6-foot wire cable for the remotely mounted control panel, but testers found the electric wiring diagram in a loose eight-page instruction booklet to be confusing. The buttons are marked "Flush," "Fill," and "Empty." The inlet hose is ¾-inch and discharge is 1-inch. The Quiet Flush's performance was Good, but its noise level was middle of the pack and the flushing action was a little slow.

Bottom line: The Quiet Flush performed well, although not quite living up to its "quiet" billing, reaching an average of 83 decibels during flushes. Its instructional support lagged behind the Raritan Sea Era, but its competitive pricing earned it a tie with the Sea Era for Budget Buy.

JOHNSON PUMP AQUA-T (80-47231-01)

Johnson Pumps is part of the Swedish SPX Flow Technology Corp., which has 75 years of experience providing pumps and liquid transport systems. The company's toilets come with a two-year warranty, compared with the one-year warranty for other products in this test. The intake water pump—rated for 2.4 gallons per minute—seemed anemic compared to others in this test. It took longer than others to fill the bowl and longer to evacuate. It was also a little noisier (86 decibels, about 25 decibels louder than normal conversation), despite the permanent rubber feet on the pump motor. The stamped metal mount used spot welding, a common failure point on similar components when exposed to a marine environment. Testers found the long instruction sheet to be somewhat confusing. The lightweight, round, compact ceramic bowl and wooden seat and cover are very similar to the Jabsco Quiet Flush, as is

Johnson Aqua-T 47231

the switch. It comes with a 4-foot cable for the remote rocker switch for "Fill" or "Flush." Both Johnson test toilets are relatively inexpensive.

Bottom line: Although testers had no major complaints about this unit, both the Raritan Sea Era and the Jabsco Quiet Flush performed better in tests and scored higher points for features and construction quality.


Johnson Aqua-T 47436

JOHNSON PUMP AQUA-T (80-47436-01)

This is the "comfort" model, and unlike the other Aqua-T we tested, it has a wooden seat and cover. Although it was one of the most compact in our test group, weighing only 29 pounds, this Aqua-T has a larger oval bowl and seat. The toilet has one motor with a well-proven, dual-diaphragm, self-priming pump. Noise was a little high, but the water intake and discharge worked faster and better than the other Johnson model in this field. It was, in fact, one of the fastest flushers overall. The remote button was distinct from its sibling's, with a single button to control fill and flush. Both Johnson Aqua-T toilets are compact and utilitarian, with open bowl bottoms and exposed pumps.

Johnson also has a "premium" line of electric toilets with more deluxe looking one-piece bowls.

Bottom line: Of the two Johnson models we tested, this one stood out. Pricing was competitive, the seat was among the most comfortable, and the two-year warranty is better than any other pump in this test. This Aqua-T is a close competitor with the Jabsco Quiet Flush, but not as impressive as the Raritan Sea Era.


Raritan Sea Era

RARITAN SEA ERA (160MF012)

Raritan, a 50-year-old company, manufactures a wide line of marine toilets, sanitation devices, and freshwater systems. The Sea Era model is an inexpensive, lightweight, compact toilet with a small footprint, even with the pump attached under the bowl.

This seawater model has one integral pump for both water intake and flushing. It comes with three intake options, left, right, and straight back with the necessary plugs, straight or 90-degree fitting for a ¾-inch intake water hose. The discharge port comes with two nozzles, either a straight combo 1-1½-inch fitting or a 90-degree 1½-inch fitting. It also includes an in-line water strainer, the most rugged of the three brands testers looked at. Function is simple, with one pushbutton to operate the one motor with intake and discharge pumps. The Sea Era was a little louder than others, but in terms of water usage and time-to-flush, its performance was in the middle of the pack. It was one of the lightest-weight units with a small round bowl and seat, and was the least expensive of our test field.

Bottom line: Raritan's long experience in the marine market is evident, even in its bottom-of-the-line products. The Sea Era lacked the flushing power of the two-motor models, but it is a good low-budget choice for those making the switch to electric. Small parts and materials were generally a cut above Jabsco and Johnson. This toilet earned a Budget Buy in this category.

RARITAN MARINE ELEGANCE (220AHF01202)

This is an elegant-looking, one-piece, cream-colored heavy-duty marine toilet with a larger bowl and wood seat and cover that was set up for pressurized freshwater supply and a solenoid valve to control flow. It can be configured to operate with a separate supply pump. It is a full-size seat, but is considered a compact due to its small 12-inch footprint. All components are first-class, tucked nicely under the bowl, and the discharge motor is coated to resist corrosion.

Function is also simple since it comes with the same single remote pushbutton as the Sea Era. Hookup and installation was easy, and the function was fast and efficient and quieter than most. It did leave a few inches of clean water in the bowl after flushing, but this should not be a problem.

Bottom line: Larger and heavier than the others in this field, the Raritan Marine Elegance is a good compromise for someone who wants the comforts of a home toilet, but is limited by space. An excellent choice for those who can spare the extra money, the Marine Elegance was the *Practical Sailor* Best Choice in this group.

WHAT WE FOUND

Most manufacturers offer multiple models, and each model can be ordered with multiple options and features. Most electric toilets are designed for the RV market or the higher-end marine market. It was obvious that marketing and sales efforts are being directed to boat manufacturers, not retrofit end users. However, you can choose various styles, sizes, voltages, water intakes (pressurized water or raw-water pumps), and many different electronic controls. We probably could have tested 14 different toilets from each manufacturer.

Activation can be a simple pushbutton or multiple buttons to give timed functions for amount of water, length or number of flushes, and how much water to leave in the bowl. Automation might be an advantage in some situations, but basic manual controls to fill, flush, and empty the bowl, are all most users will need.

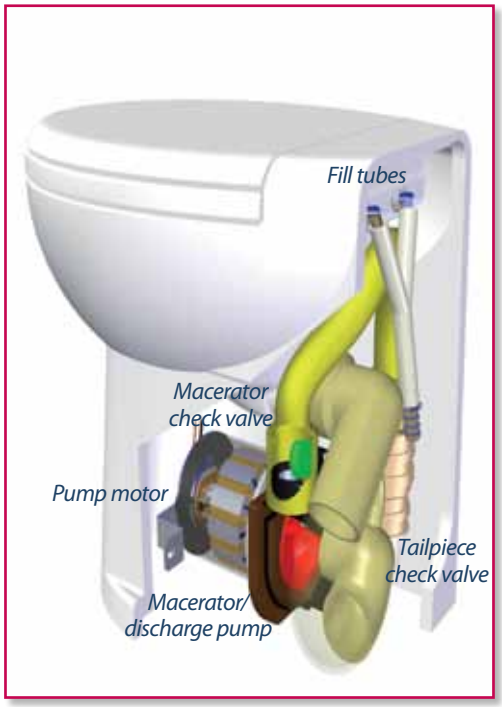

Raritan Marine Elegance

Some of the better functioning toilets were also the loudest. Noise comes from two sources: The discharge motor and pump (depending on whether it is tucked under the porcelain housing) and the suction noise of water leaving the bowl. The suction noise in some test toilets were continuous, and others just

had a quick cough at the end.

Better efficiency is determined by two functions: The amount, pressure, and swirl in the bowl of the intake water, and the speed and efficiency of the discharge pump. Those samples hooked up to pressurized fresh water had a little advantage with the 48 PSI pressure to fill and swirl the bowl, and the actual engineered design of the outlet hole in some bowls allowed the material to be swished away faster.

There are reasons your household toilet has water in the bowl at all times. It is much easier to swish solid material down if it is in water. In addition, there is a reason that the attached water tank, or water closet (WC), as it used to be called, has at least a gallon of water to flush, with gravity.



Presumably, we could use standard household toilets on board if you add a WC and could tolerate water sloshing out of the tank and bowl in pounding seas, heavy weather, or when heeling. (Fun!) Our better functioning marine toilets provided ample water either through good intake pumps or pressurized intake water. The best seemed to have controls to allow a "fill only" function before flushing to better imitate a household toilet.

To eliminate the chance of holding tank odor, some designs opted for leaving a little water in the bowl (but it could spill in lumpy seas or excessive heeling) or left water in an "S" curved pipe (like under your sinks). Others (including many manual heads) include the infamous joker valve, a rubberized flexible valve that allows discharge in one direction only, and pinches off the backflow of waste and odor.

Most of the compact units looked more traditional and were probably adapted from their manual pump cousins. The more modern style with one-piece China bowls may be more expensive, but they seem to be quieter and easier to clean and keep clean. We definitely will see more of them.

Deluxe Electric Toilets

Our second group of electric test toilets, the deluxe electric heads, comprises the larger, taller, and more expensive household-type toilets. To fully appreciate these seven high-end toilets, it helps to understand how they are designed to combat the loathsome clog.

With manual-pump heads, clog resistance usually depends on the discharge pump's ability to pass bulky material—baby wipes, feminine hygiene products, paper towels, and other fibrous paper products—the sort of stuff that shouldn't be in a marine toilet in the first place. Typically, water and material is moved toward the holding tank with a piston pump or diaphragm pump, both of which can push fairly bulky items into the discharge hose.

Backflow from the tank is prevented by check valves, typically a flapper valve, and/or a flexible tricuspid or duck-billed valve that allows water flow in one direction. These, too, can allow some surprisingly large objects to pass into the plumbing system. In fact, in the days of raw-water intakes and direct overboard discharge, the ability to flush such things as a glove or sock were badges of honor among toilet makers. The old bronze Wilcox-Crittenden Skipper and the Lavac (see Chapter 3) are examples of heads that don't flinch when you flush a baby-wipe. An ability to flush big stuff is fine, provided you have an endless supply of seawater for flushing and direct overboard discharge.

However, with holding tanks now the norm, anything that makes it past the check valve winds up in a holding tank. In a perfect world, what goes into the tank is easily pumped out, but as anyone who has spent some time at a marine pumpout station can attest—we do not live in a perfect world. To complicate matters, the trend toward freshwater flushing, which reduces odor problems, leaves less water available for flushing. Enter the macerator pump. Like your sink's garbage disposal, macerator pumps chop up material into finer parts, creating an emulsified mixture that can flow freely through the system without building up.

For many years, head macerators had a serious image problem. They were loud and they didn't work. A common design incorporated an impeller to move water and some rotating blades to chop the solids. Typically, both components shared the same motor shaft. Neither was very good at its respective job, especially once a wad of paper wrapped around its blades. Clogs were frequent. Today's macerators are significantly different.

In the mid-1990s, the Italian company Tecma (purchased by Thetford in 2003) changed the perception of macerators with the introduction of a high-speed centrifugal "Vortex" pump, which had a unique convex rotor and a funnel-shaped casing or "volute" that converts kinetic energy into pressure. Other makers soon followed suit with similar designs. Akin to a common bilge pump, the centrifugal pump has a set of curved blades on a rotor. The fast-spinning rotor creates a change in pressure that can quickly push a "slug" of liquid through the system, using very little water and making far less noise than the earlier renditions.

When combined with cutting blades located on the rotor itself or the pump housing, the pump is also very effective at chopping down some surprisingly tough material. Apart from the more obvious differences in sizes, shapes, and buttons for flushing, the subtle distinctions in pump design are what set apart the toilets in this month's test.

WHAT WE TESTED

Best suited for boats over 40 feet, the deluxe electric heads have obvious differences from those in the compact group. They are bigger, heavier, more comfortable, more expensive, and are equipped with more sophisticated flushing systems. At around

PS VALUE GUIDE — DELUXE ELECTRIC-FLUSH TOILETS

MANUFACTURER	RARITAN		DOMETIC	JABSCO	PLANUS	THETFORD (TECMA)	
MODEL #	231HS012	A8R12	(Sealand) 8152	58040-1012	90450	38485	38660
MODEL NAME	Marine Elegance ✓	Atlantes Freedom	MasterFlush $	Deluxe Flush	Artic Standard ★	EasyFit $	Tecma Silence Plus
PRICE	$1,291	$1,479	$700	$999	$1,200	$700	$1,149
BOWL MATERIAL	China	China	China	China	China	China	China
SIZE (H-W-D)	16.75 x 14.38 x 19.25 in.	17.8 x 15 x 19.5 in.	18.375 x 14.75 x 18.375 in.	17.6 x 14.7 x 17.6 in.	18.4 x 14.8 x 17.2 in.	17.4 x 14.3 x 18.7 in.	17.75 x 14.5 x 17 in.
WEIGHT	52 lbs.	59 lbs.	53 lbs.	48 lbs.	54 lbs.	48 lbs.	63 lbs.
PORT SIZES (IN/OUT)	½ in. / 1 in. or 1½ in.	¾ in. / 1½ in.	½ in. / 1½ in. or 1 in.	¾ in. / 1½ in.	¾ in. / 1½ in.	¾ in. / 1½ in.	¾ in. / 1½ in.
RUGGEDNESS OF PARTS	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent
STYLE & APPEARANCE	Oval bowl	Oval bowl	Oval bowl	Oval bowl	Oval bowl	Oval bowl	Elongated bowl
AMPS PER MAKER SPECS	18 amps	20 amps	20 amps	20 amps	40 amps	30 amps	30 amps
MAX DISCHARGE HEIGHT	10 feet	12 feet	9.8 feet	Not stated	29 feet	6 feet	18 feet
WARRANTY	1 year	1 year	1 year	1 year	2 years	2 years	2 years
TEST RESULTS							
FLUSH NOISE LEVEL	76 decibels	76 decibels	74 decibels	75 decibels	71 decibels	78 decibels	86 decibels*
CONSTRUCTION	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent
TIME TO FLUSH 1 GALLON OF WATER	22 seconds (2 flush)	10 seconds	12 seconds	23 seconds	10 seconds	13 seconds	20 seconds
BANANA & PAPER EFFICIENCY	7 seconds (1 flush)	10 seconds	12 seconds	23 seconds	8 seconds	5 seconds	10 seconds
EASE OF INSTALLATION	Good	Fair	Good	Good	Fair	Good	Good

★ Best Choice $ Budget Buy ✓ Recommended * Brief 'cough' at end of flush (see text)

18 inches tall, they are 4 inches taller than the compact bowls in Group I. The elongated seats and bowls are also bigger.

Manufacturers represented in this group include Dometic, Jabsco, Planus, Raritan, and Tecma. These manufacturers offer a wide range of toilets, allowing boaters to choose colors, sizes, and pump systems that suit their needs. Most of the toilets tested here are offered in a range of sizes, colors, functions, and features. Prices ranged from $700 to $1,500.

Installation details will vary for each toilet and depend on the type of cruising you intend to do. All of the toilets in this test are primarily designed to be flushed with freshwater supplied by an onboard tank via a pressure-regulated pump or a pressurized system. An electronic solenoid valve—often linked to an automatic timing device—controls the water supply.

These toilets can be used with seawater (alone or in addition to the freshwater system) supplied by a separate pump, and some toilets are designed to be simultaneously plumbed to both fresh- and saltwater pumps, allowing the user to select one or the other. However, if you go the saltwater route, keep in mind that good water pressure is essential to proper function. Vented anti-siphon loops on the inlet side will reduce flow and will likely need to be closed during flushing. There are solenoid-controlled vented loops designed for this purpose.

Dometic MasterFlush

DOMETIC MASTERFLUSH

As maker of SeaLand marine tanks, hoses, and fittings, Dometic Corp.'s responsibility doesn't end at the flush. If something causes a problem in the holding tank, it's Dometic's problem, too. As a result, the MasterFlush (8152) is designed as an integral component to the SeaLand sanitation system.

The MasterFlush's water usage was at the higher end of the spectrum among our test toilets, and it has a metal macerator "fan" that finely chops solids. According to the manufacturer, these two features are key to preventing clogs and protecting the system. The company recommends only Sealand toilet paper, but *PS* testers had no trouble using West Marine TP. (The company's own testing has shown that the macerator's able to

shred even tampons.) The MasterFlush comes with a remote control unit with three functions: add water to the bowl (activates water valve only), flush (actives water valve and discharge macerator pump), and dry bowl (activates discharge macerator only). Designed for use with pressurized water, this was the tallest and one of the heavier test toilets. Hook up was easy, operation very quiet (second best), the function fast and efficient, and it is relatively inexpensive. Its metal-blade macerator was one of the most effective in dicing a banana.

Bottom line: Quiet, efficient, and cheaper than other products in this group, the MasterFlush is a tie for the Budget Buy.


Jabsco Deluxe Flush

JABSCO DELUXE FLUSH

Testers noted that this good-looking, one piece, household-size toilet was packed very well. The Deluxe Flush (58040-1012) we tested was designed for pressurized water, and adding an intake pump is an easy option. The 10-page instruction book was one of the better guides in our test. The toilet can be ordered with a straight or slanted back.

The hardware to hold the seat and cover was difficult to figure out. The two nylon nuts and bolts have flat un-slotted heads, making them difficult to tighten. No matter how much testers tightened them, the lid assembly kept slipping. Our test unit had a sealed control panel with pre-set connectors. The four buttons are for pre-programmed, timed fill, quick flush (water saver), flush, and empty (dry bowl). They functioned quite well, although a little slow, and the Deluxe Flush fit the middle price-range of our larger deluxe models.

Bottom line: A good-looking toilet with middle-of-the-pack performance, decent pricing, and an unnerving seat design.


Planus Artic

PLANUS ARTIC STANDARD

Planus Marine Toilet Systems are manufactured in Italy and sold through Scandvik Inc. in Vero Beach, Fla. The company president is Marco Giovannini, a marine toilet innovator who founded Tecma. It is no surprise that the Planus toilets have many pump components that are nearly identical to those found on the Tecmas, with some key differences. Among the changes is a stainless-steel valve seat meant to prevent odors from coming back into the toilet. The company offers six very stylish models in 12 color schemes with various available options. High-end models reach all the way up to the Race model, which sells for $9,000. We tested the popular Planus Artic Standard, which came with a remote control box with a switch and a heavy-duty "Electrovalve" solenoid to regulate pressurized water. The heart of the system is its high-speed Vortex discharge pump that Planus claims will push liquid up to 29-feet high.

The Artic is quite heavy, has above-average construction, and came with a pre-wired harness that connected to a sealed electronic box with one pushbutton. It included a heavy-duty bronze inlet pipe with a large solenoid and backflow preventer. Pushing the button starts a timed sequence to add water, quickly flush twice, and then add a little water to leave fresh water in the bowl. A knob on the back of the control box adjusts how much water is left in the bowl after flushing. It is tall and heavy but has a deluxe look; all components are heavy duty; and the operation is very impressive, quiet, and efficient.

Bottom line: Our price-is-no-object Best Choice, the Artic has more oomph than the small-boat owner will likely need (or want to pay for), but this quiet, powerful, clean flusher was the cream of the crop. Planus does not have its own U.S. tech support and parts department, leaving that to the U.S. distributor, Scandvik, a company with a long history in the boating market.

RARITAN MARINE ELEGANCE

The Raritan 231HS012 is similar to the Marine Elegance unit that was rated the Best Buy in Group I, but with a taller bowl. It also comes with Raritan's optional Sea Fresh system, which allows the user to switch between one of two supply sources: a seawater-intake diaphragm pump or pressurized fresh water controlled by solenoid. The switch that controls flushing has four buttons, one for each function: "water only" to manually add water; "empty only" to evacuate bowl as long as button is pushed; "water saver," which automatically gives two consecutive 1/3-gallon flushes; and "normal flush," which automatically starts a four-stage cycle of fill, flush, rinse-flush.

This Marine Elegance has a selective rocker switch and hook-up for both seawater and pressurized fresh water, making it an attractive option for extended cruising. All the components and wiring are substantial and well sealed. Despite smaller half-inch inlet and 1-inch diameter outlets, this is a very fast and efficient toilet. Set-up of the dual-water system was understandably more complicated and took a little more time than others in the test.

Bottom line: The versatile big brother to our Best Choice in last month's test gets a Recommended rating in this go-round.


Raritan Marine Elegance

RARITAN ATLANTES FREEDOM

This is a heavy, household-style, one-piece porcelain unit with a molded wood seat and cover. The Raritan Atlantes Freedom (A8R12) was the only test product with a chrome manual flush lever on the side. It comes with an 18-page instruction book that can get a little complicated with all the possible functions and options. In the A7 model, the lever activates separate micro switches for fill and flush motors. The A8 adds

an electronic timed function to start the fill pump first and then the flush pump. The A9 model has a remote control panel to activate three modes: fill, dry flush, and fill and flush. The "dry flush" function empties the bowl completely of water, a good thing to have for a hard beat.

Our test toilet came with two motors and two pumps, but a solenoid is available for hooking up pressurized water. All the wiring is heavy #8 AWG, and all the parts were well above average in quality and construction. Our sample was very well made and easy to install, and it functioned exceptionally well. The timed operation starts the intake pump to put water in the bowl, flushes for 10 seconds, and then adds a little water, all very quietly. At the back, the macerator pump housing has a unique viewing window, making it easy to confirm a clog and clean it out, if needed.

Bottom line: Initially developed for the houseboat rental market—renowned for marine toilet neophytes—this is an industrial-strength head. Although it will be a tough squeeze in an average cruising boat, it fits the bill for the boat owner with a steady supply of careless visitors or charter guests.

Raritan Atlantes Freedom

THETFORD EASYFIT

Thetford offers a wide variety of sanitation, RV, and marine care products. The Tecma EasyFit Eco (38485), made in Michigan, is as tall as other test toilets but has a small footprint and a compact, contemporary, one-piece china bowl. It has an enamel-covered wood seat and a basic, manual, two-position rocker switch.

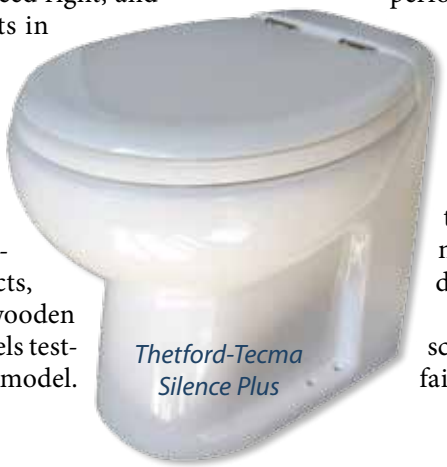
Thetford Tecma EasyFit Eco

It can be ordered either with a remote input pump or with a solenoid for pressurized freshwater input. Ours came with the solenoid, a very small 1-inch by 2-inch, two-position activation switch, a pre-wired wiring harness, and an impressive 16-page installation book, which unfortunately did not include an electric wiring diagram. According to Thetford, the wiring diagram is usually included in the same box as the wiring harness. The buttons are not timed: Hold to add water and then hold to flush. Water swirls in the bowl, and the flush is fast and efficient.

Bottom line: Right up there with the Dometic for Budget Buy, this is a no-nonsense electric head, priced right, and compact enough for most cruising sailboats in the 35- to 40-foot range.

THETFORD SILENCE PLUS

A high-end European-style luxury model, the Thetford-Tecma Silence Plus (38660) is assembled in Italy. It is available in three colors and features its powerful turbine macerator pump. The heaviest of the test products, it has a solid porcelain base, epoxy-coated wooden seat and lid, and was one of two 24-volt models tested. It is also available in a 12-volt (30-amp) model.



Thetford-Tecma Silence Plus

Components are first class. It features an electronic, timed wall switch with two well-marked buttons to "add water" or "flush." Pushing the "flush" button also adds a little water, then flushes, delays for 5 seconds, and flushes again. It uses a minimum of water, is fast and efficient, and is very quiet except for one little cough at the end of the flush. This was one of the most powerful flushers in the test.

Bottom line: Quiet and efficient, the Tecma Silence Plus, like its distant cousin, the Planus, has some significant pumping power.

CONCLUSIONS

Practical Sailor's 14 electric marine test toilets ranged from compact utilitarian heads to very stylish—and heavy—thrones. While the latter units presented some NASA-worthy installation challenges, putting in any of the seven toilets in this report is within reach for the do-it-yourselfer.

In some cases, you could save money by fitting your existing toilet to the new electric pump base. An exception would be the Raritan Marine Elegance, which has a different footprint.

If you are looking for the least-expensive entry into the field of electric toilets, three units stand out: (in order of ranking) the Raritan Sea Era, the Jabsco Quiet Flush, and the Johnson Aqua-T (80-47436). The chief differences in the three boiled down to ruggedness of individual components and ease of installation.

If you're looking for the best compact unit on the market, and aren't too concerned about the expense, the Raritan Marine Elegance was clearly the Best Choice. Its modern style, excellent construction and rugged components set it apart. It also proved to be the most efficient flusher, fast and requiring very little water.

In the group of larger models, the ratings were much closer. Of the three heaviest units, *PS* testers were most impressed with the Planus Artic Standard, followed closely by the Thetford Silence Plus. Both have smart flush controls, tank-full indicators, and two-year warranties. Both are made in Italy, but the Thetford has much a stronger U.S. presence. For those inclined to stick with domestic brands, the Raritan Atlantes Freedom was right up there in terms of robust construction and solid performance.

In the Budget-Buy category, the Dometic MasterFlush and the Thetford EasyFit Eco were neck-and-neck. Performance and construction details competed closely with more expensive models, and customer service was strong. It had sensible flushing options (including dry bowl), and Dometic's new switch, which will have a full-tank indicator, will bring added value.

The Thetford EasyFit stood out with high scores across the board for performance. It is fairly light, installation is straightforward, and

performance is fast and quiet. Tech support is reliable, and the two-year warranty is a bonus.

If a switchable, freshwater/raw water model is what you want, then the Raritan Marine Elegance is an obvious choice.

Since many of our readers are long-term cruisers who value simplicity over convenience, we would be remiss not to mention the lingering question underlying this test: What's wrong with a manual toilet?

True, modern electric-flush marine toilets offer a huge step in convenience over manual models, particularly when you start mixing freshwater flushing and holding tanks. But toilets are mechanical systems whose moving parts have finite lives. Shaft seals on these electric pumps, for example, will eventually start leaking. Key components on these heads are mostly tucked away and difficult to service. Solenoids, motors, sensors, and timers must deal with a corrosive marine environment.

And when we ask a cruiser who is micro-managing amp hours (not to mention fresh water) across the South Pacific for 40 amps (at 24 volts!) every time he wants to flush . . . we can almost feel his nerves flicker with the lights.

Chapter 2

Manual-flush Toilets

Manual Heads Bench Test · Head-to-Head Long-term Field Test

A marine head that works—every time, without fail—doesn't necessarily make a boat a happy place. But if it doesn't work, perdition and pinched faces abound.

Those boat owners most likely to suffer a "busted head" probably do not own a Wilcox-Crittenden Skipper model or a British-made Baby Blake. These are two of the lofty veteran thrones that have stuck around the marine market for decades—still holding court on many a used sailboat or being sold in used-gear chandleries.

Because these trusty heads are still prevalent today, *PS* decided to bench test them to determine the king of the thrones. Based on the results of the test and to supplement our findings, we also launched a long-term head-to-head test of two models, the Raritan PHII Standard and the Jabsco Compact.

Manual Heads Bench Test

Practical Sailor evaluated nine veteran, manual marine heads on how well each meets the basic goals of sound, robust construction, and horrendous reliability that requires as little service as possible. Because "servicing" these necessary evils is among the most unpleasant of a yachtsman's tasks, the idea is to reduce to an absolute minimum the amount of hands-on attention given to what is essentially just a bowl with a seat on it, a pump and a few assorted valves and seals.

The nine heads gathered for this bench test were the Baby Blake; Groco's Models K and HP; Jabsco's Compact; the Raritan PH II and Cricket, and two Wilcox-Crittenden heads called the Head-Mate and the Skipper. Although the Cricket, Head-Mate, and Skipper are no longer in production, if you own or are shopping for a used boat, chances are, one of these is onboard.

LOW-COST HEADS

In the "economy" heads class are three models: the Wilcox-Crittenden Head-Mate, Jabsco Compact, and the Groco HF. All three have side-mounted piston pumps that are, in our experience, troublesome.

The Wilcox-Crittenden Head-Mate probably is found, more than any other head, aboard older boats built in the United States. Its low cost, compact size, and easy installation make it very favored "original equipment" among boatbuilders.

A word here about Wilcox-Crittenden: This old company's products long had the reputation for being rugged and reliable, but not exactly modern in design. However, in the five or 10 years prior to 1997, both metal and plastic castings for its marine toilets were sent overseas. According to Jock Allpress, Wilcox-Crittenden product manager, there was very little if any quality control. He said parts broke that should never break. A piston lever arm was a particular problem.

Not included on anybody's "best" list is the Wilcox-Crittenden Head-Mate. Unchanged for several decades, it has thin, complicated flap valves and a pump that won't stand hard use, clogs easily, and is difficult to clear. It must be used and treated delicately. The flush water intake switch, when abused by a neophyte, can easily be broken (seven of the 10 items in the repair kit are for the water intake valve).

Jabsco's Compact doesn't enjoy a great reputation, either, but to Jabsco's credit, it appears to be an improvement over its prior iteration. However, the water flow still seems to be excessively circuitous and the fluids are required to squeeze through small places.

The Groco HF model has an extremely minor change—a T-shaped handle to replace the former knob. The head comes standard with a bronze base, which is a sound choice of materials. It also has good, robust valves and seals.

It is a shame that some builders, even of boats that sell for prices well up into six figures, opt for these "economy model" heads, purely because the buyers are not, perhaps, experienced enough to know about, let alone demand, a higher-quality head.

MEDIUM-PRICED HEADS

The medium-priced heads are Raritan's Model PH II and Cricket.

Raritan's Model PH II is plastic and has a side-mounted pump. However, the piston pump has an unusually large diameter (2-1/2") and is operated with a lever on an articulated hinge. The valves are spring-loaded balls and there is but one rugged flap valve, in the base of the bowl.

It's old-fashioned looking, but the excellently designed Raritan Model PH II is very easy to work on and the overhaul kit is inexpensive.

The out-of-production Crickets is smaller, with a more modern appearance and it's better engineered than the PH II.

Like the expensive heads described in the next section of this report, the Cricket has a double-action, lever-operated diaphragm pump built in its base. The waste from the bowl is drawn by the pump through a big, thick flap valve and expelled on the next stroke through a 1-1/4" discharge elbow. The flow path is very simple, involving only one 90° turn. The pump housing

Value Guide: Manual Marine Heads

Make	Model	Price (Discount)	Overall Size Height	Width	Depth	Base Material	Pump Material	Diameter
Blake	Baby Blake	$1,650	17.5"	20"	19"	Bronze	Bronze	2-1/2"
Groco	Model K	$482	15.5"	16.5"	16.75"	Bronze	Bronze	3"
Groco	Model HF	$178	13.75"	17.6"	15.5"	Bronze	Plastic	1-3/4"
ITT/PAR Jabsco	Compact	$140	13.2"	17.75"	16.75"	Plastic	Plastic	1-3/4"
Lavac	Popular	$270	13.8"	13.5"	16.3"	Plastic	Plastic	(see copy)
Raritan	PH II	$230	14.5"	18.2"	19.25"	Plastic	Plastic	2-1/2"
Raritan	Cricket	$208	15.8"	16.75"	17"	Plastic	Plastic	3-1/2"
Wilcox-Crittenden	Head-Mate	$140	13"	16.75"	17"	Plastic	Plastic	2"
Wilcox-Crittenden	Skipper	$781	16.2"	16.5"	17"	Bronze	Bronze	4"

gasket includes a simple, cam-actuated valve to shift from "dry pump" to "flush."

The Cricket's only negative is that getting at the pump's innards (for service or clearing clogs) requires the removal from the bottom of 10 machine screws, some of which are difficult to reach, especially when replacing them.

Most of the advantages of the diaphragm pump, as enumerated in the next section about premium heads, apply to the Cricket.

The Cricket is a purely manual pump. It cannot be electrified, like the PH II, which is perhaps another reason why Raritan keeps the PH II in production.

For the money, these medium-priced heads all have good pumps and strong valves. They are far better designed and built than the "cheapies" and much easier to service with the standard repair kits.

PREMIUM HEADS

At the top of the heap are the Baby Blake, the Groco Model K and the Wilcox-Crittenden Skipper ($781). The price range is considerable.

The Groco Model K and Skipper both have bronze pumps below the bowl, which gives them a huge edge over heads with small side-mounted pumps. Included in the "pluses" are the size of the pumps, the pumps' locations and their strong lever actions. With these pumps, the undesirable matter drops straight down and is expelled through one 90° turn, a considerable advantage over the route taken by waste matter via a side-mounted pump.

A side-mount piston pump must draw the waste down, through a turn to the pump base, through another 90° turn up into the pump, and then through another turn through the joker valve into the discharge line.

Groco's Model K, has a 3" diameter pump below the bowl. It is a rugged mechanism that should resist clogging. The Model K is sealed with two simple O-rings, which lead to the only negative comment about this otherwise excellent head. The O-rings are not easy to replace. The entire head must be disassembled to do so.

The Skipper, unchanged for years, has an enviable reputation. It's big, heavy, and reliable. Its position as a top-flight head rests on that desirable quality mentioned earlier—it comes closest of all heads to "working—all the time, without fail." Hinckley used to special order Skippers with all exposed metal parts chrome-plated.

It has a big 4" bronze pump operated with a 26" lever. The pump piston has a thick leather seal, and the valves are big and tough.

With the Skipper, most any clog can be cleared just by laying into the lever. That's good, because if it does clog, it's difficult to work on.

The other head in this premium group—the British-made Baby Blake—is almost revered. Other than using better materials for the seals (the changes were made in 1992), this bronze classic has not, believe it or not, been changed in about 70 years.

The Blake has a side-mounted pump built to last. In fact, it has two of them—a lever-operated version for discharge and a piston-type for washdown. The pumps have both lip seals and gland packing, and it's the gland packing that does the work, with the lip seals providing back-up protection against leaks. The Blake has a built-in water shut-off valve (very handy), a mahogany seat (painted white), and, of course, a bowl that used to be made of Royal Doulton china (the one we examined was not labeled).

The Blake comes in right- and left-hand versions, offered, we suspect, not only to fit various installation situations but to accommodate human differences. Besides the Baby Blake,

Clear, reinforced PVC hose, while fine for pressurized freshwater systems, is not a good choice for tight turns or suction-side applications, and it won't fight odors as well as a premium hose.

there are two other models (the Minor and the Victory) with different space dimensions.

The Blake's "Spares Kit" costs nearly as much as several of the low-cost heads discussed above. Should you elect to do your own maintenance and repairs, Blake's set of two keys and five spanners (wrenches) is a desirable option.

THE BOTTOM LINE

Perhaps it would suffice to say, "Don't choose an economy model head, unless you have no choice." If in a corner, the Groco HF definitely is preferable; it's well worth the extra $30.

The medium-priced heads are head-and-shoulders above the economy models. Raritan's new Cricket has a great deal to recommend it, including its looks and the fact that it is the only relatively low-cost head with a diaphragm pump built into the base. However, despite it being known as the "Fred Flintstone Model" around Raritan's empire, we'll take the Raritan PH II for the day-in-day-out reliability you want in a head.

Choosing among the ultimate heads is a bit easier.

If you want the head without which noted bluewater voyager Eric Hiscock said he would not sail, if you think antique iceboxes are gorgeous, and if you don't mind having your pocket picked, pay the shot and go for the Baby Blake. It's a tremendously refined and archaically elegant contraption upon which to sit and read Frankenstein (which was written by Shelley's wife).

The Wilcox-Crittenden Skipper, although out of production, also deserves its lofty reputation, and it is a fine choice, if its weight and size are not a problem.

However, coming in lighter, smaller and for less money, the Groco Model K is the most logical choice—and it's still available new..

Head-to-head Field Test

As our bench tests showed, a good marine toilet doesn't come cheap. But how much better is a more expensive head when it comes to real-world use? Despite many bench tests of manual flush heads over the last 30 years, *Practical Sailor* had never carried out a long-term test of two different manual flushing toilets on board a boat. The opportunity for such a test presented itself when *Practical Sailor* contributor Mike Slinn was in need of two new heads for his Beneteau First 435. Thus, with our resistance to bad puns exhausted, *Practical Sailor* plunged headlong into the abyss and began our head-to-head test of two different brands of toilet.

WHAT WE TESTED

Based on past testing, budget, and time constraints, the initial contenders for this comparison were whittled to four: the Jabsco Compact Marine manual head, the Wilcox-Crittenden Headmate, and the Raritan PHII.

After attempting to revive an existing Headmate, we ultimately settled on the Jabsco Compact and the Raritan PHII, both of which were near drop-in replacements for the Headmates formerly installed on Slinn's Beneteau.

The Raritan PHII was an obvious choice. It remains one of the most popular heads on the market. Installed as original equipment on many boats, the Jabsco Compact also commands a large share of the market. It is also one of the least expensive heads available.

So the challenge was on: In terms of installation, maintenance, ease of use, and, most importantly, reliability, which head would come out on top—the Raritan PHII or the economy-oriented Jabsco Compact?

HOW WE TESTED

This long-term evaluation aimed to offer a different perspective. It focuses almost exclusively on the real-life installation and use of the heads. The test aims to be as objective and fair as possible, but—as with any project that involves a tester's digestive tract—there are many uncontrolled variables. These will be accounted for in the final conclusions. (We encourage readers who have experience with either of these heads—or any others—to submit their observations to the editor at practicalsailor@belvoirpubs.com.)

The test protocol was straightforward. We ordered the prospective heads, examined the products and accompanying documentation, and installed the heads according to the manufacturer's instructions. Customer service for the manufacturers was rated after testers contacted each at least three times. Once installed, the heads were immediately put into use.

As much as possible, the heads will be used equally during the course of the test period, and they will be maintained according to the manufacturer's guidelines.

The long-term comparison of the two heads is an ongoing project.

JABSCO COMPACT

The Jabsco Compact Head is made by ITT Corp., based in White Plains, N.Y. ITT is a $7.8 billion company employing 40,000 people. ITT also makes Rule, LVM, Sudbury, Flojet, HydroAir, and Danforth products.

We found the Jabsco for $140 online. The parts kit was $65. This head is well packaged, with a good eight-page manual and many helpful pictures that make it easy to install.

Because the toilet's base was longer than that of the Headmate it replaced, a new mounting platform was cut out of

PS VALUE GUIDE **LONG-TERM COMPACT MANUAL TOILET TEST**

PRODUCT	PRICE	WARRANTY	EASE OF INSTALL	OWNERS MANUAL / INSTALL GUIDE	PERFORMANCE	CUSTOMER SERVICE	DESIGN/ CONSTRUCTION
Jabsco Compact $	$140	1 year	Excellent	Good/Good	Good	Good	Fair
Raritan PHII ✓	$299	1 year	Good	Excellent/Good	Good	Good	Good
Lavac*	$350	1 year	NA	Good	NA	Good	Good
Wilcox-Crittenden Headmate	$150	1 year	Good	Good	Fair	Fair	Fair

$ Budget Buy ✓ Recommended *The Lavac and a new Headmate were considered but not installed for this two-head comparison.

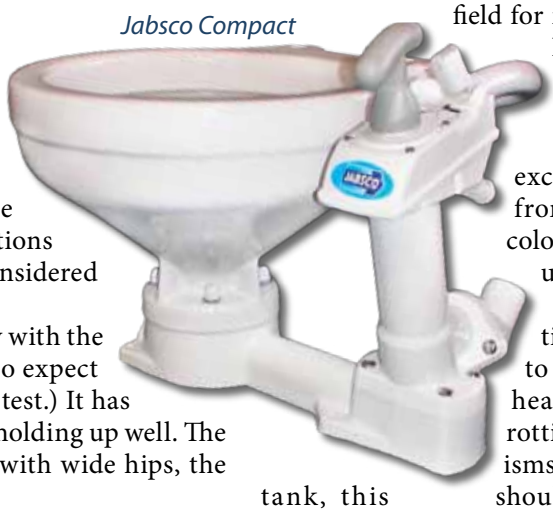
Starboard. Once that was taken care of, the head was easily installed in less than an hour.

The head has worked smoothly and easily. The piston-type pump is oriented at a slight angle off the vertical, which makes it easier to pump. Some squeaking has been noted, but it still is performing well without any apparent leaking.

Three sticky-back instruction sheets (in Spanish and English) came with the head, for application on and around the toilet. These were by far the best instructions for novices of all four of the heads we considered for this project.

Bottom line: So far, we are quite happy with the Jabsco, but past experience tells us not too expect too much. (It rated low in the last bench test.) It has begun to squeak slightly, but seems to be holding up well. The only other complaint was that for users with wide hips, the handle tends to stick in the thigh.

Jabsco Compact



RARITAN PHII STANDARD

The Raritan PHII Standard Head is made by Raritan Engineering Co., based in Millville, N.J. Most of the parts, according to the company, are manufactured in the United States. Raritan also makes holding and water tanks, a rudder-angle indicator, waste treatment products, water heaters, and a marine ice-cube maker.

The price of the Raritan ($300 online) has gone up significantly in recent years. According to Raritan, this is partially due to the rising price of raw materials.

The PHII head is well packaged for shipping, secure enough that it will likely survive a flight into Kapingamarangi atoll (an entry point into the Federated States of Micronesia), should the need arise.

The plastic base is only a quarter-inch thick. Although there are six bolts to help distribute the load, we used large washers between the head and the bolts for mounting.

A minor point worth mentioning is that the Raritan features four different shades of white while the Jabsco is of a more uniform white. A plastic skirt (yet another shade of white) is intended to improve the Raritan's appearances, but we suspect that this will become a fertile field for mold. (The boat's former toilet, the Headmate, faded to a uniform and unattractive yellow over the course five years of use.)

The Raritan's 12-page manual is excellent. The PDF version, available from the manufacturer's website, has color cutaway photographs of an actual unit, with the parts labeled.

The Raritan installation instructions were the only one we reviewed to suggest an inline strainer. Since head odors are often attributable to rotting seaweed or small marine organisms that meet their end in the holding tank, this should help reduce odor. The trade-off is an added expense, a potential source of leaks, and another maintenance point.

For mounting the head, 5/16-inch lag bolts worked best. The installation document suggests nothing smaller than a quarter-inch but does not specify the optimum diameter.

As with the Jabsco (and the Headmate, for that matter), there is no mounting template for the PHII. While it is easy enough to make a cardboard template, this is something the manufacturer should provide, in our opinion. Again, testers had to make some minor adjustments to the mounting platform on the Beneteau. We used half-inch-thick Starboard to make the platform a little deeper (front to back).

Raritan PHII Standard

On both of these heads, there is a switch to control the valves that allow water into the head for flushing. To empty the head, the switch is put in the "dry" position. Initially, the Raritan pump seemed to require a bit more effort to clear than the Jabsco or the Headmate it replaced, but an improved hose run at the inlet

solved this problem.

Bottom line: The Raritan is more than twice the cost of the Jabsco, but the pump seems to be holding up slightly better. *Practical Sailor*'s previous studies have rated the materials used and the internal workings of this head to be superior to those on the Jabsco, but it will be interesting to see how much of a difference this makes over the long term.

CONCLUSION

So far, both the Raritan and the Jabsco rate higher than the Headmates they replaced. Considering the huge price differential, the less-expensive Jabsco is a surprise, although it seems to be slowly getting a little stiffer to pump. Also, a powdery black substance is accumulating below the pump handle. Presumably the rubber seal is starting to give way.

If you expect to use your head hundreds of times a year, or you plan to be cruising off the beaten path, the Raritan looks to be the better option of the two. But if you are keeping your boat in home waters, and cruising infrequently, the Jabsco offers an economical option. You can effectively buy two Jabsco's to one Raritan, although it's hard to put a price on the frustration associated with a broken toilet.

Tech Tips

One of the chief causes of head odors is poor maintenance or design of the onboard sanitation system. The hose and hose connections are often, but not always, the culpable components.

Good hose is useless if the unions are not well clamped. Barbed hose end fittings should be snug and securely sealed and, of course, free of leaks.

All hoses fail. You can prolong the life of your hose and prevent odors by ensuring there are no loops that can trap sewage. The easiest way to identify a failed hose, is to rub a clean cloth along it and sniff it every foot.

Rigid PVC tubing will also contain odors well, but it is only suitable for long, straight hose runs between the head and holding tank. If there are many bends and unions, they will only introduce more potential for leaks.

Some head odors come from rotting organic matter, such as seaweed and krill in the intake line or holding tank. Boats that have ready access to a dock or adequate freshwater capacity (either in tankage or watermaker) may want to consider upgrading to a freshwater-flush system.

Saltwater heads will benefit from a freshwater flush as well. Some head odor problems can be resolved simply by a routine flush—losing the seacock and flushing freshwater through the head.

More tips can be found in Peggy Hall's book "Get Rid of Boat Odors," available on www.amazon.com

Chapter 3

Vacuum-flush Toilets

In our ongoing effort to evaluate on-board sanitation equipment, we had an opportunity to test some toilets that rely on a vacuum (negative air pressure) in the lines for flushing.

Similar to the types of toilets found in airline lavatories, these toilets are touted for their ability to flush with very little water. In order to reduce water use, some newer homes are employing pressure-assisted toilets that operate on a similar principle.

Most makers also claim the design helps eliminate odors and keeps the system cleaner and bacteria-free since they use onboard fresh water, instead of raw sea water, for flushing. Most vacuum systems use only about 2 pints of water per flush, so they conserve the fresh water supply and increase holding-tank capacity.

WHAT WE TESTED

PS worked with two electric vacuum-flush units from Dometic Corp. and a manual unit from Blakes Lavac Taylors. The Dometic Group also markets products under the Sealand brand name.

Dometic offers a wide range of marine sanitation systems and toilets in addition to the six different series of its VacuFlush line of vacuum toilets. Its 5000 series of compact VacuFlush toilets is geared for medium-size sailboats. The No. 5006 is the shortest in the series. We tested the taller No. 5048 and No. 5148.

For sailors looking to replace older, compact manual heads, the 140 series will likely be a better fit, and for owners of larger yachts who want a residential-style toilet, the premium-grade 4000-series models are worth a look.

The Blakes Lavac toilet is a manual toilet system that is made in the United Kingdom. It is significantly different from the VacuFlush toilets in that the powerful suction is generated only during flushing, whereas VacuFlush lines are airtight and kept at a constant negative pressure.

The Lavac was first introduced in 1963 and has served on many small sailboats around the world. It is imported into the U.S. by St. Brendan's Isle Co. in Green Cove Springs, Fla. As we reported in our last comprehensive test of manual toilets in September 2000, it is small, relatively inexpensive, easy to use, and easy to maintain.

HOW WE TESTED

As in our previous toilet evaluations this year, this was a controlled bench test. We compared size, weight, price, style, features, and functions. We reviewed installation instructions and documentation, parts inventory, construction and ruggedness of materials, ease of installation, installation options, added features, and customer service.

To test the electric toilets, we hooked up the Dometic vacuum pumps to a fully charged, 12-volt battery and installed the proper hoses for water intake and waste discharge. The installers evaluated the ease of electrical and plumbing hookup, commented on possible ease of maintenance, and compared functions. Testers also measured amp draw, sound level, and ease of use. For filling, flushing, and rinsing the Dometic units, which call for a pressurized water supply, testers hooked up a standard three-quarter-inch garden hose at low pressure to draw water into the bowls. The Blakes Lavac toilet is manually operated, so it didn't need 12-volt power, nor did it need a pressurized water intake.

To compare flushing, we mixed equal batches of "faux poo," consisting of a rotten banana and 4 feet of West Marine Pure Oceans single-ply, quick-dissolve tissue paper, and evaluated the speed and efficiency of the waste discharge.

It is worth noting that Dometic included a bright yellow "Technical Alert" sheet that specifically called for quick-dissolve toilet tissue used in these systems. One brand in

During the evaluation of the VacuFlush systems, testers used a six-foot hose run between the toilet and the vacuum generator.

particular, Charmin Ultra-Soft toilet tissue—was cited as a known cause of clogged vacuum generators and tanks. The company recommended Sealand Ultra Two-ply TP, although we found others that dissolved just as well or better in our recent toilet paper test.

DOMETIC (SEALAND) NO. 5048

This is a standard, mid-size toilet with a semi-oval ceramic bowl sitting on an 8½-inch diameter plastic base. The base has a white plastic cowling that wraps around, snaps in place, and is held by one screw. The cover is purely cosmetic, adding smooth curves to the toilet's base. It has a heavy-duty wood lid and cover. For our first test, the waste outlet of the 5048 was led to the J-series VG4 vacuum generator (described below).

On the side of the toilet is a control handle and valve that you control with your foot. (Dometic's electric units have a bulkhead-mounted push-button as an option.) Various sensors and panels to check for vacuum leaks or monitor holding-tank level are optional.

Lifting up the foot pedal allows water to enter the bowl. Pushing down opens the water inlet valve as well as a 3-inch diameter plastic ball valve at the bottom of the bowl. This opens up the suction line, allowing the vacuum generator to suck out water and waste from the bowl and pump it into the holding tank. The water and waste are pulled through a small 1-inch opening under the ball valve. This passage is deliberately sized smaller than the other plumbing to make it easy to clear any foreign material that might clog the system. The vacuum in the line automatically re-charges after each flush. In our installation, with 6 feet of hose between the vacuum generator and the toilet, this took 30-40 seconds.

PS VALUE GUIDE — VACUUM-FLUSH TOILETS

MANUFACTURER	DOMETIC (SEALAND)		BLAKES LAVAC
MODEL #	5048	5148	TLZ 0801
NAME	VacuFlush ✓	SailVac ★	Popular $
PRICE	$1,682	$1,772	$439
TYPE (AS TESTED)*	Electric, separate vacuum generator	Electric, combined tank-vacuum	manual diaphragm pump (TLZ 9090)
BOWL MATERIAL	China	China	China
SIZE (H-D-W)	16.5 x 18 x 15 in.	15 x 18 x 15 in.	12 x 15 x 13.5 in.
WEIGHT	28 lbs.	28 lbs.	17 lbs.
PORT SIZES (IN/OUT)	½ in. / 1½ in.	½ in. / 1½ in.	½ in. / 1½ in.
RUGGEDNESS OF PARTS	Fair	Fair	Fair
STYLE & APPEARANCE	Oval bowl	Oval bowl	Round bowl
AMPS PER SPECS	6 amps	3 amps	None
MAX DISCHARGE HEIGHT/DISTANCE	12 feet / 70 feet	5 feet / 13 feet	Not stated
WARRANTY	1 year	1 year	1 year
TEST RESULTS			
SOUND LEVEL	69 decibels*	68 decibels*	65 decibels
CONSTRUCTION	Good	Good	Fair
WATER USAGE	1.5 pints	2 pints	5 pints
BANANA & PAPER EFFICIENCY	Good	Good	Excellent
EASE OF MAINTENANCE	Fair	Fair	Excellent
EASE OF INSTALLATION	Fair	Fair	Good

★ Best Choice $ Budget Buy ✓ Recommended *Does not include momentary 'pop'

The operation of the ball valve at the bottom of the bowl depends on the tight fit of two, round, 7-inch rubber gaskets. These seals are Teflon coated and should last for years, but may need to be checked and cleaned periodically in order to keep an airtight seal. Cleaning is a simple matter of reaching down from the bowl with a sponge or brush, just as you would clean a home toilet. The use of clean fresh water will minimize the build-up of salts, minerals, and foreign material that might inhibit this seal.

Dometic offers several options for generating vacuum pressure in the lines, ranging from the compact S-type vacuum generator to the bronze-body M Series for multiple toilets. Our test toilet came with the new J-series VG4 vacuum generator and tank, which Dometic says employs its new "whisper quiet" technology. This is a white plastic box about the size of a toolbox—6 inches high, 7 inches wide, and 19 inches long—with flanges for securing to a floor or bulkhead and 1½-inch hose fittings for waste input and output.

On the top of the vacuum generator is a 12-volt, 6-amp motor to operate the vacuum pump. The motor is activated by a pressure-sensitive internal vacuum switch and is protected by an internal thermal cutoff switch. Early versions of the vacuum switch, which should not be adjusted by the user, had some problems, but according to Dometic, there have been very few switch problems since 2008.

To wire the generator, you simply connect the positive and negative leads to 12-volt power, with a 10-amp fuse or breaker to protect the circuit against over-current.

This J Series 6-amp motor is a good size for its dual function of sucking in waste from the toilet and pushing it out to a holding tank. Specifications call for locating the vacuum generator within 50 feet horizontally and 6 feet vertically from the toilet. The pump is supposed to push the waste up to 6 feet vertically overboard or to a holding tank. During our test, the pump managed to pulse waste out of the vacuum generator at the 6-foot level but did not clear the hose completely. Installers should aim for short hose

runs with the least amount of lift (the vertical distance a pump has move waste), particularly after the vacuum generator. The hose between the vacuum generator and the toilet typically retains little water because it is under vacuum.

Four bi-cuspid "duckbill" valves prevent any effluent from getting back into the toilet. When testers ran the vacuum generator outlet hose horizontally, all the water and waste was pumped out. The operation is fairly quiet except for one initial, quick "pop" in the bowl. The pump motor noise is a tolerable hum that lasts less than a minute (30 to 40 seconds in our installation) as the vacuum recharges.

VacuFlush 5148

During testing, we experienced one clog, as one of our test bananas blocked the inlet valve at the base of the toilet. (According to Dometic, our test bananas are denser than human waste.) We were able to dislodge it without too much trouble by reaching into the bowl with a plastic knife. To help clear clogs, four screws at the top of the vacuum generator allow you to easily remove the pump for access to the chamber below. The entire lid may also be removed for more thorough cleaning.

Bottom line: This unit generated the fastest, most powerful vacuum flush of the three toilets we tested, and the motor was surprisingly quiet—except for the pop, which was loud enough to wake sleeping bunkmates. The J-series vacuum generator permits a wide range of installation options. Since the generator becomes, in essence, a temporary holding tank for waste and paper, owners need to be vigilant about what goes in.

DOMETIC / SEALAND 5148

The bowl, seat, and cover of the No. 5148 we tested were identical to the No. 5048, but the base was smaller and about 1½ inches shorter. The white plastic base is all one piece without the extra cover. Unfortunately, the plastic threads on the half-inch inlet fitting on our test toilet were misaligned or damaged, and we had to find a replacement. The 5148 has a "pedal-lock" feature that holds the foot pedal down and flush ball open during a holding-tank pump-out.

The 5148 came with a SailVac VHT 5200, an integral vacuum generator and holding tank (14 gallons). This system could be used with any of the company's VacuFlush toilets, and is one of several integral vacuum pump/holding tank options that Sealand offers in sizes ranging from 6 to 14 gallons. The SailVac holding tank is specifically shaped to install vertically in the outboard bulkhead space in a head. It is exactly the same size as Sealand tanks already found on some production boats.

Sealand claims the VHT 5200 provides enough holding tank capacity for two people for four days, and we found this to be an accurate—if not conservative—statement. It comes prewired with a 12-volt, 3-amp motor, a vacuum pump, internal vacuum switch, and a tank sensor indicating when the tank is three-quarters full and full. There are also relays for an alarm and auto shutdown.

The tank is made of a green, heavy-duty polyethylene composite material and is 36 inches high, 20 inches wide, 11 inches deep at the top and 5 inches deep at the bottom. The 1½-inch diameter hose connections fit snuggly into three round, flexible, rubberized donut rings, which, in turn, squeeze snugly into the tank.

The threadless design allows the fittings to turn a complete 360 degrees to point in any direction, but the hose fittings and donut must fit smoothly and tightly in order for the tank to maintain the vacuum. One fitting is for the waste inlet from the toilet, and the other is an outlet to another holding tank, offshore pump-out, or dockside pump out.

The top of the tank has a 5/8-inch discharge fitting exiting the air pump to evacuate the foul odors while the air pump creates a vacuum. There is no vent in this system. The vacuum pump is quiet, but it takes longer for the system to reach a full vacuum. When powered up, the tank can take up to three minutes to reach a full vacuum after each use. This time becomes shorter as the tank fills.

The VHT 5200 tank may be up to 13 feet horizontally and 5 feet vertically from the VacuFlush toilet. The weight of a full tank is on the bottom of the tank, secured to the bulkhead with straps. The tank came pre-wired with a Sealand Tankwatch level indicator, a small 2-inch by 2½-inch flush-mount panel with a yellow LED for three-quarters full and a red LED for full. Several other tank-level indicators are available, and some of the ones *PS* last tested are also compatible.

Both of these Dometic vacuum toilets recommend a half-inch freshwater line with a water pump flow rate of at least two gallons per minute. Any of the freshwater marine pumps, we recently tested would provide more than enough water flow for this function.

Bottom line: The SailVac will appeal to owners of production boats that are already fitted with vertically oriented holding tanks of roughly the same dimensions. The SailVac took more time than the J-Series pump to restore vacuum pressure, but its integrated vacuum generator/holding tank design simplified installation. Owners of small boats may want to look at similar, smaller integral tank/pump options offered by Sealand.

BLAKES LAVAC POPULAR MODEL

Using the same type of manual diaphragm pump commonly used to dry up bilges, the Blakes Lavac does not require electricity or pressurized water. An electric version, however, is an option.

Blakes Lavac

The small white vitreous porcelain bowl is a mere 12 inches high and would typically be mounted on a small riser for added comfort. The base can be easily disassembled and turned to allow the discharge hose to be directed left, right, or back.

The white plastic seat and cover each have special round gaskets. The toilet seat must be closed, and these seals must seal properly when pumping to create the vacuum for flushing and to allow the pump to pull clean water in.

The separate white plastic diaphragm manual pump is

5¼ inches high and 7 inches wide with four flanges for securing to the bulkhead. It comes with a 12-inch stainless-steel removable pump handle that travels about 6 inches with each pump stroke. The top or front of the pump has a wide opening with a screw-on lid to access the rubberized bellows of the pump for cleaning.

For toilet installation, the pump should be installed and secured to a firm bulkhead above the level of the pedestal base at a minimum. This allows some clean water to remain in the bowl after each flush and allows water to drain out of the pump bellows. If installed level with or below the pedestal base, water in the bowl would instead drain out through the pump or collect in the pump instead.

To prevent back-siphoning, the installer must loop the ¾-inch inlet hose above the waterline at maximum heel. In addition, the installer must drill a small hole at the top of the loop and install one of two airbleed plugs that are included with the toilet. These air-bleed plugs release the vacuum after each flush and determine how much water is left in the bowl after each flush.

In addition to preventing back siphoning, this bleed hole relieves the pressure in the line so that the lid may be opened again after flushing. It also determines how much water will be drawn into the bowl for refilling after pumping has stopped. Normal operation leaves about a pint of water in the bowl, depending on the length of the intake hose and which air bleed plug is used. The bleed holes are tiny, so it's important to keep these clear of any debris.

To flush the toilet, you must close the seat and lid and give eight to 10 steady full strokes of the pump handle; pause for 5 seconds and repeat. More strokes may be necessary, depending on the length of the hose runs. Once a few installation issues were resolved (described below), our test toilet performed very well. It evacuated our bananas and toilet paper with an average of 16 to 18 strokes and about 4 to 5 pints of water. Lavac's tests show 3 to 4 pints.

Diaphragm pumps of this type are famously resistant to clogs. The valves and diaphragm last two to three years, but are cheap and easy to replace.

Like a few of the toilets in our other test, the Lavac makes the seemingly simple task of fastening a toilet seat to a toilet amazingly complicated. Six different pieces had to come together correctly before tightening the wing nuts to hold the lid down. Two of those pieces, a gasket and a wing nut, gave testers trouble and had to be replaced.

Since the vacuum principle of this toilet depends on the seat and cover sealing properly to the bowl, the hardware joining these pieces is critical. In any case, new gaskets and metal (metric) wing nuts from a local hardware store easily solved the problem.

During our first tries to fill the bowl, the seal around the seat and cover did not seem to hold a vacuum for more than 10 to 15 seconds. Testers could hear air sucking in after pumping. We replaced the seat and cover gaskets with new ones, and that immediately solved the problem. We recommend keeping a spare set if you plan to venture farther afield.

In our conversations with Lavac after testing, we learned that this gasket and hinge assembly has been improved, ensuring a tight seal out of the box.

Bottom line: This Lavac system is highly regarded by many cruising sailors for its simplicity and the robust construction. The diaphragm pump is difficult to clog, and if it does, it is fairly easy to clear. Flushing is efficient, requiring about 2 to 4 pints of water per flush.

CONCLUSION

Switching to a vacuum system requires some changes in habit. With the VacuFlush system, it is important to turn off the power to the system at a proper switch or breaker whenever leaving the boat for long periods. If any of the seals in the toilet or hoses should begin to leak, the vacuum pressure would drop and the vacuum generator would turn on automatically, gradually running down the ship's house batteries.

Users also will have to be more vigilant about what goes into the toilet. Reduced water usage means that the bowl is not rinsed as well. Some VacuFlush owners provide a separate small garbage bin for users to deposit toilet paper in.

Holding the vacuum pressure is critical. Any leak around any hose fitting would compromise the performance of the system. The installation guides suggest having a digital vacuum gauge (available from Sealand) to assure vacuum level integrity, and this would be a good addition on any boat planning a cruise of a year or more.

Although the vacuum-pressure reduces water usage, some of the best electric-flush toilets in our tests were also quite miserly with water, and more forgiving with solids. If you host many guests who are unschooled in the ways of the marine toilet, you should also look at other models from Dometic and other manufacturers that had vortex-type water pumps to break up and wash out solid waste. If you like the VacuFlush concept, consider having a pro install it, and explain how to operate, maintain, and troubleshoot the system.

The Blakes Lavac is best compared to compact manual toilets like the Raritan PHII or the Jabsco Compact. It is aimed at the basic, "keep it simple" sailor. It is relatively inexpensive, small, lightweight, easy to install, use, and maintain. It has very few moving parts and is definitely our Budget Buy choice in this comparison.

We recommend the VacuFlush system for the sailor who wants to be extra-stingy with water and wants the conveniences of a vacuum-type system. For new-boat buyers and builders, the more simple SailVac system or a similar unit with a matching holding tank and vacuum generator would be our choice. The VacuFlush with a separate vacuum generator is better suited for integrating into an existing holding tank system.

Chapter 4

Other Toilet Options

Composting Toilets • Porta Pottys

While electric-flush and manual-pump heads hold the lion share of the marine toilet market, there are other options available for those with limited cabin space and those who'd rather not deal with the potential headaches of a holding tank and its associated regulations.

Composting Marine Heads

Composting heads offer several big advantages for sailors: They require no through-hull fittings, no plumbing, and no separate holding tank. They have few moving parts. The solids are reduced fairly quickly, and take up less space than the mixed sewage, urine, and flush-water of a holding tank. On the negative side, the toilets themselves take up more space in the head compartment, they require a through-deck fitting and vent, and they need a constant supply of electricity (in very small to moderate amounts) to perform at their best.

Composting heads are essentially Type III MSDs, but with an important difference. Rather than simply storing sewage, composters separate the solid waste from the liquid portion, and convert the solid portion—the one that presents environmental problems—into an easy-to-handle, safe, non-odorous humus. The liquid waste is either stored or evaporated.

Composting of solid waste is a natural process. It's what happens to dead leaves on a forest floor, or to fallen trees. In the process of composting, or aerobic decomposition, oxygen-using bacteria feed on the organic matter. They consume carbon, nitrogen, phosphorus, and other nutrients, releasing carbon dioxide. This conversion of carbon to carbon dioxide produces a good deal of heat, warming the organic mass, and thus speeding up the reaction.

Composting is a process of aerobic digestion. Anaerobic digestion, which occurs when sewage is not supplied with sufficient oxygen, is a malodorous process, while aerobic digestion is odor-free. Composting MSDs require a lot of oxygen, and are usually equipped with fans to insure that there's an adequate supply. The sewage is mixed with a fibrous organic material such as peat moss, which serves to maintain a spongy mass that allows oxygen to penetrate. It also helps absorb excess liquid and supplies carbon to help maintain a good carbon/nitrogen balance.

A compost pile operating properly will heat up to about 140° to 160° F within a few days. Temperatures in this range will destroy disease-causing bacteria and protozoa (one-celled organisms.)

Temperatures will remain high for several days, after which it becomes necessary to mix the pile to provide additional aeration. Composting action can slow down drastically in cold weather, so a typical composting MSD will have an electric heater to make sure that the composing continues in the proper temperature range.

When the composting action is complete, what's left is a black odor-free powder that's free of dangerous bacterial contamination. It's safe and not unpleasant to handle, and can be stored in the MSD itself, or in plastic bags or any other container. The humus, however, cannot legally be dumped overboard within US territorial waters—it must be brought ashore and disposed of on land. It makes a fine fertilizer for your flowerbeds, but maybe not for your vegetable garden.

Urine, which presents much less of an environmental and health hazard than does solid waste, is a major problem with composting toilets. It can't be composted, and the boater using a composting MSD has only two choices: store it, or evaporate it. Stored urine, while not particularly hazardous, does develop a strong ammonia stink. Storage within the MSD itself is limited, so stowing it until landfall usually means transferring it to sealed plastic jugs, which add to the space requirements of a larger-than-usual head.

Evaporation works, but requires a lot of electrical power, which is often not available except from a shore supply. Urine, though it's virtually sterile, still is considered raw sewage, and can't be legally dumped within three miles of shore. Apparently you can't be fined for peeing overboard (unless they get you for indecent exposure) or for peeing while swimming, but you can't pee into a container and then pour it overboard.

AIR HEAD AND ECOLET MOBILE

We set up two composting toilets approved by the Coast Guard for marine use—the Air Head, which many have seen advertised in sailing magazines and at boatshows, and the standard version of the Ecolet Mobile, from Sun-Mar Corp., one of the biggest makers of composting toilet systems in the world.

The Air Head consists of only a few parts, none mysterious. There's an upper unit with standard toilet marine seat assembly and a lever-operated trap door; a lower unit below the trap door to catch and compost solids, a liquids jug, a plastic "shroud" to hide the jug, and a vent hose with a small fan in the end to extract moisture from the solids tank. Inside the solids tank, there's a stainless stirring bar, activated from the outside by a stainless crank handle. There are stainless brackets to hold the whole unit

down. These are designed to be spread out sideways so that the tank can be removed for emptying. The main toilet elements are made of high-density polyethylene and are of excellent quality. All up, the empty unit weighs 18.5 lbs.

The Sun-Mar Ecolet is a somewhat more elaborate device. It has three chambers: a composting drum located under the standard-size toilet seat; a compost finishing drawer underneath the drum; and a lower evaporating chamber for liquids. The compost finishing drawer accepts partially composted material from the composting drum, and allows it to complete the composting operation without any introduction of raw sewage. There's a crank handle for rotating the composting drum and a drum lock arrangement for transferring material from the drum to the finishing drawer. The finishing drawer slides out to simplify emptying. There's a 3" diameter vent with a built-in 12-volt 4-watt fan.

To evaporate liquids the Ecolet is equipped with a 110-volt heating element that runs at 120 watts. (A 12-volt, 120-watt heater is an option.) The heating element should be run "if and when power is available." Otherwise, unevaporated liquid needs to be let out through a 1" drain and stored in a holding tank, or transferred to some other container for disposal.

The Ecolet is tall, with the seat 29" from the floor, so that a folding footrest 10-3/4" from the floor is provided. It's solidly constructed of fiberglass and stainless, and weighs in (empty) at 40 pounds.

Before putting the Air Head into use, we tried to see if we could make it leak water from the urine tank. We mounted the head on a board, as per instructions (and had to shim it forward 1/2" in order to get the spring-topped rubber gasket/stopper to make hard contact with mouth of liquid bottle). We then rolled the board back and forth across a barbell to 20-25° degrees either side, violently, to get a sloshing effect, with the bottle filled with water to the refill line. We were able to get one or two drops to appear outside the bottle mouth, but nothing more. Then we tilted the whole arrangement to 45° and sloshed hard. No leak on one tack; a few drops on the other. With the whole assembly held at 90° (full knockdown) for about 15 seconds, about 3 tablespoons of liquid dribbled out.

We also tried some pitching and hobbyhorsing movements, approximately 20° fore and aft. This had no noticeable effect.

We didn't subject the Ecolet to the same tilt tests, simply because there's no way for an appreciable amount of liquid to leak out unless the toilet is tipped beyond 90°, at which point we would have bigger worries.

We set up the Air Head in the *PS* office bathroom, tossed in a couple of small bags of peat moss for the start-up, per the instructions, and got to work (two men on the job).

We tested the Ecolet at a boat club in western Connecticut. Our test area consisted of a very small room—all right, a closet—and our testers were two stalwart volunteers from the club (again, both male).

Into the Ecolet drum, we added 1-3/4 gallons of peat moss mix and a quart of Sun-Mar Microbe Mix (topsoil, we're told, would also work), sprayed "Compost Quick" into the drum and evaporating chamber, and plugged in the fan and the heater. Testers were instructed to add one cupful of peat mix after each bowel movement, and to rotate the drum 4-6 turns every third day.

The Ecolet is rated by Sun-Mar for one adult in continuous/residential use, or three adults or a family of four including small children, for weekend or vacation use. The Air Head is rated for a month of everyday use by a couple, or roughly five months of vacation use by a couple. The bottom-line solids capacity for a five-month season (which allows the contents time to break down) is about 80 uses.

We used both toilets for four months.

THE AIR HEAD EXPERIENCE

The main idea of the AirHead, and the feature that separates it from the EcoLet and other composting toilets, is that it separates urine from solid sewage via the design of the upper part of the toilet. Liquids go down drain holes in the forward part of the bowl, and solids are dropped through a trap door into the main tank (solids tank). The liquid tank is emptied out, either ashore, legally offshore, or into a holding tank via an optional hose connection. The contents of the solids tank are mostly water anyway; they gradually break down and settle, with the liquid evaporating and being withdrawn through a vent hose by a fan, and out through a deck vent.

In dropping solid waste, you have a choice of going with the tank closed and using a coffee filter to make the catch, after which you open the hatch and drop filter and contents into the tank; or going filterless and making the drop straight through the open bomb-bay door. This method is simpler and makes for less paper and faster composting. After use, you shut the bomb-bay door and turn the stainless-steel hand crank half a turn or so to help mix and settle the contents.


AirHead

The separation scheme works fine for anyone sitting down. Men standing up have to aim for the holes—no big deal in a bathroom or calm water, more of a challenge in a seaway.

For optimum composting, the moisture in the solids tank should be kept at a certain level, not too soggy and not too dry. Too wet, and things get smelly; too dry and composting slows and it becomes hard to turn the crank. We found that it was no problem to balance the moisture. We never added water, but we occasionally added small amounts of peat moss to help drying.

For the first few days, the Air Head was quite aromatic, but then it took on that not unpleasant smell of peat and humus familiar to those who have used well-established outhouses. Within a week

after that there was virtually no smell at all, except for a short time after use.

We hooked the extraction fan (a muffin fan that runs, according to our measurement, at .049 amps) to a 12-volt power supply and ran it constantly. When we were in the office we ran the bathroom's regular AC fan vent, so that we were essentially venting into a vent. When we were away from the office we left the Airhead's muffin fan on, but turned off the bathroom vent. After the composting process was well established, there was very little smell day to day; after a weekend with no one in the office there was a slight musty smell in the bathroom.

We kept no strict account of pee-only sessions after noting that the urine tank holds a gallon safely—around 8-12 pees. It's easy to empty the tank on an unmoving platform, but would be somewhat trickier with the head compartment in motion.

In four months, two men made a total of 61 solid deposits, 26 in month one, 20 in month two, 8 in month three, and 7 in month four. These concentrations had more to do with our summer office habits than our gastrointestinal tracts.

We think the manufacturer's estimate of 80 uses is about right—our 61 uses, when settled, occupied about two-thirds of the solids tank. However, ultimate capacity assumes adequate evaporation and break-down time between deposits. It would be easy to imagine a family of four, or two couples, pressing the limits of the tank on a week-long cruise, if the Air Head was the only place to go and it could not be emptied out.

The way to avoid over-piling is to pay attention to the cranking and the addition of peat. We found, during heavier periods of use, that the only way to do this is to open the trap door and watch the distribution of material as you crank. You want to leave things level for the next person, then toss in a bit of peat to help the drying and reduce the smell of the new addition.

We had a mild infestation of sewer flies (aka moth flies, drain flies, filter flies) that lasted about 10 days. These are very small, fragile, mothlike flies that look and behave a lot like fruit flies. We've all seen them in our houses. According to an Ohio State entomology department fact sheet online, they tend to hatch in garbage, stagnant water, sewage disposal beds, rain barrels, etc. They live about two weeks. They're not much of a nuisance, but we didn't like them in the Air Head, so we sprayed 'em, turned over the compost, and sprayed again. Then we reversed the muffin fan in the vent line and put a shot of spray down through there. That seemed to do the trick. If the aerosol insecticide interfered with the composting process, we couldn't tell.

After four months of use, the Airhead weighed 33.5 pounds (10 lbs. top section, 23.5 lbs. solids tank). This would indicate that our 61 deposits reduced themselves to a mere 15-pound mass.

We did have some fit-and-finish quibbles. First, the gasket/stopper for the liquid tank needs to be strongly seated in the bottle mouth. It's held down on the lip of the bottle by a spring. A better arrangement, in our view, would be to have a captive, gasketed cap on the upper unit that would screw down on the neck of the bottle and pull the lip tight against the gasket. This would leave a small space under the bottle that would need to be shimmed, but it would be unlikely to leak in any seaway, and would be easy to engage and disengage.

The "modesty shroud" over the urine tank is a pain, requiring the removal of two knob-screws (and their painstaking reinsertion after emptying the tank). We ended up leaving the shroud off entirely and taping a piece of paper around the front of the transparent blue plastic urine bottle, in case any of our infrequent visitors might be offended by the sight of the seemingly green contents of the bottle. We would suggest a translucent bottle with a simple Velcro retainer strap, and no shroud at all. Ideally the bottle would show the level of the urine, but in no particular color.

The stainless bails that hold the Air Head to the structural surface in the head compartment are convenient, and we were surprised at how tenacious they were during our leak tests. Even so, we would probably use a different hold-down system between the head platform and the lower-unit carrying handles—maybe turnbuckles, maybe lashings.

THE ECOLET EXPERIENCE

By the time we shut down operations on the Ecolet, our testers had urinated 159 times and defecated 78 times (1.6 times per day and 0.8 times per day per person, respectively.) Neither reported any odor in the room (one of our intrepid engineers climbed up to the roof and reported a very faint odor from the stack for the first day or so and nothing discernible after that). The test was, in a word, uneventful.

Our testers had no real complaints about the Ecolet, except for the slightly messy necessity of adding peat moss with each bowel movement. Peatmoss is light and fluffy, and a bit difficult to handle without some spillage; we did our testing on land, and we'd expect that the task would be trickier in a seaway. Cranking the drum over every three days presented no problem, except for remembering when to crank. A calendar in the head would help in this respect. We tried turning off the fan for a week with no adverse results. It's likely, though, that the eight-foot stack we used was enough to provide a pretty good natural draft.

Urine proved to be no problem, as we kept the evaporative heaters connected for the duration of the test, and evaporation was complete. If sufficient power hadn't been available, urine would have to be stored, as with the Air Head.

CONCLUSIONS

Anything that can simplify matters of the head compartment—holes in the boat, plumbing, storage space for waste, pump-out hassles, expense—is devoutly to be pursued, and both the Ecolet and the Air Head are worth consideration.

The Ecolet will only fit on a boat with a good-sized head compartment. While its footprint is actually only marginally bigger than that of a standard toilet and plumbing fittings, it takes up a lot of cubic feet and airspace. And it needs plenty of electrical power to work at its best.

The Air Head is more suitable for boats with smaller head compartments and less electrical capacity. It will also require a smaller hole to be drilled through the deck for the vent.

The Ecolet is in some ways more "civilized" than the AirHead, in that its size, capacity, and mechanisms are designed to manage waste without much help or attention from you. The Air Head is smaller, a bit simpler, and demands very little electricity. The only trade-off we can find, however, will be a show-stopper for some people: To a certain extent you have to commune with your own waste, and that of everyone else who uses the head. Yes, you can get it to a point where it hardly smells, but you will be inspecting it, pouring it, stirring it, and generally living close to it. In our opinion, it's no worse than having it sloshing around in a holding tank, awaiting a trip to the pump-out station, but many would argue that waste out of sight is waste out of mind.

Sun-Mar Ecolet dealer prices range from $800 to $1,000; the Air Head costs $770.

Portable Heads

Aboard boats, head is indeed a four-letter word. Nothing good about 'em. They stink, leak, clog and break down. Not at all like your residential toilet that just seems to keep flushing as reliably and tirelessly as the Energizer bunny bangs his drum. But, of course, you have to have a head…or do you?

We'll explore that question vis a vis several products that aren't much more than buckets—or bags—with lids. First, however, we'll examine four popular portable toilets, whose low cost and utter simplicity might make you think twice about your "real" marine head, with pumps, hoses, springs, valves, through-hulls and myriad other failure-prone parts.

THE CASE FOR THE PORTA POTTY

The portable toilet was developed not only for small boats but also recreational vehicles, campers, and just about any place regular plumbing either isn't available or isn't wanted. If Thetford wasn't the inventor, this company did much to popularize the product, coining the term "porta potti" that is now universally applied to all brands, like Kleenex is to tissue. Out of respect for Thetford, when we refer to portable toilets in the vernacular, we'll spell potty with a y—porta potty.

The beauty of the porta potty is the almost total elimination of moving parts. The only ones of consequence are the pump that draws fresh water from the upper tank and rinses the bowl, and the handle-rod-valve assembly that opens the trap for waste to fall from the top tank/bowl into the bottom tank.

In the U. S., a distinct appeal of the porta potty is the U.S. Coast Guard's recognition of it as a "legal" head. That's because of its built-in, albeit small, holding tank. This logic doesn't fly in the province of Ontario, Canada, and some U.S. states, however, which stipulate that the unit must be permanently installed. But simply installing hold-down brackets, optional with SeaLand and standard with the marine Thetford unit we tested, isn't enough; the toilet also must be plumbed. SeaLand's SaniPottie 964MSD/965MSD models include the fittings necessary to discharge waste from the built-in tank to another remote holding tank, or deck fitting for dockside pump-out. You'd have to buy the connecting hose, of course. A 5/8" through-hull vent fitting is supplied as well. Thetford also offers MSD versions. Portable toilets are inexpensive; three of the units tested here cost less than $100.

Now for the downside to portables. Capacity is limited. Holding tanks in these models range from about 2½ gallons up to 6. Depending on the size of your crew, and how much food they're consuming (or beer), such small tanks can fill quickly. If you're still at sea, what do you do then? Dumping these into the lake or ocean (inside the 3-mile limit) is illegal.

It is therefore best to think of portable toilets as day toilets, for use on small boats that return to the dock each or every other night, where the tank can be emptied into a shoreside toilet. And that's the second disadvantage: You do have to look at, and smell, the waste as it pours out of the tank. But, if you use the recommended chemicals in the holding tank, the waste is broken down, colored (usually blue) and deodorized to the point that you won't gag.

Third and fourth disadvantages: Spills occasionally will happen, say on the bathroom floor of your marina, and require cleanup. And you've got to lug the tank up and down the dock, or on and off a trailered boat, a minimum of around 22 lbs. in our test.

Nevertheless, porta potties are marvelous little devices that are much appreciated on the boats in which they serve.

WHAT WE TESTED

The players: Thetford, SeaLand (now owned by Dometic), and Sanitation Equipment, which makes the Visa Potty. The design and manufacture of each unit remain essentially unchanged over the years. We looked at the very simplest models from SeaLand and Thetford and tried to take a fresh look at the common features of each.

While thumbing through the West Marine catalog, we also noted several products we thought worthy of examination: a rotomolded polyethylene seat that fits over most any bucket, and the PETT, a fold-up camp toilet that uses bags and a chemical that solidifies waste.

HOW WE TESTED

In deciding how to evaluate these inexpensive toilets, we focused on how most people use them, and the issues that are of obvious importance. These lead us back to the disadvantages listed above: capacity, weight, and spills. Capacity and weight are, of course, directly related: The more capacity, the

Value Guide: Portable Heads

SeaLand Sanipottie 964	
Capacity	3.25 gals. (top) 2.8 gals. (bot.)
Dimensions	16-1/2" L x 14-1/2" W x 12" H
Seat Hole	8-1/4" x 9"
Weight	10 lbs.
Strokes to fill	92
Oz. per stroke	3.9
Wt. (full tank)	22-3/4 lbs.
Warranty	1 year
Price	$69.99

Thetford 735	
Capacity	2.6 gals (top) 2.6 gals. (bot.)
Dimensions	15"L x 13-9/16"W x 12-1/16"H
Seat Hole	7-1/2" x 9-1/4"
Weight	7-3/4 lbs.
Strokes to fil:	160
Oz. per stroke	2.1
Wt (full tank)	23-1/2 lbs.
Warranty	3 years
Price	$119.99

Thetford 155	
Capacity	2.6 gals. (top) 4.3 gals. (bot.)
Dimensions	14-7/8"L x 13-3/8"W x 14-1/2"H
Seat Hole	7-1/2" x 9-1/4"
Weight:	8 lbs.
Strokes to fill	145
Oz. per stroke	2.3
Wt. (full tank)	38 lbs.
Warranty	3 years
Price	$89.99

Visa Potty 248	
Capacity	3.7 gals. (top) 4.8 gals. (bot.)
Dimensions	14-1/2"L x 14-5/16"W x 16-1/2"H
Seat hole	9" x 10-1/2"
Weight	9 lbs.
Strokes to fill	141
Oz. per stroke	3.4
Wt. (full tank)	40-1/4 lbs.
Warranty	1 year
Price	$99.99

more the filled tank weighs. So the advantage of a large holding tank, which requires less frequent emptying, is partially negated by having to lift its heavier weight. A dolly or dock cart would come in handy here.

Your decision on capacity is probably a personal one, varying with how big and strong you are, the number in your typical crew, and so on.

We measured capacity, and weighed the filled tanks so you have a basis for comparison.

Each toilet was filled and flushed, with the number of strokes counted. This gives an idea of how much water is flushed with each stroke, and that is useful information in relation to how well the bowl is rinsed, and the number of flushes one might expect. (Strokes were counted to empty the top tank, or fill the bottom tank, whichever came first.) But there are variables for which one can't easily account. For example, urine requires perhaps one pump stroke to flush, whereas a stool may require half a dozen, depending on whether you first wet the bowl or not.

We then emptied that tanks, noting convenience of the caps and spouts, vents, and spillage.

Lastly, mention is made of the various features, such as level indicators, caps, and locking mechanisms.

THETFORD PORTA POTTI 735

Though it's difficult to tell, the two Thetford models tested are from different model series, each with half the tank capacity of Thetford's larger AquaMate models. The 735 is from the marine series and comes with hold-down brackets and a tank level indicator. It holds just 2.6 gallons in each tank, the lowest number of the four models tested. Yet it required the most strokes to empty the top tank, meaning that less water is used with each stroke—about 2 ounces. You can look at this two ways: either the 735 conserves water best, or requires more strokes to flush. Frankly, we wished for a little more flow from this pump; none of these toilets pump easily. The bellows pump depresses just an inch or so. The company says it's good for about 27 flushes; that's six strokes per flush.

The fill cap is a non-threaded twist lock with side vent. Every toilet has one, and water can leak out the pinhole if tilted too far. Water also can leak out the flush tube in the bowl, but shouldn't if you carry the upper tank by its handle.

The two tanks are secured by a sliding lever on the back side of the toilet; at first, it isn't immediately obvious which way one should push the lever, but you have only two choices, right?

The permanently attached pour-out spout works very well

and is less likely to splatter than those with caps directly on the tank.

The holding tank level indicator is a green gauge that turns red when full. Handy, but honestly, you're probably going to have a visual of the tank contents every time you use the toilet.

Hold-down brackets come with the toilet.

Bottom line: We like the pour-out spout, but its price and limited tank size are drawbacks.

THETFORD 155

The 155 is a non-marine model, but has many features in common with the 735. One big difference is its larger holding tank—4.3 gallons versus 2.6 gallons. This means it is more than 2 inches taller, which, unless vertical space is critical, is a double bonus because it makes sitting a little easier. (The 135—which *PS* didn't test— has the same size holding tank as the 735 and sells for $10 less than the 155.)

The holes in the seats of the two Thetford models are the narrowest at just 7-1/2 inches, so people with big bottoms—even average ones—may find the Sanipottie or Visa Potty more comfortable, or a larger Thetford model such as the AquaMate series. Men, in particular, may find that there isn't room for Mr. Ding-a-ling to dangle.

Molded into the top of the bottom tank is a deodorant storage compartment, which is handy, we guess, though you'll probably want to carry more than just one bottle, so you'll be stowing supplies elsewhere anyway.

The locking mechanism, rotating pour-out spout, and other features, are the same as on the 735, including the button you press to vent the bottom tank when emptying. The vent is an important feature since you can't empty the tank without it open. The rest of the time, especially when carrying the waste tank, you want it closed so nothing leaks out. Because you need to use two hands to empty the tank, you must depress the button with the thumb of one hand. It works.

The flush tube in the bowl of our unit was aimed a bit high; with aggressive pumping, water ran over the top of the bowl and down the side of the toilet.

Bottom line: A better buy than the 735, with almost twice as much tank capacity.

SANIPOTTIE 964

The grayish-colored Sanipottie doesn't look quite as clean or shiny as the Thetford potties, perhaps because it is made of blow-molded polyethylene instead of injection-molded polypropylene. As we pointed out in the previous reports, blow-molded tanks have no seams to be joined and the insides are uncluttered and easier to clean (usually by spraying a hose inside and rinsing several times). This also enables SeaLand to use an external slide valve mechanism threaded to the top of the waste tank that remains free of waste contamination.

The vent in the top tank is a pinhole in back of the seat. The bottom tank has no vent, which means waste may burp a little when emptying, though we found little splashing in our tests.

Like the Thetford toilets, pumping is much easier if you close the seat and cover, which otherwise obstruct your hand. Okay, so you didn't want to look at the waste anyway, but now you can't tell when the bowl is thoroughly clean. You have to lift the lid and take a peek.

Unlike the other three toilets, the Sanipottie holds more water in the top tank than in the bottom. This means you'll have water left over, though not enough, probably, to avoid filling it at the same time you empty the bottom tank. Seems like the extra capacity could have been given to the bottom tank instead.

The bellows pump pushes nearly 4 oz. of water per stroke, the most of the four toilets. Flushing action doesn't cover as much of the bowl as the others, and that can be a problem.

The tank-locking system uses two latches that seem easier to use than Thetford's rear-mounted lever, though sometimes they fold under and one must fumble with them for a moment to get them free.

Optional hold-down brackets sell for around $20.

Bottom line: Nice price, but there are better flushers.

VISA POTTY 248

Largest of the four toilets, the Visa Potty 248 has a generous seat compared to the others. Its 4.8-gallon waste tank weighs 40 pounds full.

The mechanism that locks the two tanks together is simply two molded snap-flaps on the top half; set the top tank on the bottom and push. To unlock, pull out the flaps and lift. It works pretty well, if a little sticky at times, but if one of the flaps breaks, you're screwed.

The top tank has no handle so one must grab it by the lip, which isn't very comfortable.

The fill cap with vent hole simply presses on, but it surprised us by staying secure even when the tank was turned upside-down. The waste tank vent is a push-pull valve that is easy to operate—no thumb needed.

The Visa Potty comes with a drain spout that stores on top of the waste tank. You don't need to use it, but it helps. Unlike the Thetford spouts, which are permanently affixed to the tank, you must screw on the Visa spout each time, and then remove it.

Where the other three toilets have bellows to pump, the Visa has a piston pump, advertised as being "bi-directional," though little water moves with the down stroke. Of more significance is the split flush tube in the bowl, which sends water in both directions, doing a good job of wetting the entire bowl.

Each tank has a level indicator, basically a hole with a clear plastic cover that turns dark when full. We had to stare at each for a while to figure out what, if anything, was going on. Thetford's green-red indicator is better.

We purchased our Visa Potty from www.cabelas.com.

Bottom line: Expensive, but it has the largest seat, and we like the split flush tube that rinses the entire bowl.

THE PETT

This is a tough, three-legged thermoplastic camp potty that folds up to carry like a briefcase, or backpack. Open, it measures 14" x 14" x 18"; folded, it is 5" high. The seat opening is a full size 8-1/2" x 10".

To use, fit a WAG (Waste Alleviation and Gel) bag into the mesh that is suspended below the seat. These bags contain a

substance called Pooh-Powder that, according to the label, "will gel waste and kill odors in seconds, no spills." Each bag can be used four to five times. However, one should not dispose of the contents in a regular toilet plumbing system, but rather toss it into a garbage can. The company says the contents are landfill-legal. WAG bags are sold by lots of 12 or 100, and can be used in any other device as well, including a regular marine head should you not want to sully the holding tank (as in winter, when freezing is a concern). You can buy the Pooh-Powder separately and use your own bags, but just make sure you buy waterproof trash bags because not all are. Each WAG bag comes with a moist towelette, a tiny pack of toilet paper, and a reseal-able plastic pouch for containing the larger waste-filled bag.

The company also sells the PUP, a portable pop-up tent for privacy, but this would have little place on a boat.

The weight of the PETT is 8 lbs. and its price from West Marine is $92.99. Twelve extra bags (it comes with three) will run you $25.99.

Bottom line: Clearly this toilet is intended more for hikers than boaters. However, if you find it desirable to stow your head after use, the fold-up feature does recommend it. So does the fact it is made in the U.S.

BUCKET POTTY SEAT

The only thing simpler than a plain old poop bucket like the 'round-the-world racers use is a bucket with a seat on top, and that's exactly all the Bucket Potty Seat is. Marketed for use in boating, construction, hunting, and camping, the seat attaches to a 3- or 5-gallon bucket with a press fit. You can use a trash bag tucked between the seat and bucket to catch waste. Or better yet, buy some WAG bags from the makers of The PETT and turn your waste into a solid, more sensitively disposed lump. The seat measures 14-3/4" x 14-3/4" x 2-1/2" with a 7-5/8" x 9-1/2" seat opening. (Just for comparison purposes, a standard residential toilet seat hole measures about 8-1/2" x 10".)

We tried fitting the seat to several buckets and got the best fit with a sturdy 5-gallon tool bucket from Home Depot.

This product seems best suited to a boat with a cuddy cabin or no cabin at all. (Certainly if you have the space, a two-tank porta potty is preferable.) The weight of the Bucket Potty Seat is 2 lbs., and it seems like you could run over it with a truck and not hurt it. Price, from West Marine, is $25.99 with a one-year warranty.

Bottom line: Inexpensive and simple, the Bucket Potty Seat is a good choice for that "just-in-case" need on a day outing.

CONCLUSIONS

Looking first at the Thetford toilets, we fail to see justification for the higher price of the 735 "marine" toilet over the standard 155, which has a larger waste tank.

Priced slightly above the 155 is the big Visa Potty at $99.99, and slightly below, is the Sanipottie at $69.99. While the Thetfords have a nicer finish, and some clever extra features like the rotating pour-out spout and chemical holder, their seats are small compared to the other two. The Visa flushes better than the Sanipottie, and does have tank level indicators (though again we think they're pretty useless). The Sanipottie continues to represent, if not the highest quality, at least the best value among portable toilets.

If you want the biggest porta potty available (6.1-gals. waste tank), check out Thetford's AquaMate series.

For short, occasional excursions, the WAG bags available from the maker of The PETT really work well in any kind of receptacle, including the fold-up PETT or a plain old bucket. Suit yourself, or rather, seat yourself.

Chapter 5

Toilet Paper Test

Aah, just when you thought *Practical Sailor* had covered all marine issues, we found an interesting subject dear to your hearts, or bottoms. Something we all use every day, several times a day, and of concern to anyone with a marine toilet. Yes, we are talking about toilet paper, or as the manufacturers say "toilet tissue."

After getting several letters from readers on this subject, we decided to follow up our reviews of electric marine toilets with a look at the best tissues available for use in these toilets and on-board sanitation systems.

At home, selection of what toilet tissue to purchase is swayed by the major brands marketing for softness. Some of us may remember Mr. Whipple and his "squeezably soft" Charmin. For marine and RV use, strength and price are also important, but since mobile sanitation systems are more vulnerable to clogs and dependant upon holding tanks, a tissue made of quickly dissolving material may be more important.

Whether manual or electric, a clogged toilet or a fouled holding tank is no fun aboard any vessel. Most manufacturers of marine toilets do not recommend use of standard toilet tissues. Some offer their own tissues. Those tissues that break up quickly and easily dissolve in water normally lack the adhesives of regular toilet tissue.

In addition, there are environmental issues. Every American goes through some 24 rolls of toilet paper per year, and that paper doesn't just vanish when you flush the toilet. Consumers are looking for biodegradable materials that don't unnecessarily introduce dyes and harsh chemicals into the waste stream.

Clogging of sanitary lines, pumps and valves is an issue in many areas. In the Caribbean, Pacific Islands, undeveloped counties, and aboard some charter, ferry, and fishing vessels, you are encouraged to use a separate wastebasket for tissues. Some extra-cautious owners install signs saying that the toilet accepts only items that have been eaten first.

Historically, the Chinese started using linen and paper products for their toilet use back in the 14th century. In the U.S., sheets of medicated paper were sold in the 1850s, but the mainstream introduction of toilet tissue began at the start of the 20th century when the Scott Paper Co. cornered the market. Scott, now part of Kimberly Clark, still dominates the market. The company makes tissue for several different private labels, some of the marine tissues among them.

For marine and RV use, the aim is to create tissue to be strong enough to hold together long enough to do its job then quickly fall apart. It also should be as soft as possible, and immediately dissolve in water.

WHAT WE TESTED

Practical Sailor evaluated 10 toilet tissues from seven manufacturers: Coleman, Dometic, Kimberly, Thetford, West Marine, Camco, and Charmin. All are relatively well-known brands and readily available from local marine and RV distributors, or retail outlets. They are touted as being biodegradable, quick dissolving, and non-clogging. Prices vary significantly. One product was found under two different names, with one name selling for nearly 25 percent less than the other. It was no surprise that the "marine" product was the one with the higher price tag.

We did not attempt to test or verify all of the manufacturers' claims. For example, they all claim to be biodegradable. This is good, but open to wide interpretation. To an oil company, an oil spill in the Gulf is biodegradable, eventually.

Sunlight and bacteria will break down a lot of stuff that we put in the ocean, over many years. Most of our tested products claim to use recycled fibers with no specifics on where they come from, and some do not give what percentage is reused. Most say they are free of dyes and fragrance additives and many said they were septic-tank safe.

Greenpeace publishes a list of toilet papers that use post-consumer recycled paper. Only one of the products we tested, Charmin Ultra Soft, was on its list, but it was given a "don't buy" rating because, according to Greenpeace, it contains no recycled materials.

While Coleman targets the camping market and West Marine is strictly a marine distributor, three of the companies manufacture sanitation products for both the marine and RV markets, and Scott is big in paper products. All of these products are specifically designed not to clog toilets. As mentioned, Charmin was added just to have a comparison with a major brand not claiming to be quick dissolving. Pricing can vary considerably between retailers, special offers on the Internet, and normal fluctuations in paper products.

HOW WE TESTED

This toilet paper evaluation aimed to find out three things: how quickly the different TPs dissolved in water, how strong they were, and how soft they felt. Each brand was given a number (1 through 10) for blind judging. Four sheets from each roll were crumpled and placed in a clear plastic canister with two quarts of lukewarm water and were stirred for five seconds, or five swirls, with a plastic straw.

PS VALUE GUIDE QUICK-DISSOLVE TOILET PAPER

TYPE	MAKER	NAME	PRICE	ROLLS	SHEETS PER ROLL	TOTAL AREA/ PER PACK	PRICE/SQ. FT.	SHEET SIZE	WEIGHT	DISSOLVE RANK	TEAR STRENGTH RANK/WEIGHT	SOFTNESS
SINGLE-PLY	COLEMAN	Rapid Dissolve	$3	4	NA	NA	NA	4 x 4.5 in.	3.2 oz.	2	10 / 2.08 oz.	--
	DOMETIC $	Sealand Toilet Tissue	$3.50	4	500	234.4 sq. ft.	3.4 cents	3.75 x 4.5 in.	3.5 oz.	3	8 / 5.17 oz.	--
	KIMBERLY ★	Scott Rapid-Dissolving	$3	4	308	143.6 sq. ft.	2.1 cents	4 x 4.2 in.	3.9 oz.	1	9 / 4.42 oz.	--
	THETFORD ✓	RV/Marine toilet tissue	$3	4	350	163.3 sq. ft.	1.8 cents	4 x 4.5 in.	3.7 oz.	3	6 / 5.5 oz.	--
	WEST MARINE	Pure Oceans Mega Roll	$4.20	2	1,000	229 sq. ft.	1.8 cents	3.75 x 4.4 in.	6.7 oz.	4	7 / 5.42 oz.	--
TWO -PLY	CAMCO	TST RV & Marine Mega Roll	$6.10	4	500	245 sq. ft.	2.5 cents	4 x 5.5 in.	5.6 oz.	5	3 / 11.92 oz.	--
	CAMCO*	Ultra Soft	$4.40	4	500	245 sq. ft.	1.8 cents	4 x 5.5 in.	5.6 oz.	5	2 / 12.08 oz.	--
	CHARMIN	Ultra Soft-Double Rolls	$3.30	4	176	83.5 sq. ft.	4 cents	4 x 4.5 in.	3.6 oz.	6	5 / 9.25 oz.	1
	THETFORD	Aqua Soft 2-ply Toilet tissue	$6.20	4	396	184.4 sq. ft.	3.4 cents	4 x 4.2 in.	5.3 oz.	5	4 / 10.92 oz.	2
	WEST MARINE	Pure Oceans Marine Toilet Tissue	$6.30	4	500	229 sq. ft.	2.8 cents	3.75 x 4.4 in.	3.7 oz.	5	1 / 12.83 oz.	3

★ Best Choice ✓ Recommended $ Budget Buy * Same as Camco TST RV

Testers made initial observations and notes, waited five minutes, stirred again for five seconds, and made more notes. We let them stand for an hour, then mixed it up again by gently shaking, not stirring (to satisfy 007). Testers observed and noted differences.

To test strength, we used spring-clips to attach a plastic bag to individual sheets of tissue. We then added ¼-ounce fishing bullet weights until the tissue tore. Each product was tested three times to confirm the weight of the breaking point, and the average listed on the Value Guide table. The brands were ranked for strength (1 being strongest).

Thickness was tested with a Starrett #1010L gauge, and weight was measured on a Pitney Bowes postal scale.

To evaluate softness, seven volunteers were enlisted for a blind comparison. The volunteers rated each product's softness on a scale from 1 to 5. The scores were averaged to determine the three softest products.

CAMCO TST RV AND MARINE

Marketed by camping and RV supplier Camco, the TST paper is sold through marine and RV outlets. It is exactly the same as the Camco Ultra Soft, which sells for about 25 percent less per packet. Touted to have no dyes or perfumes, and being fast dissolving and clog resistant, the TST paper was one of the strongest papers in our test.

Bottom line: Given its target market, the product was surprisingly slow to dissolve.

CHARMIN

We included Charmin Ultra Soft, made by Proctor & Gamble, as a benchmark and major supplier of "standard" toilet paper. It lived up to its reputation as the softest, whitest, and thickest. The rolls are light and fluffy, but had the fewest number of sheets per roll of our group. You are literally paying for air when you buy this product. It took four hours to dissolve, much longer than any other product.

Bottom line: It's as soft as Mr. Whipple says it is, but probably not the best thing for your holding tank.

COLEMAN

Part of the Coleman line of lanterns, camp stoves, and other camping supplies, this tissue was one of two we tested that are sold in a re-sealable plastic pouch. A rainy campout is bad enough, but wet or even damp TP is a mess, especially this brand, which seems to easily disintegrate in water. This four-pack is advertised as "rapid-dissolve" and "biodegradable." This was the only product that did not give the buyer any clue as how much paper they were getting for their money. Most products listed not only the total square feet of paper in the package, but also the size of the sheets and how many sheets were in each roll. Coleman did not even list the weight of the package.

This was the lightest roll in our comparison. It was only slightly lighter than the Scott, which held about 300 sheets per roll. It was the second fastest to dissolve and tore the easiest.

Bottom line: Coleman's paper dissolves quickly, but you don't appear to get much paper for your money.

DOMETIC

Dometic manufactures an extensive line of marine toilets and sanitation systems. The company specifies its Sealand rapid dis-

solving, single-ply toilet tissue for its toilets and sanitation devices. This toilet paper landed in about the middle of our group in terms of strength and ability to dissolve in water.

Per square foot, the Dometic TP tied the Thetford paper as the most expensive among the marine tissues, but it was still cheaper than Charmin.

Bottom line: It works as designed, and it gets our Budget Buy pick.

Thetford RV/Marine

THETFORD.

The Thetford RV/Marine, single-ply tissue also claims to "dissolve quickly" and to be "biodegradable." Thetford has an extensive line of toilets, chemicals, holding tank accessories and refrigerators for both marine and RV use.

These rolls were lightweight, tore easily, dissolved quickly, and were inexpensive. Thetford's Aqua Soft two-ply is a little heavier, stronger, and much softer. It does not dissolve as well.

Bottom line: Thetford's single ply was the third-fastest dissolving paper. Buy it from an RV store, where it'll be sold much cheaper than at a marine outlet.

WEST MARINE

The Pure Oceans Marine toilet tissue in the single-ply, 1,000-sheet Mega Roll was the heaviest single-ply we tested. These rolls come individually wrapped in re-sealable plastic pouches—a nice idea if you sail in a damp climate.

The two-ply Pure Oceans Marine Premium Ultra Soft toilet tissue came in a 500-sheet roll. It is also sold in a re-sealable pouch.

These two products from West Marine seem to be made of the same paper, but one is in a two-pack of 1,000 sheet single-ply rolls and the other is in a four-pack with 500 sheet, single-ply rolls.

These turned out to be one of the softest, largest, heaviest and strongest of the marine tissues. They were also near the bottom of our test group in ability to dissolve, but definitely better than standard toilet paper.

Bottom line: Soft, heavy, and strong, the West Marine TP just doesn't dissolve as quickly as some other marine papers.

SCOTT

Scott's Rapid Dissolving tissue (made by Kimberly Clark) made for RVs and boats was the fastest-dissolving product in our test. It wasn't a very strong paper, but it got the job done. Sheets were relatively thick, and in terms of dollars per ounce, it was a pretty good value.

Bottom line: This is our Best Choice and one of the cheapest, a rare sweep.

Scott Rapid Dissolve

CONCLUSIONS

When all the scientific data was crunched, *Practical Sailor* had to give the nod to Scott's Rapid Dissolving Tissue as it was truly the fastest to break up and dissolve in water. Thetford's toilet tissue was a close competitor.

Any of the marine and RV fast-dissolving tissues we evaluated would be better for your on-board toilet than standard TP. The main way to prevent problems is to always have enough water in the bowl and do not use globs of tissue before flushing.

Contacts Directory

AIRHEAD, 740/392-3642, www.airheadtoilet.com

BLAKES, 800/544-2132, www.blakes-lavac-taylors.co.uk

BUCKET POTTY SEAT, 401/467-2750, www.toddusa.com

CAMCO, 800/334-2004, www.camco.net

COLEMAN CO., 800/835-3278, www.coleman.com

DOMETIC/SEALAND, 800/321-9886, www.dometic.com

GROCO, 410/712-4242, www.groco.net

JABSCO (ITT), 714/557-4700, www.jabsco.com

JOHNSON PUMPS, 847/671-7867, www.johnson-pump.com

PLANUS (SCANDVIK), 800/535-6009, www.planus.biz

PROCTOR & GAMBLE, 800/777-1410, www.charmin.com

RARITAN, 856/825-4900, www.raritaneng.com

SANITATION EQUIPMENT, 905/738-0055

ST. BRENDAN'S ISLE (U.S. IMPORTER), 904/284-1200, www.lavac.com

SUN-MAR, 905/332-1314, www.sun-mar.com

THE PETT, 406/388-5999, www.thepett.com

THETFORD, 800/543-1219, www.thetford.com

WEST MARINE, 800/262-8464, www.westmarine.com

WILCOX-CRITTENDEN, 860/447-1077