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## **MACERATORS AND OTHER SEWAGE STUFF**

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### **First, General RV sewage stuff (important info many people don't know).**

With an emphasis on proper venting, chemicals and more.

We go to great lengths to avoid tank odors--and with good reason. All too often, though, we associate getting rid of odor with popping in chemicals. It's the American way. If something's offensive, painful, uncomfortable, just pop in a chemical or take a pill or pour in an additive. Feel depressed? Pop a pill. Engine pinging? Pour in a can of something. Toilet stink? Dump in some perfumed formaldehyde.

Why not find the cause and try to fix it first? Once that's done, set up a good, renewable biological action in the tanks and avoid most of the problem in the first place. In the case of sewage tanks (black's usually the prime offender, but gray can be just as bad), poor venting is most often the cause.

### **VENTING**

Gas from decomposing sewage is supposed to vent out through a pipe that goes from tank top through the roof. Using the black tank as an example when you "hit the pedal," the gas that was building up in the tank should vent out through the roof. Your momentary opening of the tank shouldn't allow enough "feedback" into the RV to be noticeable--unless the tank was nearly full or the end of the vent pipe was under water and the gas had no place else to go.

Vent pipes need to penetrate the top of the tank, but only an inch or so. All too often, they are sloppily installed and, after only a few miles of travel, begin to slip further down into the tank. Many manufacturers only use a putty-like material to hold these pipes in place. Incredible, but true. To their credit, though, if the thing were glued in, you'd have a hellova

time getting it apart. Even if the pipes don't slip, as described here, they often leak.

In some cases, vent pipes are inserted down through the roof into the tank and just shoved on until they stop. (How much smarts do you expect from somebody who gets paid next to nothing for shoving a pipe in a hole?) In any case, if the end of the vent pipe is submerged, it won't vent.

How do you determine where the end of yours is? Sometimes easily, sometimes with great difficulty.

If you're lucky: Go to the roof, remove the cap on the vent and look for the end of the pipe. It should be nearly flush with the rooftop or a bit higher. This does not necessarily mean all is well (see below). If it's way down there someplace, or you can't even see it, it probably just slipped.

If you then go into the RV and to the back of the closet (or wherever they hid it), you might be able to grasp and twist and raise it. Don't do this too hastily. If you pull it all the way out, you can have a job getting it back in. If it's where it's supposed to be in relation to the rooftop, you might have an extra-long pipe (poor you).

If you're not lucky: You need to determine where the end of the pipe really is. Sometimes, if you have polyethylene tanks, the kind that are translucent, you can shine a very bright light against them and, looking through the opposite or side end of the tank, see the shadow of the usually black ABS-type pipe. If so, you lucked out and can adjust it.

Some RVs, usually the newer ones, have tanks that are literally buried, and you can't do much of the above. You'll then need to disassemble or cut your way to the vicinity of where the vent pipe enters (poor you).

## **REBUILDING AND REHANGING TANKS AND CONNECTIONS**

Look at this as a positive exercise, though. You need to know how to get there because someday the thing will probably leak, and you'll have to do this anyway.

Two of my RVs have had improperly inserted vent pipes. Many do. My solution was not to fool around with all the above in the hope I'd get

lucky. I rebuilt the things. I located the point of entry of vent pipes, partially removed them by pulling up through the roof, dropped the tanks, inserted gasketed fittings (see below) and reassembled the whole business. While I was at it, I hung the tanks properly.

Manufacturers do a lot of cheap stuff. They hang tanks, or shove them in a compartment, with no regard for friction or wear (because by the time the hangers grind their way through the tank and create leaks, you'll likely have traded it and they won't have to honor a warranty).

When I reinstalled my tanks, I used foam (computer mouse pad pieces) to prevent rubbing at the hangars. I used **gasketed fittings** to connect vent pipes. These things don't cost very much. Available in better RV and building supply stores, they're kind of like the compression fittings used on water lines--plastic, screw-on, with a neoprene insert. You shove one end into an appropriate-size hole in the tank, stick the end of the vent pipe in the other and down in the tank (just enough) and start twisting the knurled nut until it's snug. It's harder to describe than to do.

You'll have a leak-proof fitting that you can always disassemble, that will flex as the RV vibrates and prevent future problems. Many variations are available, some have part of the fitting cemented to the tank, but have similar neoprene twist gaskets that the pipe goes through to allow the same disassembly and flexing. Shop around.

**Tank heaters.** Along with the above, while you're doing this job, consider installing tank heating pads and heated cable on your outlet valve pipes. Not cheap, but not expensive either. You can buy the pads and cable in lots of places. An easy one is any RV dealer who has the "Coast Distribution" catalog. Most RV stores use "Coast Connection" (a.k.a "Coast Distribution System")--not to be confused with "Coast-to-Coast" RV parks. Tank heating pads will usually be both 12VDC and 120VAC. They don't use much electricity. If you're parked with a hookup, no big deal. If driving, no big deal either. You can get cheap "household" heater cable in building supply stores. Usually, it's 120VAC only. Not too swell. Some stores have 120VAC/12VDC combination cable; look for it. Mine is sheathed in stainless-steel loom and can be cut to size. Very nice.

My tanks hang under the RV. Some people have them in basements and

don't need all of this. But consider. Is the basement heated? If not, you might need pad and cable heaters. If heated, then by what? Many newer RVs brag of furnace heat to basement as well as living quarters. Do you want that? Think about it. How much LP and 12VDC do you want to waste in the basement? On the other hand you might need it.

**Grey tanks** won't smell as bad as black if there's a problem, but can still really stink. Worse, while the black is under the bathroom (where you can slam the door and escape), the gray gas usually escapes into the living area. Grey gas doesn't smell like you-know-what, but more like somebody threw up or like a mouse died. Familiar?

With black, the toilet evacuates directly into tank with no trap in between, thus the abrupt attack on your nose if something's wrong. Gray is more subtle. The "P" traps under your bath tub/sink(s) should retain enough water to provide a barrier to gas. However, if the vent is blocked, as with black, the water in the P trap can be siphoned into the tank or, in extreme cases, blown back into the sink. In either case, no more barrier and the escaping gas makes you wonder if there's a dead rat under the bed. Treat gray venting the same way as black. P trap water will evaporate in time also which you should consider if your RV is in storage for long periods.

**"Back vents" or "Air-Lock Vents"** can cause the same problems as the above. Essentially, these are one-way air valves (that let air into the vent system, but not back out into the living area). They were developed for certain, specific conditions in homes when people wanted to add a sink but didn't want to get involved in the major construction and expense of running vent pipe through walls and up through the roof. These are very restricted by building codes and must be quite close to the existing vent system. Some RV manufacturers use these as cheap alternatives to real vents. Some work, some don't. These things use a simple vinyl flapper as the check valve and can easily fail. In an RV, with one of these under the kitchen cabinet, in a closet or similar place, they can create a real stinky problem. Look for these if you have smelly problems.

**Okay, I've saved the best for last!** None of the above may be your problem! You might be your own enemy.

**RV SEWAGE -- It's More Than Just the Smell**

Are you a "tidy Tilly" who's an obsessive cleaner-upper? Do you commonly use extremely caustic cleaners in toilet and sinks? Dump nasty stuff like paint thinner in there? Use formaldehyde toilet chemicals -- or other perfuming stuff? In short, do you treat your RV tanks like you did your house on a municipal system where any possible thing was just flushed down the drain? Well, you can't do that in an RV!

RV waste systems depend on bacteria to decompose waste, including toilet paper and anything else that's biodegradable.

But there's bacteria -- and then there's bacteria.

"Aerobic" bacteria need oxygen (air) to live. These "good" bacteria decompose waste efficiently. Ideally, a tank with waste, water, and simple biodegradables will decompose into a thin slurry and will not smell. Ample air enters each time the toilet is used. If the vent pipe is properly placed through the top of the tank and isn't submerged so far down that it's blocked most of the time, and if the pipe isn't blocked elsewhere or at the roof, the system should work fine.

"Anaerobic" bacteria live without oxygen. They will also decompose waste, but in doing so produce various gases. Those gases also produce "STINK."

Obviously, the two types of bacteria can't coexist.

One will always displace the other. Proper venting helps keep the aerobic bacteria active, but there's more to it. Putting the wrong additives or chemicals in a tank may result in killing BOTH types of bacteria, then you really have problems.

Your mission, Mr. RVer, should you choose to accept it, is to encourage aerobic bacteria and discourage anaerobic bacteria without turning the tank into a receptacle for destructive chemicals.

**There are generally three ways to treat waste tanks: Chemicals, Enzymes and Bacteria.**

**CHEMICALS are absolutely the worst way to do it;** yet that's what most RVers use. Store shelves are jammed with chemical treatments. The first thing they do is kill bacteria -- which is exactly what you DON'T want to

do. Then, they use a chemical to "break up" the solids into progressively smaller pieces that accumulate on the bottom of the tank in a big pile of crud instead of decomposing. The tank will stink, so then they have chemicals that overpower the natural (bad) odor with yet another odor.

There's not enough room here for the entire list of typically used chemicals, but here's a sampling: Formaldehyde (aka Formalin) is a preservative. I see no reason to "preserve poop for posterity." As people have become aware of the dangers of Formaldehyde (also a carcinogen), you now see many chemicals boldly labeled "Formaldehyde Free." That's good, except some treatments now use "Glutaraldehyde" instead (it's used in embalming fluid). Nuff said?

Some other things you definitely don't want to put in your tank individually or as part of chemical treatments: Bleach, methanol or alcohol, nitrites or nitrates, phosphorous or phosphates, bronopol (a pesticide) or any petroleum-based product, acid or cleaning fluid.

More no-no's listed separately because so many RVers use them in home-made concoctions: Pine oil (which deteriorates gaskets if used in large amounts), automatic dishwasher detergent (extremely caustic), mineral, coconut or cooking oils (which won't really "lubricate" valves and seals but will just float on the surface and keep air from getting to the good bacteria), yeast (which will promote bacteria, but so much so you'll have a tank full of goo).

**ENZYMES** won't do any harm, but won't do all that needs to be done either. They will do pretty well with an odor, but just for a short time. Enzymes can help sometimes and are often included in good bacterial treatments.

Active **BACTERIA** will do the job. A properly set up and maintained system won't need much either. As opposed to chemicals (where more and more must be used with less and less effect), when adding bacteria "less is better." It's important that you follow the instructions. You must start with a clean tank (or residual chemicals will defeat the action). You need to start the tank with a few gallons of water. You shouldn't add the bacteria until there's a deposit of human waste in there. If you do it right, it will take about three, in normal use, dumps before you have a good,

renewable system. You can then keep it going with only small additions of bacteria every other dump or even fewer.

I lived on a boat once. Prominently displayed over the john was a poster saying, "Don't put it in here if it ain't been et yet." Well, it's not that critical, but a good colony of bacteria will eat lots of stuff and not smell bad if you don't kill the bacteria.

**WHICH BACTERIAL AGENTS ARE THE BEST?** There are several good ones. Homeowner septic tank chemicals work. They're readily available in most supermarkets and cheap. They are not fast working, which is why RVers are sometimes dissatisfied with them, but they were designed for thousands of gallons and a lot of time, not the short time demanded by the 40–100 gallons in most RVs. "Rid-X" is the best of these.

"Roebic" ([www.roebic.com](http://www.roebic.com)) and "K.O." (in boating stores) are excellent holding tank bacterials. I'm also impressed by "Mean Green" (800) 999–2847 for info. "Pure Power" in RV stores or call (800) 411–8801 for info is very excellent. In a lengthy "head-to-head" (pun intended) test against "Eco-Save," results were almost identical.

The very best holding tank product I've ever found is the "Eco-Save" brand from JWH Distributors, Box 195, Santa Rosa, CA 95402. (800) 950–9666 or (707) 579–0643. Web site at [www.eco-save.com](http://www.eco-save.com). It works better than anything else I've ever used. Liquid, Concentrated and Dry versions. Detailed instructions are provided. Follow them!

**BE VERY LEERY OF:**

Recipes from RVers for home-made concoctions. The ingredients will often kill bacteria. The pine oil ("Pine Sol" or equal) usually used will also deteriorate valve seals if used in large amounts and you will create your own leaks.

**BE VERY LEERY OF:**

The word "biodegradable." Almost everything is, eventually, biodegradable. Unfortunately, you and your grandchildren may not be able to wait up to a hundred years for the toxic crap (pun intended) that you threw in the tank to go away.

Finally, the inclination of most RVers is to use toxic chemicals and not

worry about it. The attitude is "The dump station or RV park will handle it." Not so. The EPA is getting very strict. At present, their rules state that if a system causes contamination, the park or dump station *"may"* be forced to close. I'm reliably informed that the new EPA rule will state that if contamination is detected, they *"WILL"* be forced to close. Think about it.

Purging a sewage system of contaminants is complicated and expensive. That cost is going to be passed on to the RVer. It's a necessity and it doesn't necessarily mean the RV park operator is greedy. Operators of courtesy-type dump stations at rest areas and similar places have solved the problem the easy way -- they're closing many of them.

Most of the problems RVers face can be blamed on the manufacturers. This one can't. The enemy is us.

### **HOW TO CLEAN SEWAGE TANKS -- Lengthy process but really easy.**

First, dump and flush as normal -- no detergents and PLENTY of water. Once that's done, close dump valve and remove slinky. Then open dump valve and more residue will come out. (Do this at home or somewhere there's no audience.) Use your garden hose to spray the "stuff" at valve and open end of tank. Finally, spray all the poop on the ground and the "brown tea" will dissipate and biodegrade. It's no big deal.

**Now comes the easy part.** Pour about a quarter cup of ordinary dishwashing detergent in the tank (NON anti-bacterial version), "Dawn" or "Joy" are best. Then pour in about two gal of water. Drive RV to nearest market. Get about two or three bags of ice cubes and pour them in tank. Then drive to RV park or similar -- make a holiday of it -- (about a two to four-hour drive is adequate). The tank will be about as clean as it ever gets as the ice cubes slosh around and scrub it. Get a site with full hookup. Dump and flush repeatedly. Add about three gallons of water when done. Take a crap (Bio needs something to work on). Add bio per container instructions, then drive home, or wherever your next stop is, to mix things thoroughly.

Routine future dumping should include simple flushing with water and no detergents (unless doing the whole process all over again). You want to keep a residue of the good bio going. (Kind of like a sourdough starter.)

Do all this properly, adjusting amount of bio through experience, and you should be trouble free. In my case, as an example: With a 40 gal tank, using "Eco-Save," I put in only one (liquid) capful or one tablespoon of dry version every-other dump (or more) and am odor free and don't have any "floaters" in the tank.

**Here's one that screws people up.** Often, especially in motor homes, the bathroom, and black tank, are behind the rear axle(s) and the kitchen, and gray tank, in front of the rear axles. So, where does the gray water from shower and bathroom sink go? In most cases, it drains into the Black tank (a cheap and EZ solution for the RV manufacturer). Many RVers don't realize this and wonder why the Black tank fills up so fast. Actually though, it's not a bad situation. More frequent dumping *is* required, **but** the bathroom gray water added to the black tank "thins out" the black goop. Reasonable amounts of soap/detergents/shampoo (of the right kind) don't interfere with the bacterial action. RVers with this setup often have very few el-stinko problems if venting and such are OK -- and the RVer knows about it.

### **FLUSHING WITH GRAY WATER -- For those who know what they're doing:**

#### **Just some notes.**

- \* I used gray water for flushing on boats (and later in travel trailer).
- \* Relatively simple on boat since had access to top of gray tank. Some RVs have access also if lucky.
- \* Some marine terms/equipment referred to here. If you're not familiar with them get copy (free) of "West Marine" catalog. Box 50050, Watsonville, CA 95077-5050 (800) 538-0775 ([www.westmarine.com](http://www.westmarine.com)). Excellent, descriptive reference. Useful for many RV things. Variety of hatches, pumps, etc. Once you know what to look for, can shop around salvage yards.
- \* On boat: I cut hole in top of tank to fit "Deck Hatch/Plate." (Two-piece waterproof access hatch.) Comes in various sizes. Has flange and hatch insert. Hatch flange made to be screwed to decking, but can be cemented to water tank. Inserts come in screw-in or cam type. Have "O" ring seals.
- \* Inserted small, submersible, 12V bilge pump into tank. Since not trying to prevent sinking, used smallest, cheapest pump. 12V wiring and tubing easily sealed through small hole in hatch (why cam type is better than

screw in).

- \* Ran 12V wiring and 3/8" flex vinyl tubing to toilet area. Attached electric switch and kitchen sink spray hose.
- \* Have seen people attach directly to toilet input, but not always too swell. Can be messy as particles plug small holes in toilet and limits flexibility.
- \* Have seen people use "tees" and valves so can switch from fresh water to gray. Not too swell. Requires elaborate use of expensive check valves and vacuum breakers and fresh can still get contaminated.
- \* Above is basic, crude system.

In RV, used a variety of pumps. Old style RV pump, (big diaphragm in can with exterior motor on top turning eccentric arm) worked best. Was bought at flea market for next to nothing. Had pressure switch, so just had to run water line to toilet area and manual switch to any convenient place (near fresh water pump switch so was easily reminded to turn them off when leaving RV). In use at toilet, just had to point sprayer and squeeze trigger.

- \* At tank, since just need about 1/2" fittings, can sometimes attach to an existing, extra fitting (if there are any). Go through side, near but not at bottom (where heavy crud collects).
- \* RV and marine stores have threaded fittings that can be cemented to tank. Better is a "compression-type" fitting (plastic with big vinyl ring that works similar to small brass compression fittings). Costs more, but is more reliable and flexible.
- \* If you draw water from about 3 or 4" up from bottom of tank, you won't get much crud.
- \* RV and marine stores have a fitting that is built like a threaded bushing. Usually 3/4" outside thread by 1/2" inside thread. Stuck on the end that goes into the tank is a tubular screen of stainless steel about 2" long. If your initial access to tank mentioned above is 3/4" and you screw the screen bushing into that, then you can attach standard 1/2" RV hose and fittings to connect the pump. You'll get very little crud in pump. Once or twice a year, when gray water level is below the tank fitting, it can be unscrewed and cleaned.

## REMINDERS AND ODDS AND ENDS

- \* Neither black or gray water should stink IF you treat them properly. **See elsewhere in this poopsheet.** You do NOT just cram chemicals in a tank. You use "biological" agents that decompose waste.

\* Various pumps: The old timer mentioned above is reliable and easy to repair. I have also used a macerator for this (since I had an extra). I've seen people use rotary drill pumps (that cost as little as \$4 but wear out early). About 10 years ago, you could easily find a "tiny" macerator in surplus stores. These cost about \$15 and were from some ill-advised venture that incorporated them into the bottom of some camper or marine toilet. If you find one, they work great (I had one). There are all sorts of fountain pumps, trash pumps and similar. Best way to view the variety available is check the "W.W. Grainger" catalog available at about any hardware store. Check Yellow Pages for things like Industrial Supplies, Surplus, Salvage, etc.

\* The odd fittings I mentioned aren't really odd. Good RV stores will have them in bins and you can just poke around and find them. Camping World has them, but you have to go to the special parts counter and try to explain what you want to some numb nut -- not much fun.

\* Deck hatches are good for lots of things. I have one on top of my fresh water tank. Above the low-end output, it allows me to clean the bottom of the tank (that always holds an inch of water and crud when drained). I have another through the floor directly above the 65 gal fuel tank. By carefully measuring, I got it directly above the fuel pump/pick up/gauge unit that drops down into the tank. (Why drain and drop a tank if you don't have to?)

## **SIMPLE SEWAGE TRICKS**

- Keep jars with screw-top caps for disposing of things like cooking grease, alcohol, paint thinner, etc.
- Don't use colored, double thickness, perfumed, household toilet paper because it just makes sludge and doesn't biodegrade fast enough. But don't bother with RV toilet paper that costs too much either. Generic, single-layer, el-cheapo toilet paper is the same thing as RV paper and lots cheaper. Better, in my opinion, is "Scott" brand single-ply, white, unscented toilet tissue sold in supermarkets in 1,000 sheet rolls. With these, you won't have to bother with the TP-in-a-plastic-bag ploy as some RVers do (unless you feel like it).
- Again, paint the exposed plastic pipe and fittings under your RV. Ultra-

Violet (UV) from sunshine deteriorates plastic and is the reason for so many broken RV pipes and fittings.

- Supervise children and visitors! Kids will throw anything into the toilet just to see where it goes (and they'll hold the pedal down an hour to do so and you'll wonder why you ran out of fresh water and wonder why you have to dump after a one-day drive). Non-RVer visitors will throw diapers, sanitary napkins, cigarette butts, apple cores, peach pits, facial tissue--(you name it) in your john without ever thinking about it--just like they do at home.

- Read the label on cleaning agents. Don't use caustics; use biodegradables. Baking soda (or Bon-Ami) is every bit as good a cleanser as the poisonous stuff.

- Baking soda is also an excellent drain cleaner. Pour a cup into sink/bath drains at night (just before bed), pour a cup of water on it (just enough to get it down in the P trap), leave it 'till morning. You don't have to flush it away with copious amounts of water either. It won't hurt a thing.

- Remove your black and gray sewer caps once in a while. Clean them and put a very thin coat of grease on the "O" ring seals and you won't be dribbling sewage all over the country (or next to your neighbor). "Plumbers Heat-Pruf" grease is best, but "white" grease is good too. "Vaseline" works but tends to get sticky.

- A piece of wire coat hanger a foot or so long with about ½" at the end bent 90° is a good tool for cleaning the "slots" in slider valves and some toilet valves. **(Don't drop the thing in the toilet!)**

- **Don't ever stick anything down in the toilet bowl unless you have a string tied to it!** The retrieving of brushes, flashlights, etc., from the black tank is called "diving for pearls" -- but it ain't near as much fun.

- Use all the water saving tricks when out in the boonies, but, when on a full hookup, use water lavishly (just for a time, not forever). You'll have nice, clean tanks and hoses. But don't use someone's full hookup as a place to dump poison into their septic tank.

- A good way to get rid of black water. Use your macerator to pump it into

old milk-type jugs. Pack them in a box. Gift wrap the box and leave it in the back of your pick-up at a mall. Someone will steal it. (Works for garbage too.)

- (I shouldn't put this in here, but I can't resist it) There's an old RVer joke: If you're ever faced with an insurmountable poop problem, consider getting an "Airstream" -- because, as any Airstream owner will tell you, "their shit don't stink."
- Think about what you're doing when playing with poop. Screw up many of the above, especially screwing up with the macerator (below), done when you're half potted or distracted by BS-ing with your neighbor, will end up with your neighbors in hysterics and you with 40 gallons of poop on your shoes.

## **MACERATORS:**

Macerator pumps provide a partial answer to sewage disposal, chopping waste into a thin slurry and pumping it out through a garden hose to a proper disposal. And that's all there is to it. They're not magic and they're not maintenance free. They can, though, eliminate the most onerous part of the dumping chore if used properly.

Most RVers use macerators in a temporary fashion and only when a full hookup is unavailable. In doing so, they miss out on some of the real benefits of a macerator. Temporary hookups involve adapting a macerator to an RV sewage outlet and attaching/reattaching it just as you would a "slinky" sewer hose. While this allows pumping sewage long distances and into otherwise unavailable receptacles, like septic tanks, plumbing cleanouts, sewers, or toilets, it also requires handling something even more clumsy (and prone to spilling) than a regular slinky. Storage and electrical connections (macerators demand hefty wiring) can also be a problem in this case. (See later for pointers on using a "temporarily" connected macerator.

Many of us have found that installing a macerator in a semi-permanent fashion is a far better way. Semi-permanence means that it can be used without attaching and disconnecting and it can be bypassed with valves and can be easily removed for maintenance. Carefully installed, a macerator can be used full-time with only a flick of the wrist and nary a

drop of spillage.

Because of the variety of plumbing layouts in RVs, it's impossible to show a specific arrangement of fittings. The drawing at Figure 1 shows a typical RV waste tank and valve arrangement modified to accept a semi-permanently mounted macerator. If you're fortunate, you'll have just such a straightforward, squared-off arrangement. Some RVs have lines that come together at angles or other odd-ball configurations. In these cases, it's a matter of planning the layout to use angled fittings, squeezing things in the space available, and using branches from the main line rather than the simple in-between arrangement shown.

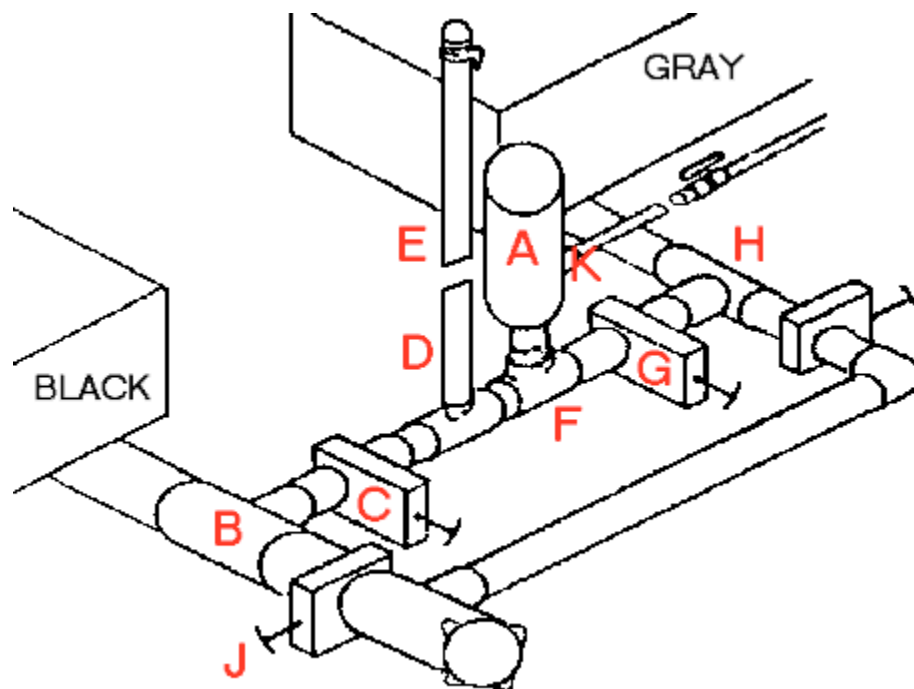


Fig.1 TYPICAL SEMI-PERMANENT MACERATOR HOOKUP

### EXPLANATION OF THE SYSTEM IN FIGURE 1

**A**--The macerator. Shown upright, it may be flat or angled as convenient. Make sure you allow enough room to unscrew and remove it for maintenance. Shown is a macerator with 1½" male pipe thread fitting option. It's much better than the 3" slip-on version in some cases since it can be installed in smaller areas.

**B**--The 3" black water line cut with a 3" tee inserted. The outlet is reduced

to 1½" to save space and allow using smaller and cheaper valves and fittings. Use an "offset" 3"x 1½" bushing. Usually available in RV stores, seldom in plumbing stores. Position the outlet hole at the lowest point in the line. Don't use a ready-made reduced tee. The side outlet in these will be centered and allow crud to accumulate in the line.

**C**--A 1½" slider valve connected to the bushing. Again, valve may be at any angle convenient. Use cheap plastic/nylon valves in the "Grentec" or "Valterra" style. Metal valves like "Thetford" cost more, get corroded and stick. (The idea here is to have a dumper that doesn't require your playing with poop.) The valve can be glued in place. If it ever leaks, it'll usually be the flat part, held together with nuts and bolts, that can be removed and replaced if there's just a bit of slack in the line.

**D**--Another tee (1½"), optional. The system will work without it, but if you want to avoid problems, you'll use it. The side outlet of this tee will point up. The easiest size for the outlet, ready-made or "bushed" is ¾" (see E). This tee and (E) allow venting the pump when both valves are closed and attachment of a fresh-water "flush" line to the pump. Venting allows you to run the pump for several seconds after the sewage valves are closed and extract the last bit of stuff that might otherwise dribble. A flush line will be appreciated the first time you have to remove the pump for maintenance. NOTE: In an RV where existing valves are located under the middle of the rig and are operated by very long rods, this valve is a necessity. Those long lines can hold gallons of sewage.

**E**--(Optional) Soft vinyl tubing of a convenient length. Run it upwards, generally, until above the top level of black and gray tanks, and you'll have a "sight" gauge. A garden-hose stop valve at the top allows connecting a cleaning hose and shutting off the line (to prevent spilling if your tanks get overfilled).

**F**--Another tee, with side outlet, to which the pump is attached. Ideally, it'll have a 1½" female-screwed fitting to which you can attach the male fitting on the pump. You can, of course, adapt the 3" slip fitting on a pump with various plumbing fittings and clamps. Ask a good plumbing store person for "no hub-style" fittings (neoprene flexible fittings with clamps attached). These come in an enormous variety and are used by plumbers to fit new parts into existing lines. The pump attaches to (F), but

it weighs about 7 lbs. Support it. Most macerators have a good mounting plate. Insert a piece of dense foam or similar between the pump mount and whatever you attach it to for shock-absorbing flexibility as you bounce down the road. (Computer "mouse pads" are cheap, very dense but still thin foam and pieces of them are perfect for this and many other RV uses.)

**G**--A valve as at (C), but from the gray water side.

**H**--A tee similar to (B), but usually 1½" to start with in most RVs. If 2", you can reduce as with (B).

**I**--The original gray valve. Reconnect it to (H) so the system can still be dumped in the old-fashioned way if needed.

**J**--The original main valve. Reconnect it as with (I). Depending on space used for the project, the pipe from (I) to (J) and from (B) to (J) may have to be adjusted. This can be done with simple couplings.

**K**--The outlet from the macerator. Depending on which model, it may have a ¾" male garden hose thread or a 1" barb/clamp fitting. In either case, connect a clear poly hose to it and run the hose to a convenient point where you can attach a valve and a quick-connect fitting to the garden hose(s) that empty the system. The manufacturer recommends 1" hose, but ¾" or 5/8" works fine. The end of the poly part and valve should be where easy to reach but as close to the pump as possible. Why poly/clear? So you don't get surprised when disconnecting.

## DOING IT AND USING IT

As shown, a macerator may be used with no more than slipping on a garden hose "quick connect," opening valves, and switching on the power. There's more to it, though, in assembling all this:

Make a detailed drawing first. Holding up a large piece of cardboard and marking existing fittings makes it easier since you can work with a full size plan and measure accurately. If you've a rig with a sealed bottom, good luck.

When you first begin the installation, you'll have dumped and flushed the

lines thoroughly (or that first cut of the three-inch line would have been a tad messy). Once you get it all together, for your first test, fill the tanks part-way with fresh water. Connect a garden hose and run it to a dumpo. Close (I) and (J). Open (C) or (G) and the valve from (K). Turn on the pump. If there are leaks, you want to find them now, not when the tanks are full of nasty stuff. After it runs a bit, close the valve from one tank and open the one from the other. With both valves closed, run the pump a little bit. Hear the difference in sound when it sucks air? Open the vent at (E) and do it again a bit. Stop and look at clear hose portions. Open (C) and (G) and fool around some more. Fiddle around like this several times and you'll see how you can control valves, pump and vent without spilling.

That's almost all there is to it except for things like dropping the hose with the pump running and similar tricks that will provide an enormous amount of entertainment for your neighbors.

#### TIPS:

- **Hose.** Old fresh-water hose will work, but it's hard to coil up. I use top-quality, 5/8-inch "Gates" brand flexible-when-cold hose. Fifty feet cut to about ten feet for use with a hookup (depends on where connection is) and remainder for longer runs.
- A second, 50' hose like this will handle most anything. • Old, needs-to-be-retired water hose is saved for really long (rare) runs. (We've gone over 250'.)
- **Quick-connects.** Shop around, but stick with a major brand so you won't find yourself with obsolete stuff you can't match. (I use the "Nelson" brand of quick-connects.)
- **Hose Valves.** I originally used simple plastic hose stops. Cheap and they work, but they clog and leak easily. I now use 3/4-inch or 1-inch plastic ball valves with an adapter at each end to fit either barbed/clamped fittings (as with poly hose) or garden hose thread (as applicable). Adapters in any size are available at good (not necessarily big) hardware stores. The valves have a "Teflon" ball that won't clog or leak (and seldom break) for about \$5 if you shop around.
- **Power.** Macerators draw up to 14 amps. That's a lot! Fortunately, they

don't run very long, emptying 30 gallons in about 6 minutes. They do need a full supply of 12 volts, so don't scrimp on cheesy wire or connections. Use # 12 wire and a good switch rated to carry about 20 amps DC (a skimpy switch will drastically reduce power going to the motor, like squeezing a water hose). Mount switch near the valves and poly "see-through" hoses so you can manipulate everything quickly and easily.

- **PVC/ABS Fittings.** You can use either or a mixture of both (and will probably use a mix). Make sure you get multi-purpose cement (read the label) that will join PVC/ABS/CPVC fittings. Also, since close quarters are required, get slow-set cement (ask the clerk) that will allow you extra time to manipulate/adjust fitting when you work in tight spaces.
- **PAINT IT!** When done with the job, paint the thing (along with all your existing pipe and fittings) because sunlight (UV) deteriorates plastic (and that's why most RVers have busted fittings so often). Even if you decide you're not interested in a macerator, do yourself a favor and paint all the plastic pipe and fittings under your RV anyhow -- it's cheap insurance.
- **More on Fittings.** You'll probably have to use an RV store for the offset bushings mentioned. All others are best bought at a good building supply store or plumbing store. They have odd angles and other good stuff (like the flex couplings and flex bends and tees) that will surprise you. The basic fittings are cheap. Don't hesitate to make your own. Cut a chunk off of one and epoxy it (if it's a loose fit) to a chunk from another instead of just gluing it. Get creative. You can remake plastic fittings into about anything.
- **More on electric switches.** (An option for the adventurous.) For some reason, most of us fail to check tank contents regularly and don't realize it's time to dump until after we're on the "john." Bad weather can also delay the chore. If you have a macerator installed as above, and the hoses are connected to an RV sewer outlet or other fixed receptacle, you can install "3-way" switches. These are called "single pole, double throw, on/on" switches in catalogs and stores. They're the same design of switch configuration used in houses at top and bottom of stairways (but don't use 120VAC "house-type" switches with 12VDC). Flicking the switch at either end causes the light (or macerator) to go on or off. Using two of these,

one at the macerator and one in the bathroom, can be handy.

### **SOME CAUTIONS:**

- Doing the above switching requires leaving the valves from tank to macerator open. If macerator inlet is quite close to tank outlet, this is OK. Sewage won't pass through the macerator without the pump running (except for very thin fluid). If, though, tank outlet is a long way from macerator, don't do this because the long lines can plug up. **Also, don't do this if your system isn't well vented.**
- The switches themselves, though in the same configuration as household switches, are not the same in terms of construction. Never use household AC switches with DC electricity. The contacts are not rated for DC and will soon fail through arcing. (Arcing can be reduced by using capacitors at switch contacts but can't be eliminated, so it's not generally recommended and I won't go into it here. In fact I only mention it because otherwise some smart ass will write me about it.) Further, the contacts of household AC switches simply allow too much voltage drop when used with DC. AC switches (and other AC connections) can be a lot skimpier than DC versions because AC has a lot less voltage drop. This is all covered in other poopsheets.
- Don't do this if you can't hear the macerator running from the bathroom. Or, as an alternative, just turn on the macerator from this remote location long enough to dump 5 gallons or so.
- Don't do any of this if you don't need to. Dumping can result in messy spills. You really need to be right there where the action is so you can see what's going on.

### **HOW DO YOU GET RID OF IT?**

If it's an occasional shot, just stick the end of the hose in a sewage receptacle and let'r go. Use your imagination. Flush toilets are good (you don't need to hold the flush lever down; water flows through the built-in trap in a toilet.) Pit toilets are EZ, but the ranger might complain--be discreet. Gopher holes are good (don't worry about the gophers, they'll adapt -- and Darwin will account for those who can't). Sewers work--but make sure a storm drain (that can look like a sewer) doesn't drain into the

pretty stream nearby. Shrubbery and trees are good--you'll be improving their growth--Anne's trees and roses grew phenomenally when I parked in her back yard.

DO NOT macerate into a garden that has edibles in it! DO NOT macerate--repeatedly--where the stuff will work its way toward someone's well. Macerating occasionally won't hurt anybody any more than the dog poop that can occur anywhere. Macerating repeatedly in the same place can work its way into the water system--be cautious.

If you're on a hookup in a park and need a positive fitting to the sewer receptacle, the RV store has three-inch and four-inch screw-in connectors with a garden-hose-thread fitting built in. The trouble is the fitting goes straight up. You don't want that. You want a nice, gentle curve so stuff will flow easily. You can do this with a hose "ell" from garden or RV stores.

If you're tapping the fitting cleanout plug on someone's house, buy a (cheap) threaded bushing to fit the fitting and screw a garden hose connector to it. **Caution:** The access cleanout plugs on houses work well, but many have never been used for years and have become plugged with debris. Check these out first by shooting some clean water through. No point in pissing off a friend or daughter-in-law by filling his/her kitchen sink with poop.

At rallies (fairgrounds) and similar institutions you can find plumbing cleanout fittings all over the place. Some buildings won't have an exterior vent pipe but will have a vent pipe on the roof. You can run the macerator hose up to those unless the building is extraordinarily high.

If you have some privacy, you can also, literally, water the lawn with your macerator by spraying the stuff around a bit so it doesn't puddle up. The smell won't linger more than 5 minutes (if you've a good system--see elsewhere) and try to do it at night if people can see you (by morning there won't be a trace). Watering the lawn or similar dumping in the open must be done with caution. The macerated material (black and gray) is biodegradable and won't "pile up" as if you dumped the raw stuff from the tank, but if you dump in the same place frequently, food particles will accumulate and you can create a bad vector control (bug and rodent) problem.

**Some of these methods are controversial. Some are illegal in some places. Use your head.** One RV, in one place, with some space, can do all the above without damaging the ecology. A bunch of RVs dumping on the ground will create the equivalent of a cattle feed yard--unhealthy and dangerous.

## TEMPORARY MACERATOR CONNECTIONS

Many of us feel the semi-permanent connection above is best, but temporary connections can work well and in some cases are preferable. You may not want to build the plumbing. You may not have sufficient room. May trade RVs frequently. May have two separate sewage system at different ends of the RV (some motor homes) and don't want to join them or plunge for two macerators. (Though two macerators are nice since you have a spare.) May want to use the macerator on more than one RV. Don't, though, plan to be a good sport and dump for all your neighbors. It's a nice gesture, but you will be taken advantage of and you will soon tire of the odious chore, your macerator will wear out early, will overheat and may be damaged. Let them buy their own. Save the generosity for genuine emergencies when a neighbor really needs assistance.

### Some Tips:

- Don't skimp on wiring just because it's temporary. Run stout wiring as described above to a connector near where macerator will be used and use some form of plug-in connector from there to the macerator. If you try to run a flimsy, # 18 gauge, household extension cord to the battery and attach it with alligator clips, you will, eventually, get in trouble.
- Don't ever follow the old RV tip of simply cutting a hole in a sewer cap, bolting the macerator to it and connecting it directly to the RV sewer outlet. At best, sooner or later one or more sewer cap ears will break and you'll end up with poop all over yourself and everything else. At worst, you'll break the fitting attached to the RV with the same results and a much more difficult repair.
- Attach macerator to RV temporarily through a short piece of flexible hose. A piece of slinky will do but won't last long. You can get better stuff from plumbing, irrigation or auto stores like Big A that sell large diameter water hose for trucks by the inch. Use as short a piece of hose as possible,

but enough so the macerator will be supported (against the RV, hanging from a bracket on the frame or lying on the ground). For temporary macerators the model with 3" slip-on inlet is easy for attaching hose. The 1½" inlet can be adapted easily too (and is sold as a kit in RV magazine ads if you can't figure it out for yourself).

- Support, again, is important. Ideally, mount the macerator on a board or something that you can hang from a bracket on the RV and keep things out of the mud.
- Use a switch to control the macerator. (You don't have enough hands to disconnect wires and operate valves at the same time.) Mount the switch in a waterproof box attached to the support above. Don't just bore a hole in the board and stick the switch in it, it'll get wet and corrode.
- Keeping the inside of the macerator wet or lubricated (see MAINTENANCE below) is even more important with a temporary macerator since you might leave it packed away for months.

## TRANSFER TANK

Ordinarily, you macerate your sewage and just pump it into a handy receptacle. There will be times when it's not practical to run hose far enough. Figure 2 shows a transfer tank that can be mounted in/on/under a tow (or towed) vehicle. If at all possible, it should be large enough to hold the contents of both black and gray tanks plus some more. (This is to avoid an overflow--which can be a real disaster if you ever forget to pay attention. I know this for sure.)

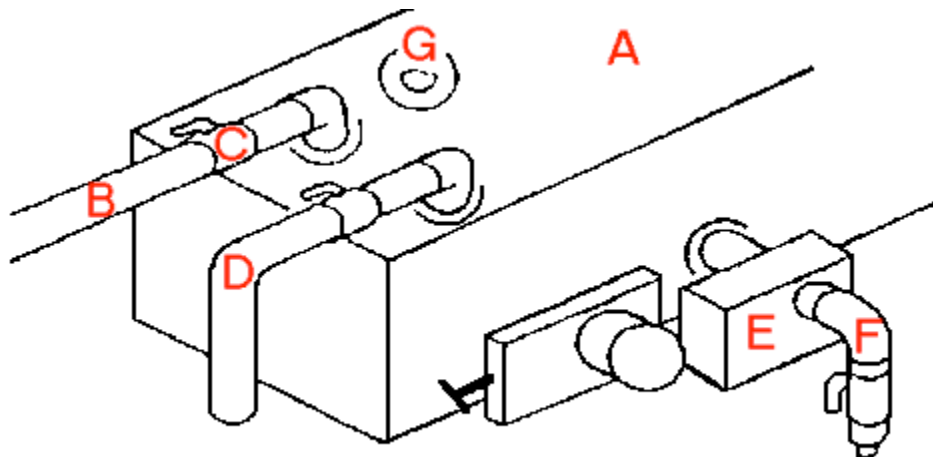


Fig.2 TYPICAL TRANSFER TANK

## EXPLANATION OF THE TRANSFER TANK IN FIGURE 2

**A**--The tank. Black, gray, fresh or homemade. Black or gray are nice because they have sturdy fittings for dump valves built in that may be used if the transfer tank pump fails. Translucent poly tanks are nice because you can see how much is in there. Ideally, the tank will be under the vehicle. It can be in the vehicle, but you'd better be careful with fittings, vents and overflow outlets.

**B**--End of the garden hose from Figure 1. It should have some clear poly hose and a hose stop at the end.

**C**--The stop prevents whatever goes in from coming back out the same way. It also prevents odors when the tank is inside a vehicle.

**D**--A vent fitting that exits outside/under the vehicle. It should have a hose stop also to prevent spills and prevent drafts from blowing odors back through the tank. Make sure you open this vent before filling the tank!--or you'll expand the tank when filling and it will bust and you'll have a hellova mess.

**E**--A pump. It could be another macerator (if the tank is also used as the sewer tank in a camper), but it doesn't have to be. Bilge and sump pumps work well. Remember, the stuff has already been ground up. This tank could be emptied by gravity, but it takes too long and is prone to stoppages. Also, the pump allows you to pump uphill when needed. Keep a couple gallons of fresh water in this tank when it's not being used to prevent things from drying out.

**F**--The line out. It should exit the vehicle and terminate at a hose stop with quick release, just as at the main tank, to allow easy dumping with the same hoses.

**G**--An optional float switch or similar device that is useful when the tank isn't large enough to hold the complete contents of the main RV. It can shut off the pump or turn on a warning buzzer or light while allowing enough space to finish emptying the line after turning off main RV pump and valves.

## THE UMBILICAL CORD

At Figure 3 are typical hose connections in series from macerator output through transfer tank input. The sequence can be assembled in any number of ways, but as shown provides dribble-free disconnects, positive closing, visibility of flow, and easy use of the transfer hose.

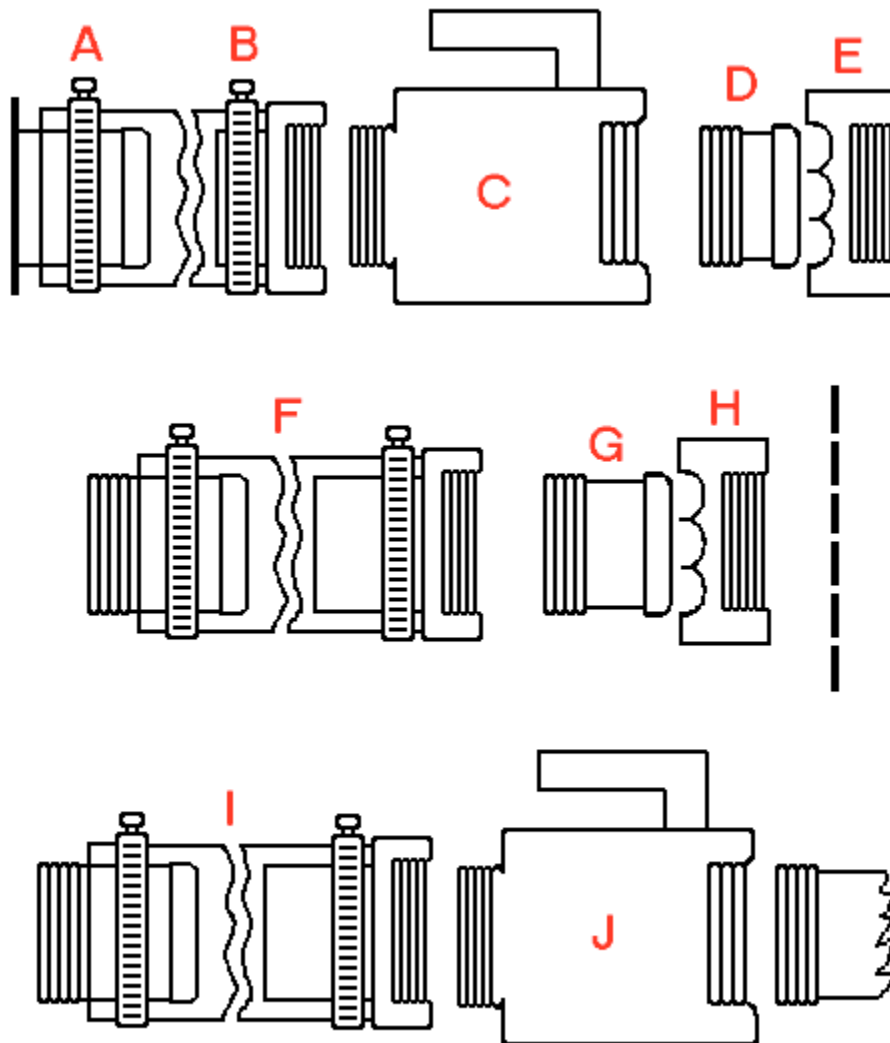


Fig.3 TYPICAL UMBILICAL CORD

### EXPLANATION OF THE UMBILICAL CORD IN FIGURE 3

**A**--Macerator output. (Point (K) in Figure 1.) Attached to it with hose clamp is a 1" inside diameter (ID) clear poly hose. Length can vary, but about 6" provides easy viewing of contents. (Some macerator models have a standard male garden hose fitting at this point, use hose fittings and

appropriate diameter of poly hose in that case.)

**B**--1" insert hose barb x female hose thread fitting (or appropriate depending on style of (A) above).

**C**--Hose stop or valve.

**D**--Male quick-release hose fitting. (As described earlier.)

**E**--Female end of quick connect.

**F**--Main transfer hose, Almost any convenient size. The manufacturer recommends 1" hose, but 5/8" garden hose works fine. (Fittings and valves will have reduced the size to about 5/8" anyway and the outlet at the macerator is only 5/8".) The only problem with smaller diameter hose is that really big tank loads or extremely long hose runs will cause the pump to get warm. Just shut it off a few minutes until it cools down then restart. (The 5/8" system shown, at a reasonable length--up to 50 feet--will empty 30 gallons in about 6 minutes.)

**G**--Another quick disconnect, this one male. Since the other end (Point E) is female, the two hose ends can easily be connected when in storage.

**H**--Another female quick-disconnect. This one feeds into the transfer tank and location is only critical if the tank is inside the vehicle. In that case, keep (H) outside to avoid spilling accidents. The dashed line (the vehicle body) will have some kind of plate/fender well/whatever that this can be attached to.

**I**--A hose with a fitting that connects to (H) and continues to a fitting at the input valve (J) (clear poly hose, again, is best so you can see what's in there before you take it apart).

**J**--The final valve as it would connect to the transfer tank fitting. Depending on the tank, threaded fittings may already be there. There are also cement-on and compression twist-on fittings in RV stores.

- With a system similar to this, even in a crowded rally site, you can get rid of "stuff " easily without moving the RV. Ideally, you'll have room for a fresh water tank also (and a pump to feed it to the RV). Just don't get the hoses mixed up.

## MAINTENANCE

Many of us are so happy with our macerator pumps we constantly advise people to get one but forget to remind people of what they must do to keep it working. Nor does the manufacturer tell you (which is inexcusable).

Under constant use: (which is the best way to take advantage of the benefits of this tool), you don't have to handle slinky" hoses, get "stuff" all over your hands, etc. But no matter how careful you are, you will accumulate hair, fiber and paper shreds behind the cutter blade. It takes a while, but you will build up enough of a tightly-wound wad that you will:

- 1) Seriously bind the shaft and damage the motor (if you don't burn it out).
- 2) Put pressure on the stainless plate, covering impeller and ruin impeller and seals.

**Solution:** Dismantle and clean once a year. (OK, it's a messy job, but somebody's got to do it.) Steps below pertain to JABSCO/PAR brands, but others are similar. Not needless to say is: Lay pieces out so you can get them back together the way they came out. An impeller put back in upside down can get torn to pieces. Stainless plate will wear unevenly. Passages in housings must match or there won't be any place for poop to go.

**A--**Remove four nuts holding front housing on. These are usually brass, threaded to brass studs. One or more may stick and bring the stud with them. No sweat, just turn all four a bit at a time and gently pull the housing along behind (if the nut won't clear the indentations on the housing with stud still attached). Sometimes the housing will "stick" to the gasket between it and the second housing (that covers the impeller). It should come loose with a rap (or the intelligent insertion of a knife blade). You might ruin the gasket, but they're easily cut out of gasket material (if you haven't had the foresight to order some in advance). Actually, you should have a service kit on hand anyway in case something breaks. Kits contain spare cutter, impeller, seal, gaskets (but the new gaskets are just cheezy paper, use them as patterns to cut better ones out of some nice, soft vinyl material).

**B--**Once front housing is off, look behind the cutter and gently cut/dig/pry the "wad" out (you'll be surprised). Be patient and don't bend

anything.

**C**--Stopping and reassembling at this point will usually "get you by," but you can go further if needed. To remove the cutter, you will need to hold the motor shaft in place. There's not much to get a grasp on. The shaft has a flat surface that a 9/32" thin ignition wrench will fit on. The little "nubs" under the cutter won't let you keep the wrench there for a full turn, but the cutter is not too tightly screwed on and, unless it's frozen with crud, it will only take a fraction of a turn to loosen it enough so that it can be removed by hand with just a bit of pressure held on the shaft by pressing against it. The cutter may be bronze or stainless steel and usually needs a screwdriver or similar to be placed between its "prongs" to turn it the first fraction. Do it gently or you'll bend it. When you finally remove the cutter, don't lose the stainless-steel lock washer.

**D**--Remove the stainless-steel plate. It should slide right off unless (as above) gaskets are stuck.

**E**--Look at impeller and note the way "leaves" are flexed (so you can put it back the same way). If you have small fingers, reach in and extract it from the shaft. If not, use something blunt (so you don't cut the butyl) to pry it gently out.

**F**--Pull the second housing off. On the underside of it you'll see a seal held in place with a "star" type washer. Unless the seal has been leaking or is obviously torn up, leave it in place (service kits include replacements).

**G**--Clean the crud off everything. Brush/wipe greasy dirt from shaft where it enters motor. Wire brush the cutter. Lightly touch up scratches you may have made on shaft. Before reassembling, apply a thin coat of grease--(Plumber's Heat-Pruf Grease is best and dandy for trailer hitch parts too--but bearing grease, white grease, work). Apply to Impeller. The hole it goes into. Seal washer underneath. Stainless-steel plate. Surfaces that gaskets will touch. Threads on the brass rods and tip of shaft that cutter screws on to. The grease does two things: Lubricates impeller the first time you turn pump on so you don't ruin it. Allows you to take everything apart easier next time without things being corroded together. Some macerators have a grease fitting built into the outer casing because the above is important. Some clever RVers have installed their own grease

fitting. Some macerators have the motor shaft extended through the rear housing with a screwdriver slot so you can initially "free things up" without damage. I still recommend you use the light coating of grease described when reassembling. If the macerator has been in storage awhile, apply some more through the fitting.

**H--Reassemble, But PAY ATTENTION TO AN IMPORTANT POINT! Do not overtighten anything!** When you screw the two long brass studs into the motor and the short ones into the impeller housing, just turn them with your fingers 'till they stop (you can turn them a little bit more later if there's too much sticking out). These studs screw into really flimsy threads and you'll strip the threads if you're heavy handed. Just snug up the cutter (don't forget the lock washer) to a bit more than finger tight (it keeps itself tight as the shaft turns). The final four nuts are most important. If you tighten them too much, you'll "squeeze" the impeller and if it turns at all, it'll just wear out quickly (and can overload and burn out the motor). All you want to do with these final four nuts is hold the thing together so it doesn't leak. You can tighten them a bit more later if there's a dribble.

Which brings us to temporary use and some of the ways people screw up perfectly good macerators: For any number of reasons, some people only want to use a macerator "when they need it" and use the old-fashioned system when hooked up. At any rate, intermittent use of a macerator still means you must clean it out once a year or so. (Some try to wait until it slows down. This is like waiting 'till your car slows down to fill the gas tank.) If you're not going to use a macerator for a while do not just put it away. The impeller will dry out (and stick to the walls of the housing). When you turn it on, you will often tear the blades right off the impeller (\$10+ at RV stores) or you might burn out the motor (about \$75+). Pour a couple of tablespoons of cooking oil in it and turn it on for just a second. Wrap it in a plastic bag for storage. When you use it the first time after storage, do the same thing, or, on some models, apply grease through the fitting.

## FINAL REMINDERS

If you're going to plug/unplug the macerator to your sewer outlet, as mentioned earlier, do not, ever, use the old RV "tip" of boring a hole in a sewer cap and simply attaching the macerator to it. The first thing that will

go wrong is that the plastic "ears" on the sewer cap will break off--can't handle the weight. (This can be especially amusing when it happens while you're dumping.) The main thing that will go wrong is far more serious. Under that erroneous tip you'll be using those same four nuts I mentioned above to hold the cap to the macerator. Your constant fiddling with them will strip threads, make the gaskets come loose and, when you overtighten them, will ruin the impeller and, likely, the motor.

Be it permanently or temporarily mounted, a macerator must have good battery connections and heavy wire. (Unless you want it to bog down, run slow and burn up the motor.) A macerator can draw well over 10 amps. That's a lot! Don't try to run it on skimpy stuff.

Keep it greased (as above) or, better yet, especially when permanently mounted, wet! Try to mount it so that you can open the valve from tank to macerator and "load" the macerator with fluid. Technically, these things are self-priming up to 6 feet (that's not 6 feet vertical), but that's a hellova strain on the motor. Often, an empty macerator, even if it's used every couple of weeks, will dry out a bit and get "sticky" because of what's in it. The amp draw when starting it under such a large load can blow a fuse or damage the macerator.

## **TROUBLESHOOTING/MODIFYING**

There's not much that can go wrong with these. The motors are outrageously expensive (I think) but extraordinarily good. (I bought my first macerator in '81 and still use it.)

Impellers are the weak link but proper maintenance precludes trouble and they are easily replaced. (I have 5 macerators and have only had to replace one impeller.) The paper gaskets are a weak link, but you can easily cut your own with better material from any auto store. (As impellers age, some parts swell up a bit and bind against other surfaces. A slightly thicker gasket stops this.) You can easily hear the difference between a freely running macerator and one that is too tight. You can also see it by watching the quantity of water and size of stream if you shoot one in the open and when you measure the time it takes to dump a known quantity of the same substance.

The four cap nuts and four threaded rods can corrode. They are available

in good hardware stores. Buy the rod in lengths of 24" or so and cut them to your own size (just a bit longer than those supplied with the macerator and you'll have more room for adjustment). Tidy up the ends with a file--you do not want to screw up the threaded inserts in the macerator housings. You don't have to use the "cap" type nuts as supplied. I prefer standard nuts (of stainless steel). They don't cost much in such small amounts and don't corrode and stick to the brass rods. The foot or so of wire attached to the motor is OK but slightly light-weight. It shouldn't be a problem, but when I had a macerator apart once I replaced the wire with heavier stuff. That macerator does run faster and with properly sized gaskets visibly dumps sooner, with more power than others. (Don't take the motor apart if you don't know what you're doing.)

**If the motor won't run:** (The only times I've seen this it was due to the user burning out the motor by not following all the cautions above.) First thing to do is check fuse, wires, power source, connections, etc.--all the usual stuff. Then connect it directly to a known, good power source for a second to see if it will turn. Only then do you start dicking with it.

**If the motor runs but no water comes out:** (The most likely trouble.) First. DON'T PANIC! Second. Don't just let the thing run. Shut it off and go through the following, turning it on just for very short periods at each test. Check that all valves are in proper position (and actually open, not broken off inside). Is there anything in the tank? Disconnect exit hose. Shoot some water back into the macerator through its outlet in case it's just stuck. Turn it on very briefly with no outlet hose attached. Watch out! -- you might get a surprise. If outlet hose is plugged, maybe even many feet away, there will be enough back pressure to keep macerator from priming and pumping.

If none of the above solves the problem, you most likely have an obstruction or a bad impeller. Remove macerator. Check for big wad of "stuff" in sewage pipe. Check for same in macerator input hole and look for pieces of cloth, glass, kitchen scrubbers, etc. Dismantle. Remove blade and impeller, don't just look at the impeller (the outer flexible part of the impeller can become detached from the hard inner bearing and you won't know it unless you remove it). When running, the inner part of a broken impeller turns, the outer part doesn't--this one fakes out a lot of people. Check outlet. Check housing. Note that there are passages in housings

that must match each other for stuff to pass through. It's possible to put a macerator together so that they are blocked.

If there are no obstructions and if impeller and blade are OK, reassemble and momentarily connect to power while peeking in input hole (carefully). The thing should turn instantly and violently with mucho noise. It should be OK. To make sure, hold the input hole under a running faucet and turn it on (better to have someone else turn it on so you can point it in the right direction).

**Blockages "on down the line."** As mentioned above, can cause macerator not to pump even though not directly associated. Make sure outlet hoses, connectors, fittings at sewer connection or transfer tank aren't blocked. **If the macerator pumps when held under a faucet, then it's OK and your trouble is elsewhere.**

## MACERATOR AND PUMP SOURCES

Most RV and Marine stores, but the best prices (at this time and for some years now) are from "West Marine" (mentioned earlier) and from "Post Marine Supply," 111 Cedar St., New Rochelle, NY 10801 (800) YACHTER. You might check also with "RV Sani-Con" ([www.emptythetanks.com](http://www.emptythetanks.com)).

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Return to list of [Poop Sheets](#)