

Composting Toilets

This material has been extracted from manufacturer's literature (SunMar), the "Earth Ship" series of excellent books and information sheets from "Backwoods Solar Electric Systems" (the most knowledgeable dealer).

I have used composting toilets on occasion, but do not use a composting toilet in my RV (though I probably would if I had room for one), so this is not written from much hands-on experience. In general, these things do work--IF you use them properly and precisely follow the instructions. If you use them improperly, you WILL have problems. First, then, an extract of the manufacturer's basic description, followed by some of the "Earthship" experience, then some feedback from "Backwoods" customers using the toilets in real life and finally a few sources and tips:

HERE'S HOW THE SunMar BRAND WORKS:

A composting toilet system has three completely separate tasks:

1. Compost the waste and toilet paper quickly and odorlessly.
2. Ensure that the finished compost is safe and easy to handle.
3. Evaporate the liquid.

In "SUN-MAR" each task uses a separate chamber with its own independent environment, reportedly doubling composting speeds of the old single chamber units with mechanical mixers. (One single-chamber unit, the lower capacity "TROPIC", remains in the product line.)



The Composting Chamber--"SUN-MAR" considers ideal conditions for fast, odorless composting are provided in a rotating drum, (the Bio-drum). The drum keeps the compost oxygenated, mixed, moist and warm--perfect for fast, aerobic (odorless) composting. Waste enters through the top. By adding peat moss, and periodically turning the handle on the front of the unit, the drum rotates, and the compost tumbles, (assisted by a mixing baffle), thoroughly and completely oxygenating and mixing every part of the compost. The drum is ideally rotated 4-6 revolutions about every third day while the toilet is in use. More frequent rotation of the drum is not recommended. The drum has a door which closes automatically to keep the waste inside as the drum rotates. After turning, a lock automatically maintains the drum in top dead center position to receive new material.

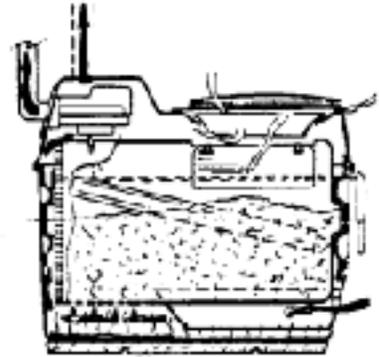
- To ensure that compost can't get saturated, a screen at the rear of the drum filters excess liquid into an evaporating chamber.
- By protecting the compost from direct heat, the drum keeps the compost uniformly moist. The drum has the volume to hold enough material to retain natural heat in the compost's core. On some models, insulation on the drum prevents heat loss.
- Warm, moist, oxygen rich conditions in the drum allow microbes to quickly break down the waste into essential minerals. When the drum is 2/3 full, some compost is extracted into the finishing drawer by pulling a drum lock, and rotating the drum backwards. Now, the drum door remains open, and compost falls into the second chamber; the compost finishing drawer.

The Compost Finishing Drawer--is immediately below the composting drum, and just above the evaporating chamber. Compost is totally isolated from material in the drum. Though no longer subject to contamination from fresh waste, it should not be used on edible vegetables. In the finishing drawer, compost is surrounded by a stream of drying air and absorbs radiant heat from the evaporating chamber. Composting and sanitation are completed, and the compost becomes safe to handle. The finishing drawer is removed and sanitized compost emptied when necessary to extract more compost from the drum.

The Evaporating Chamber--forms the base of the toilet, where excess liquids which cannot be absorbed by the compost are evaporated or drained. Liquid is evaporated by drawing air through intake holes at the base of the toilet, over the evaporating surface, and up a vent stack. A partial vacuum is maintained to

prevent odors. Electric models have a fan to assist venting and thermostat controlled heating element keep the floor of the chamber hand warm to assist evaporation. (Fans can be added to non-electric models.)

How does composting work in a Composting Toilet? Similar to that in a back yard compost pile, but much faster and more efficient due to the nature of the waste and the compartmented toilet. Heat, oxygen, moisture, organic material and microbes are needed. Heat is generated from the compost itself (the "stuff" in the toilet, augmented by a heating element in electric models and by the toilet being indoors). Oxygen by venting and drum rotation. Organic material by the addition of peat moss mix in small amounts. Moisture by the human waste (which is 90% water). Microbes (that "eat" the stuff and turn it into compost) by the addition of small amounts of rich top soil. The microbes do the real work--and they thrive in the "rich" environment of the toilet-- far better than in a back yard heap of ash and trash.



Installation in an RV. First, get the brochure and technical sheets from the manufacturer or dealer. (See Sources and TIPs from phred on last page). These things are large and you need to make sure it will fit. Note that they're rather tall. You need to make sure you can get on it. You'll need to run a (4" diameter) vent pipe through the roof. You will need to add a fan in the vent (see later and note that the best dealer listed provides a free fan with non-electric models). Note that these have a fitting for a 1" hose to allow overflow to a septic or cesspool system in case the unit is overloaded with fluids. This is no problem in an RV--you just run the line to your black water tank.

Start Up, Use and Maintenance. Start up is simple. Follow the manufacturer's instructions! Add the prescribed amounts of soil (see manufacturer tips later for how to select the proper microbe-rich soil) and peat moss mix. Begin using the toilet. Add about one half cup of peat moss mix per regular user per day. Mix and aerate the contents as prescribed by turning the handle and rotating the drum per instructions.

CAUTION! Note on the following pages that there are a lot of conflicting instructions and user tips. Someone says "Do this." Someone else says "Don't do that." Read it all and you'll see the common thread of how the successful users took the time to learn how the composting process works. They don't overload it and don't add stuff that defeats the process.

Odorless? Ideally, if it's installed and vented properly and if the composting process additives are properly done and if it's not overloaded, the thing should be odor free. Composting toilets use "aerobic" microbes (as in garden soil which doesn't smell bad). RV holding tanks use "anaerobic" microbes (as in a septic system or cesspool which smells like what it is).

Freezing--shouldn't be a problem in an RV that's being used. The toilets are all stainless steel and fiberglass and there's plenty of expansion room inside, so freezing shouldn't damage them. Freezing, will, though, decrease the composting action.

HERE'S THE "EARTHSHIP" (Vol. 3 by Michael E. Reynolds) EXPERIENCE:

"Earthship" Vols. 1-3 are highly recommended reading for people seeking a better way. The people involved have been on the leading edge for many years. If there's an innovative way to do something, it's likely they've tried it. They now have a web site--check them out. Search Earthship+Solar Survivor Architecture.

This extract pertains to the "SunMar Excel--NE "(non-electric) model which is a logical choice for RVers. There are RV and Marine models also that may be of interest (see later).

- Earthship emphasizes the necessity for a small, 12 volt "muffin" fan in the vent tube. Stating that without it the unit will stink. The fan creates a vacuum that draws vapors out of the "house"/RV. The proper fan uses very little electricity--as little as 2/10ths of an amp in some cases--and, in my experience is needed. (A fan is usually an optional extra, but "Backwoods" includes one at no cost.)
- Earthship emphasizes that the unit must be used properly, finding that most any kind of composting

enhancers worked; such as sawdust, peat moss, vegetable scraps or leaves. (More on this later (see Real Life and Factory Tips below) as opinions of just what composting enhancers work sometimes differs.)

- Earthship points out the need for "tumbling" (turning a crank that mixes the contents) after every use. And here's where there are lots of conflicting instructions: From "every use" (book fails to mention how many turns to give it). To a manufacturer instruction of "once a week with 3 or 4 full revolutions of the drum." To another manufacturer recommendation of "4 to 6 revolutions twice a week when in use--and more frequent revolutions are not recommended." Ordinarily, you should follow the instructions in the manual (but I'd sure quiz the dealer or manufacturer further on this).
- Earthship goes on to point out that the worst misuse seen was people not understanding the need to "back tumble" the unit periodically and recommends that every three weeks (under normal use) the drum be turned backwards about two revolutions. This unloads some of the content into the "finishing drawer" (see manufacturer description on page 1). This is necessary so composted material will turn into a compost that can be safely disposed of. Another conflict here, though, as one manufacturer instruction (page 1) recommends back tumbling when the drum is 2/3 full--but doesn't say how many turns. Quiz 'em some more.
- Earthship and manufacturer seem to agree that the contents of the finishing drawer should be left undisturbed about three weeks and then can be emptied (assuming no fresh stuff was put in it).
- Earthship summarizes that if the tasks of adding compost enhancers/additives, tumbling and back tumbling are not done properly, the dumped content of the finishing drawer will be "rich" (meaning part poop instead of true compost).
- Earthship bottom line is that the unit will work very well if you know how to use it.

HERE'S SOME COMMENTS FROM "REAL LIFE" USERS:

Several years ago a man bought a unit direct from the factory. He, for some reason, chose to write "**Backwoods Solar Electric Systems**" that he was not happy at all. His unit did not drain liquids, liquids leaked at the rivet holes from the drum into the finishing drawer. He felt the compost process simply didn't work. The unit was smelly, etc. He described things he had done. One was to put yeast into the unit. Exactly the wrong thing to do, as it gives the wrong reaction. Clearly, the guy failed to follow the manufacturer's instructions (they say no yeast) and there's no telling what other mistakes he made. **(Don't ever put yeast in an RV holding tank either--but that's another story.)**

"Backwoods" conducted a customer/user survey based on the above. Here's a sample of the replies: I have inserted my comments and questions in brackets []:

- "That correspondent must have had an earlier version of the toilet. Yesterday I examined mine very closely There are no rivets in the drum that would leak other than back in the area where excess liquid goes to the drain anyway. The unit came with clear, concise set-up and operation instructions It is a quality product that should serve us well."
- But another writer said, "We are less than satisfied with the unit. There was a leak in the drain at the rear of the toilet. There were many adapters and angles [?] and insufficient slope for proper draining. We put it up on 4" [?] blocks and made the drain longer and that has improved the drainage. [Looks like a case of overuse?] The composting process seems slow and the unit fills quickly. The longer I used it the larger the amount of green and brown matter I added to improve the process. [Too much?] We stopped using it for urine after a few months because the compost was too wet and not working and there was always liquid standing in the bottom. Drier conditions improved the unpleasant odor. I leave the lid and lower tray open a bit to improve ventilation. [The wrong thing to do, as it **reduces** ventilation.] The odor is unpleasant in windy weather or with low barometric pressure. [Poor ventilation. No fan?] I have emptied the barrel several times. The first few times the composting process was incomplete. There was too much liquid [?] and I would then leave the unit idle for 2 to 4 weeks. The last few times composting was close to complete. The unit was drier. The emptying tray [finishing drawer] is very small and compost gets caught on the sides before it gets in the tray. [back tumbling too soon?] It can be a messy job. Bugs like fruit flies

and soil gnats get in the compost and through the house. [No wonder, with toilet lid and finishing drawer open and improper ventilation.] Regular spraying helps but doesn't eliminate the bugs. [same as above] I have wondered if the ventilation problem is affected by our heating with a wood stove which draws air into the house. [I wonder if the toilet is vented at all to the outside?] We are disappointed and feel it was a poor investment for full time use of a small family (2 adults and one child)." [So, what was the kid tossing/pouring in there? Read this, then go back and read the "EarthShip" comments by someone who really knows what he's doing.]

- But yet again someone else wrote, "My experience has been quite positive. Like any ecologically sound process, it takes a bit more conscious thought than the power and water guzzling 'modern' methods. YOU MUST HAVE AN UNDERSTANDING OF THE COMPOST PROCESS. [How true.] My waste material really does disappear. The sight of the compost is not disgusting and no odor. I think the man who had problems probably just loaded it up and expected it to handle it. I do not add the materials specified as carefully and as often as the directions indicate, yet it is functioning well and is odor free. Mine is used by one or two people and as an experiment I did not bury the overflow drain so I could see what overflow there would be, and there has been none. I use oak leaves as my main compost material due to the slow breaking down, and use a bit more sandy soil than they recommended. My only problem has been after I left it open once or twice [That's a no-no.] I had flies breeding in the compost. I let it dry out for a week or two and that was controlled. I understand there is a biological parasite that can be put in the compost to stop fly breeding. [See manufacturer tips later.] I wish it had a directions sticker inside the lid so I don't have to instruct guests. They are uncomfortable with the discussion and tend to leave early and go 10 miles to a gas station. [So do a lot of people who visit an RV and that's a lot simpler. I love this guy. He's got the right attitude.] Overall I am very pleased and would buy it again if I had to do over, and we may eventually purchase another. I feel very good that with this, my solar electric system and a future [water] well, I will truly be self-sufficient and separate from the self-defeating and socially unsound systems the rest of the world uses. Especially around Earth Day I have had many friends remark that I must feel very good about the way I live--and I really do."

- And still again someone wrote, "While the composting action has not lived up to the brochure description, it has been adequate. The unit has held together fine and we have no odor problems. Overall, we would recommend the unit."

A pretty fair sampling, I think, and the people who followed the instructions seem to have done well. I have no idea how well you'd do or I'd do. Obviously, you've got to pay attention to what you're doing!

HERE'S SOME TIPS FROM THE FACTORY:

- There is a liquid compost helper available for gardens [any garden store] and one teaspoon a week makes it really go.
- If too wet (it looks like clay) you can install the unit with the front elevated one inch to make the drain work better [shouldn't be necessary unless you're overloading it]. If too dry (paper over a day old looks dry) add 1/2 gal water [seems like a lot]. Three or four times a year add a cup of garden soil, preferably shaken from the roots of weeds from several different locations to get a microbe mix. The 1/2 cup per day per person of peat moss is REQUIRED [One factory instruction says one cup, one says 1/2 cup.]. [The unhappy person who added yeast got exactly what he deserved--the wrong reaction. As "EarthShip" and another writer said, "You must understand the compost process."]
- ONLY turn the crank ONCE a week, but go three or four full revolutions of the drum. The door closes as it is rotated, and opens when stopped in the correct position. [Here's one to check out--as mentioned on page 3. Some of the info appears to pertain to older models and some to newer. The manufacturer does not want people complaining, so has no doubt included updated instructions as time goes by. Again, quiz manufacturer and dealer on this apparent conflict.]
- Diatomaceous earth added [garden store] will stop flies if they appear, usually from eggs added with the soil or compost material. Compost material from the kitchen may be added but is not necessary [and may be unwise].

- Toilet paper may be put in the toilet (good source of organics). [Don't put in too much. Don't use the multi-ply, perfumed, colored, stuff. Use RV paper or, better, generic single ply--that's the same thing but cheaper. Even better is "Scotts" brand single ply that's cheap in 1,000-sheet rolls.]

HERE'S SOME SOURCES and TIPS from phred:

- These things from SunMar (Excell Non Electric) are big. Width about 22" + an inch or so to turn handle, length to 33" and height about 28" (step-up is provided). Extra room is needed in front to pull out the finishing drawer. Check carefully with dealer for dimensions and routing of vent pipe. The "Excell NE" model is suited for RV use. It is rated for normal use by 2 adults (or a family of 3--whatever that means).
- The "Ecolet" model/family has two special mobile versions that might be of interest. Designed for limited space, they are about 19 1/2" wide by 23" deep by 29" tall. [Less capacity than the larger NE, so 2 adults full time might have a problem?] Both have a 12 volt fan and dual 12 volt and 120 AC heating elements to hasten composting [and use more electricity than NE models, so make sure you ask "how much?"] Ask for the manufacturer's "Ecolet Marine/Ecolet RV" brochure.
- You can get manufacturer's info from: **Sun-Mar Corp.**, 600 Main St., Tonawanda NY 14150-0888 (905) 332-1314 (<http://www.sun-mar.com/>). Also from "BackWoods Solar Electric" (below).
- "Earthship" Vol. 3, Evolution beyond economics, pp 94-95, by Michael E. Reynolds in libraries, ISBN 09626767-?-?. Call #690.837. Reynolds' organization is Solar Survivor Architecture, Box 1041, Taos, NM 87571. (505) 751-0462 for general info. (505) 758-6915 for books, etc. Earthship is an exciting concept. Read about it. The books are excellent. (They're trying a new method of waste handling now--not suitable for RVs, but fascinating)
- **Best source to buy from** (good discounts) and who has good advice since they live full time with a composting toilet is: "**Backwoods Solar Electric Systems**," 1395 Rolling Thunder Ridge, Sandpoint ID 83864. (208) 263-4290. (<http://www.backwoodssolar.com/>) If you're interested in alternative energy products, you need their catalog/textbook on this and much more. Composting toilets are expensive. Do your research. Ask "Backwoods" about obtaining the Sun-Mar video. It will cost you about \$10 but is refunded on purchase.

All things considered, I do not recommend using a composting toilet **UNLESS** you fully understand what's required. The care and "feeding" of a composting toilet is not for careless people.

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