

# Heads and hosedetails

Holding tanks, electric versus manual heads, and stamping out unwanted smells – Ali Wood gets some advice on sea toilets

**W**ith our PBO Project Boat *Maximus* now safely afloat in Chichester Marina, my thoughts turned to the jobs that needed doing before the two-day delivery trip to Poole.

It was also the end of the school summer holidays and trips to the boat were accompanied by three impatient children wanting to climb trees or swim in the harbour. DIY time was limited.

Top of my list was getting the hoses connected to the heads and galley sink. The corroded seacocks had already been replaced with TruDesign composite ones, but we'd run out of time to actually fit the hoses. While the seacocks were closed – and cable-ties protected them from curious little hands – as a double-measure I wanted the hoses fitted to the heads before we set sail. I don't know if this was so much a safety issue as my own worries. The seacocks were, of course, exceptionally robust, but I just didn't like the idea of them being our only defence against sinking.

Admittedly, now would be a good time to fit a holding tank, but we'd just come out of lockdown which, coupled with Brexit, meant prolonged delivery times for marine equipment. For now, I decided to simply refurbish the heads and replace the hoses, and fit a holding tank later.

To my enormous relief, PBO contributor Gilbert Park came to the rescue. Living in nearby Emsworth, and being handy with a toolkit and a camera, he offered to help me out. I also sought advice from Richard Call of water tech company Xylem, who distribute Jabsco toilets, and Ashley Marles of Lee Sanitation.

## Choosing hoses

"Some people try to clean hoses, but it's a false economy," advises Richard. "They're not expensive; buy new ones. Best practice is to double-clip either end, so if one clip fails the other holds it in place. Hoses harden over time, which is why you can't re-use old ones – the ends are so hard they won't compress with Jubilee clips."

The standard solution is white convoluted sanitation hose in ¾in (inlet) and 1½in (outlet) sizes. Note, hoses are still measured in imperial sizes for diameter. Some people also opt for clear hoses, so if they become blocked you can see the blockage – but in time they're likely to smell. Only sanitation grade hose will prevent odours in the longer term.



Stephen Chung/Alamy

Keeping the workings accessible in the heads means an easier fix if things go wrong

A lot of people suspect that the eggy smell you get from boat toilets is from broken or old pipework, but that's not necessarily the case. "It fools them," explains Richard. "They spend ages looking for leaks, thinking the hose must be broken but air molecules are smaller than water molecules so they can still pass through the body of an old hose."

This is particularly true with raw-water or hand-pumped toilets, where dead and dying algae in the seawater sits in the pipes and releases hydrogen sulphide as it decomposes. The smell then gets released into the toilet when flushing.

## Dynamic and static waterlines

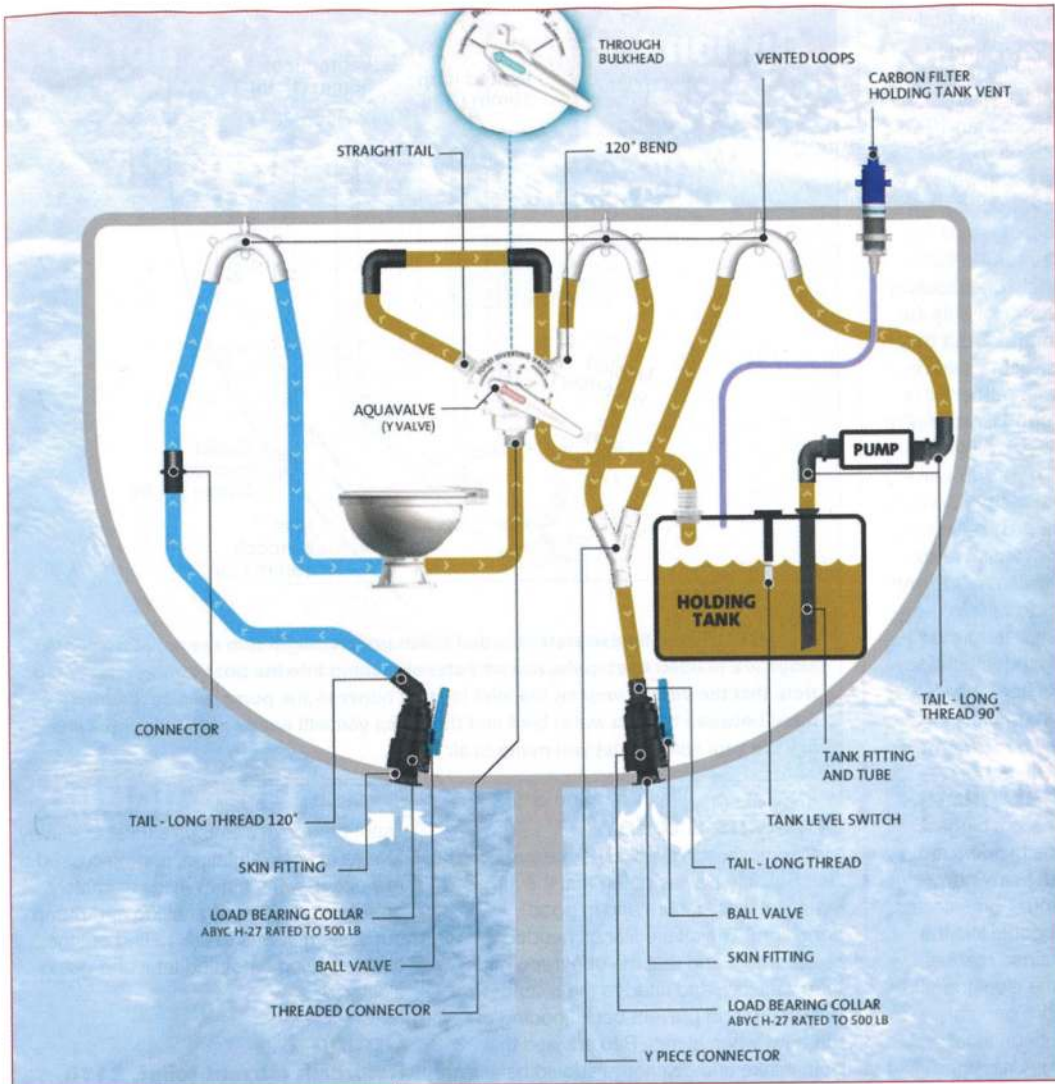
Richard points out there are a couple of things you need to know before fitting a swan neck or 'vented loop' (the 180° pipe fitting that stops the entry of water). The first is the static waterline – the waterline as you know it when you look out of the

port hole. The second is the dynamic waterline, which is when you're heeled over on the same tack as the toilet. You'll be below the waterline now as the whole side of the boat is underwater. To prevent syphoning – the water coming back out the bowl – you need to have the swan neck/anti-syphon loop at least 20cm above the dynamic waterline.

"Some people argue they don't need the swan neck on the outlet because there's a non-return valve on the toilet," says Richard. "However, that's not designed to withstand water pressure on the outside. Another common error is to put the anti-syphon valve on the inlet in the wrong place. If you do this the toilet won't work. You need the anti-syphon valve in between the pump and the top of the bowl otherwise the toilet won't prime."

## Holding tanks

Leisure boat sewage discharge is, quite literally, a drop in the ocean compared to



**LEFT** This system diagram from TruDesign shows all the parts used in a comprehensive heads system, using any marine toilet with pump, whereby the outlet can be directed straight over the side or to a holding tank, using TruDesign's lockable diverter valve. The key part not shown is a deck pump-out option, which would require another diverter valve downstream of the pump-out pump, with options to go to the skin fitting below the waterline or to the deck fitting

the damage done by companies such as Southern Water, who were fined £90m last summer for illegally discharging sewage on 7,000 occasions. However, as the RYA points out, it's important we know how to deal with waste responsibly, and consider the effects on the environment.

There are three types of sewage: black water (toilet waste, containing harmful bacteria and viruses), grey water (from sinks, showers and washing machines), and bilge water (often contaminated with oil and fuel).

The Recreational Craft Directive (RCD) requires all new vessels to have provision for a black water holding tank; grey water can discharge directly into the sea.

There are currently no regulations (apart from some harbour bylaws) for small vessels when it comes to sewage pollution, but the RYA advises holding tanks should be emptied either at a pump-out station or three miles offshore, where it will quickly be dispersed by wave action and currents. Vessels without holding tanks should avoid discharging in poor tidal flushing areas such as estuaries, inland waterways and crowded anchorages.

When cruising abroad, however, Richard warns that some European countries have tighter controls. They may send an inspector on board who'll want to see you have some way of locking off the diverter valve to the holding tank to prevent accidental pumping out to sea.

### Holding tank options

The simplest way to fit a holding tank is to have an outlet in the bottom of the tank so that when offshore you can discharge overboard. Another option would be to have a deck fitting and, rather than discharge overboard, use a marina pump-out station.

Then there's the option to do both. You'll need to control the process with seacocks and will need extra valves to make sure that when you do the pump out, you don't empty the holding tank and then continue to suck seawater water back in through an open valve.

### Where to fit a holding tank

A holding tank can be mounted where you like. Some people opt for a wall-hung one on a bulkhead, others place it in a locker. The closer to the toilet the better,

as the plumbing will be simpler and you'll have a lot less hose. If the tank is above the waterline then that also reduces the complexity of the installation. You can pump directly into the tank and that drains away to the seacock. If it's below the waterline you'll need more pumps.

### How long can a holding tank store waste?

There's no limit as to how long a holding tank can store waste. It simply comes down to the size of the tank which, in a small boat, can hold anything from 60lt to 300lt of waste. Ashley Marles advises that an electric toilet can use from as little as 0.7lt per flush whereas a manual, hand-pumped toilet can use as much as the user pumps through it, so an electric loo will fill a holding tank more slowly.

### Chemical toilet?

Another popular option, seen in canal boats and caravans – and sometimes boats laid up ashore – is a portable loo-type contraption. PBO's engine expert Stu Davies has one for when he stays on his boat in a Portugal boatyard. It's an installed toilet with a self-sealing

cassette, which you take out and empty.

"They tend to be more popular with inland waterways sailors because of their relatively small holding tank," says Richard. "Usually it's no more than 10-20lt, which, of course, isn't a problem if you have a chemical disposal point, where you can empty it each day."

### Keeping it clean

"Please don't use household chemicals in a boat toilet," says Richard. "Not only are they harmful to the environment, but they use bleach, which will attack the seals in the valve, and the seals and rubbers inside the pump. Over a short time, they're damaged, and you pump away like fury, and nothing works."

Jabsco produces Toilet Fresh, a non-chemical toilet cleaner, and also Odourlos for holding tanks, which uses enzymes to break down waste, tissue and odours. "You put a small cupful into the holding tank and they wander around munching the bad guys without harming the environment," says Richard. Leesan also has a range of environmentally friendly cleaners.

### Electric vs manual toilets

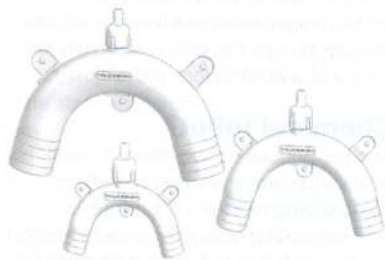
Manual toilets remain Jabsco's biggest seller, but increasingly boatbuilders are fitting electric as standard. Many new cruisers will have one manual, one electric.

"For a bluewater boat, people like the idea of having a self-contained manual toilet that will still work if the electrics fail," says Richard. "For the more general market, there is a slow but continual drift towards electric toilets. The difference is basically it's a much neater installation, more like the toilet at home."

Electric toilets can use fresh or seawater to flush, but this is a decision that must be made on purchase. Costs range from £150 for a hand-pumped toilet to between £600 and £800 for electric. Power draw is also a consideration.

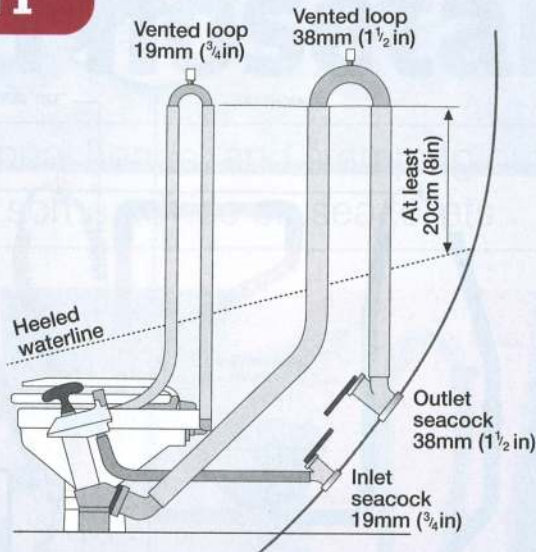
"We put big motors on and so do a lot of competitors," says Richard. "You need to know when you push the button it flushes first time. While the draw is quite high, the battery use is low as the toilet only flushes for 10 seconds. For a boat with a decent charging system it's not something to worry about."

However, if you run out of power, you're also left without a working toilet.



The heads needed an additional vented loop, like this one by TruDesign

### Option 1



A toilet below the heeled waterline that discharges straight into the sea. Two vented loops are needed to stop the risk of water siphoning into the boat through the toilet. Note that the vented loop on the inlet is sited between the pump and the bowl. If fitted between the sea water inlet and the pump you will not be able to pump water in - the vent will only let you pump in air

### Maximus's toilet

In *Maximus's* survey, our marine surveyor Ben Sutcliffe-Davies noted that the Jabsco sea toilet was 'secure and in good condition.' The intake fittings needed replacement and that the one swan neck loop was low, and fitted to the discharge only, to try and prevent back flooding of the bowl when at sea. Ben advised that both intake and discharge should have higher swan necks with anti-siphon valves.

I read the original Jabsco manual which reinforced the importance of having double hose-clips with the message that an innocent thing like a loo could actually sink the boat if not installed correctly.

"If the toilet is connected to any through-hull fittings and the pipework becomes disconnected, either from a through-hull fitting or seacock, or from the toilet or any secondary valve, water may flood in and cause the craft to sink... the ends of all flexible hoses fitted directly or indirectly between the toilet and any through-hull fitting that may possibly be below the waterline at ANY time, must be secured to the hose tails using two stainless steel worm-drive hose clips."

I sent photos of *Maximus's* toilet to Ashley Marles at Lee Sanitation, and discussed a few options with him. While I ultimately opted to keep the original loo and pump out system, it was useful to find out the costs of fitting a holding tank and going electric.

### Option 1

#### Refurbish current toilet, £116

The most straightforward and cheapest option was to keep the existing toilet, replace the pipes and fit two swan necks higher up, with anti-siphon valves. This was the option we chose.

### Option 2

#### Fit a holding tank, £548 (with new toilet +£190)

A holding tank for *Maximus* would also require a new pump assembly for the Jabsco toilet. The toilet would need to be below the waterline, using raw water for supply, and discharging to a 40lt wall-mounted holding tank above the waterline (40 x 25 x 55cm, £381), which would allow the tank to be gravity discharged to the seacock. The tank

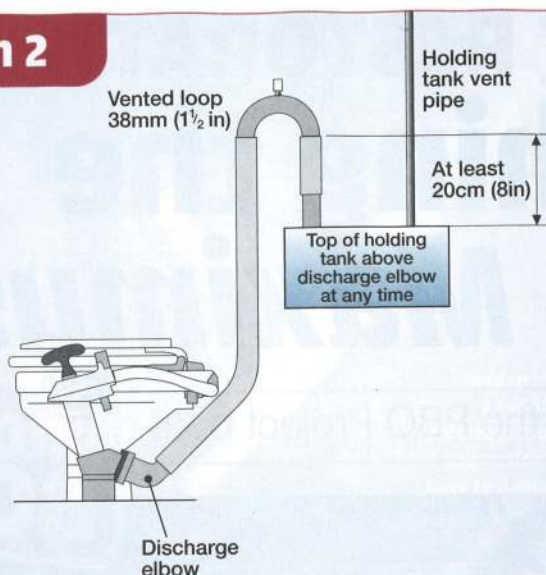


Fitting kit that comes with a holding tank



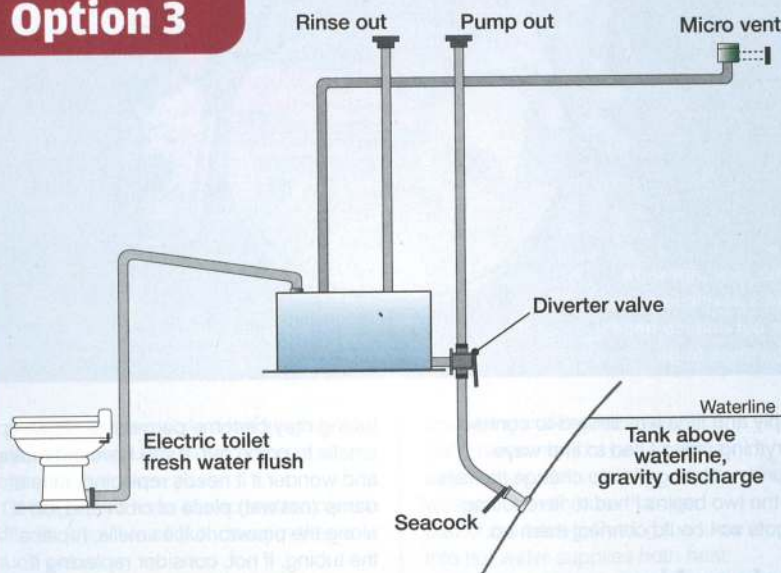
A wall mounted holding tank - like this one from Tek-Tanks - holds 80lt and costs around £460

## Option 2



Loo below the waterline with a holding tank above the waterline. This was the preferred option for *Maximus* but availability of parts and lack of time did not allow it to be fitted at this stage

## Option 3



The luxury option: fitment of an electric flush toilet with a holding tank above the waterline and both gravity discharge to sea and shoreside pump-out capabilities

comes with a fitting kit (including hoses, diptube and uniseals) which needs to be fitted in the top of the tank at the time of installation. The pump assembly, including pump-out deck fitting, rinse-out deck fitting, Microvent filter and breather fitting, tank level indicator and vented loop for the inlet, comes to £167. If we replaced the toilet too that would be an additional £190.

### Option 3 New electric toilet and fit holding tank, £829

Electric toilets use a freshwater flush so would need to be connected to the boat's water pressure system that also feeds the taps. There needs to be a minimum 1.7bar

pressure to supply the toilet with sufficient water. This discharges to the holding tank above the waterline, allowing the tank to be emptied by gravity. A new Sanimarin SN31 Toilet 12V would cost £662, plus £167 for the pump assembly (details as per option 2).

The tank would be above the waterline in level and heeled positions. Ashley advised that when measuring up we need to allow 15cm above the tank for the fittings and 15cm below for the gravity discharge outlet.

He also warned that the Microvent filter – which is essential for removing smells from the holding tank (see right) – must not get wet, so extra care is needed for installation on a sailing boat.

## How vented loops work

TruDesign's New Zealand-made high strength nylon composite vented loops (also called swan necks or goose necks) prevent water siphoning from underwater skin fittings back into a vessel, thereby guarding against accidental flooding and sinking.

In a heads system vented loops are used wherever seawater could find its way from a seacock back into the boat, either inlet or outlet. They can also be used in genset or small engine inlet cooling water systems. The simple one-way breather valve at the top of the vented loop allows air to enter the line when not in use, thereby preventing siphoning, and yet seals when water or waste passes through the loop.

Breather valve closes when fluid passes



## Why holding tanks need an air filter

Activated carbon filters contain absorptive carbon granules which are used to remove odours and gases from air streams, such as those found in holding tanks.

Holding tanks need breathers, but these are problematic unless the tank is fed with odour camouflaging chemicals, which hinder the natural biodegrading process. Furthermore, water authorities don't like the use of chemicals which can damage water treatment plants when discharged into the sewer system from boats or caravans.

With an activated carbon filter, such as Microvent, the tank can be used without harmful chemicals. The filter can be installed almost anywhere and is designed to connect with the breather plumbing from any angle.

