

Oil-Recirculating Waterless Toilet

INTRODUCTION

In the past few years, the San Dimas Equipment Development Center (SDEDC) has been seeking suitable replacements for the vault and pit-type toilets at National Forest recreation sites. During this period many waterless and water-saving toilets, and toilet systems, have been examined and evaluated. One such system, the "Magic Flush" oil-recirculating flush toilet system, has been installed at two high-use campgrounds in California Region National Forests. This system has been monitored since June 1973 and, during this period, public acceptance has been excellent. Virtually all users thought the system was a standard water flush toilet. The oil-recirculating toilet has the aesthetics of a water flush toilet; is odorless; and eliminates the problem of miscellaneous debris (rocks, bottles, cans, clothing, etc.) that is deposited into vault and pit-type toilets.

MAGIC FLUSH TOILET SYSTEM

The Magic Flush oil-recirculating flush toilet system is manufactured by Monogram Industries, Inc., Venice, Calif. This system (fig. 1) has a standard vitreous china flush toilet (fig. 2)

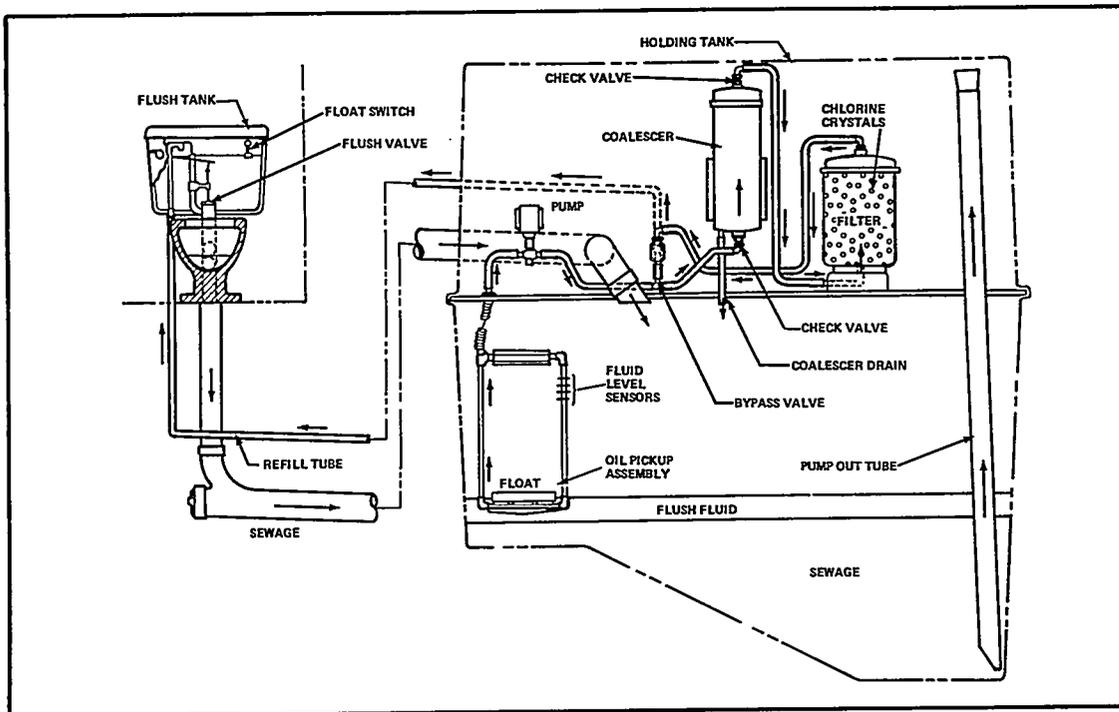


Figure 1. Schematic of the Magic Flush toilet system.

with standard 4-in plastic sewage pipe leading to a fiberglass holding tank. A water-white mineral oil is used as a flush fluid. The system is available in two holding tank sizes:

- A 400-gal fiberglass holding tank accommodating a maximum of two toilets or one toilet and one urinal;
- A 1,000-gal fiberglass holding tank accommodating a maximum of four toilets or three toilets and one urinal.

COMPONENT DESCRIPTION

The holding tank is a single tank with an upper and lower compartment. The upper compartment contains the oil pumps, electrical boxes, filter assemblies, and a quick-disconnect pump-out pipe with attached vacuum breaker. The lower compartment contains the sewage, oil, and oil pickup assembly.

The bowl and throat of the toilet have a Teflon coating. The toilet is available with standard plumbing beneath the floor or with a rear discharge for installation into existing buildings. Only ABS (acrylonitrile butadiene styrene) or PVC (polyvinyl chloride) plastic sewer pipe with long sweep fittings should be used from the toilet or urinal to the holding tank.

The flushing fluid is a water-white, non-toxic mineral oil; will not support bacteria; has a pour point of -20°F ; has a density of approximately 0.8. The flash point of the flushing fluid is between 210 and 215°F . A lighted match or cigarette will extinguish immediately when dropped into the fluid, therefore no fire or safety hazard is presented. Also, the flushing fluid is immiscible with, and lighter than, water and floats on top of the sewage mass.

The oil pickup assembly is at one end of the holding tank in a compartment separated by a Teflon-coated screen. The screen prevents large sewage particles from entering the compartment, thus reducing the chances of clogging the oil pump pickup assembly. The screen is easily removed for cleaning following each holding tank pump-out.

First, the oil is pumped through a water coalescer to remove any suspended urine, then through a filter containing chlorine crystals to disinfect any urine that might go through the coalescer, then through activated charcoal to remove any color or odor, and then on to the flush tank.

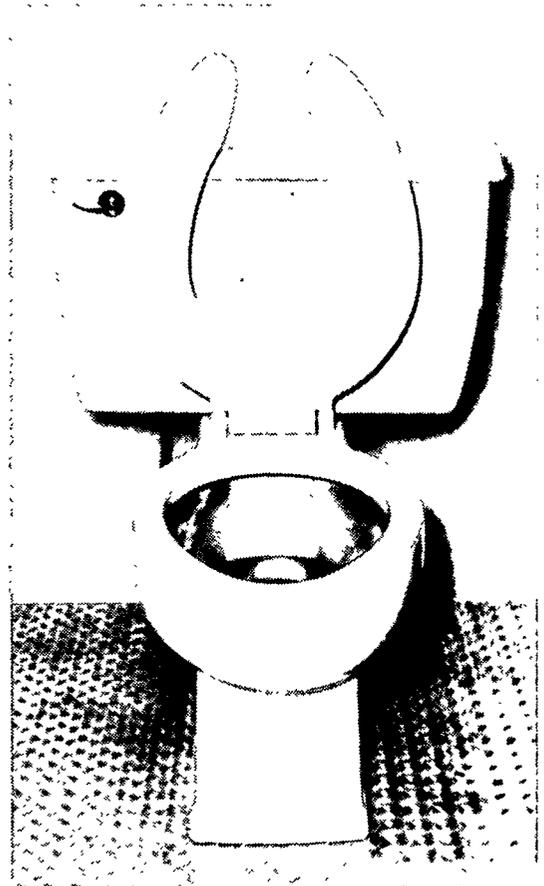


Figure 2. Magic Flush standard toilet.

There are four flush fluid level sensors in the oil pickup assembly:

- A $\frac{3}{4}$ -full level sensor to alert the operator that a pump-out will soon be required;
- A full-level sensor which will render the system inoperative in case the pump-out does not occur soon enough;
- A low-level sensor to activate an automatic vacuum breaker, assuring that no oil is withdrawn during pump-out;
- An oil depletion sensor to render the system inoperative in case of significant oil loss.

As a rule of thumb, one can expect that each 100-gal holding capacity will accommodate 1,500 average toilet uses.

EXISTING FIELD INSTALLATIONS

In June 1973, the prototype Magic Flush (three toilets, one floor-mounted urinal and two 400-gal holding tanks) was installed into an existing vault toilet at Jenks Lake on the San Bernardino National Forest, California Region. In August 1974, the 400-gal tanks were removed and new production models were installed. Before the 1975-use season, all production modifications to the system were made.

In June 1974, two Magic Flush systems (four toilets and two 400-gal tanks) were installed into two existing two-hole vault toilet buildings at Chilao Campground on the Angeles National Forest, California Region. All production modifications were also made to this system.

The initial Magic Flush prototype system was redesigned many times to reach the present production model. Based on field monitoring for two summer-use periods, the system appears to have practical application for vault and/or pit toilet replacement.

POWER SYSTEMS

Monogram's Magic Flush is available in two power systems, either 24 V dc or 110 V ac. The Jenks Lake system operates entirely from golf cart batteries periodically charged with an on-site generator. Golf cart batteries are more durable than automobile batteries because of heavy duty cells and higher amp-hour rating.

The present generator supplied for a four-unit system is a Pincor, model BL-62, pushbutton start, Briggs and Stratton 1.9-hp motor which provides up to 27 amps at 15 V. The operation of the generator depends on the area use, and type of batteries supplied. The present cost of the generator is \$300.

The existing ac power source at Chilao Campground was not sufficient for system operation; however, it was adequate to operate a small high rate charger. This charger keeps the batteries constantly charged. The battery charger, model "S", is manufactured by Lester Equipment Mfg. Co., Inc., Los Angeles.

Neither power system has caused any problems.

In cold climates (32°F and below), where 110 V ac is available, a space heater should be installed in the upper compartment of the buried tank to prevent the water coalescer from freezing. The heater presently available is manufactured by Montgomery Brothers of Los Angeles. The heater is a calrod type; it is rated at 1,000 watts, and draws 10 amps at 115 V ac. The heater's output is 3,412 BTU/hr; it maintains a temperature of 40°F when the outside temperature is 0°F. This is accomplished thermostatically by a blower capable of 100 scfm. With these conditions, the heater operates 50 percent of the time. The present cost of this heater is \$250. No heater is supplied for the 24 V dc system.

MAINTENANCE

Through design changes and parts replacement, the problems that occurred with the original prototype system have been resolved. The one major problem, which created a safety hazard, occurred when the toilets plugged up due to some foreign material (panty-hose, sanitary napkin, or sticks), causing oil to spill onto the floor. This problem has been partially solved by providing overflow hoses at the top of the toilet bowl. If the plug up occurs somewhere between the toilet and the holding tank, there is still the possibility that oil will spill onto the floor. If the plug up occurs in the throat of the toilet (and most plug ups do occur there), then the overflow hoses will prevent the oil from spilling onto the floor.

People will flush items down a public toilet that they would never think of flushing down their home toilet. It is strongly recommended that containers be installed for sanitary napkin disposal in each woman's stall, immediately adjacent to the toilet.

The manufacturer recommends that a mild solution of chlorine and water be used to clean the Teflon-coated bowl. A mild soap or detergent solution containing bleach can be used for the rest of the toilet and interior building compartment. All cleaning solutions are to be disposed of elsewhere, NOT in the toilet bowl.

At present, the manufacturer states that the water coalescer will need service annually, and the replacement cost of the coalescer is \$25. The activated charcoal filter will need service at 6-month intervals or every other full pump-out, whichever occurs first. The replacement cost of the filter and chlorine crystals is \$50 each servicing period. Flushing fluid replacement is about 1 percent of sewage volume—400 gal of sewage will remove about 4 gal of fluid. The cost of the flushing fluid is \$3/gal.

The Magic Flush system does not require any odor control chemicals. The oil covering over the sewage (approximately 4 in) prevents any aerobic decomposition and the high pH all but eliminates any anaerobic decomposition. Sewage treatment plant operators should not refuse this waste because it is in a rather dormant state, quite amenable to most conventional treatment processes.

ADVANTAGES AND DISADVANTAGES

Advantages

- The system does not require water.

- The toilets are available with a rear discharge sewer opening making it possible to install the fixtures in existing buildings without installing sewer lines beneath the floor.
- The toilets have built in overflow tubes to prevent oil from spilling onto the floor in case the throat of the toilet plugs up; however, if the sewer line gets plugged up between the toilet and the holding tank, subsequent flushing of the toilet can spill oil onto the floor, resulting in a slippery surface.
- The toilets are almost identical with most home water flush toilets, so people accept them more readily than vault or pit toilet risers.
- The toilets are odorless because during use, the fecal matter and urine settle instantly below the oil to the bottom of the bowl, thereby preventing any odor; whereas, with water flush toilets the fecal matter and urine do not settle to the bottom of the bowl.

Disadvantages

- The system requires electricity (110 V ac or 24 V dc) and periodic maintenance of the filter systems.
- The waste has to be pumped out and treated at another facility.
- A large pit has to be excavated to install the holding tanks within 50 ft of the building.

COST DATA

The Magic Flush oil-recirculating flush toilet is available in four systems and two holding tank sizes (400-gal capacity—96-in long, 50-in wide, 99-in high; and 1,000-gal capacity—96-in long, 70-in wide, 110-in high). The prices listed below are as of May 1975, and subject to change.

Manufacturer

Monogram Industries, Inc.
3226 Thatcher Avenue
Venice, Calif. 90291

Systems and Cost

Magic Flush System 1-A—\$3,020.

1 toilet, 1 400-gal tank
 1 purification system, initial charge of Magic Flush fluid

Magic Flush System 1-B—\$4,105.

2 toilets, 1 400-gal tank
2 purification systems, initial charge of Magic Flush fluid

Magic Flush System 1-C—\$7,840.

3 toilets, 1 urinal, 1 1,000-gal tank
4 purification systems, initial charge of Magic Flush fluid

Magic Flush System 1-D—\$15,680.

6 toilets, 2 urinals, 2 1,000-gal tanks
8 purification systems, initial charge of Magic Flush fluid

Three other companies producing an oil-recirculating system are:

Chrysler Corp.
P. O. Box 29, 200
New Orleans, La. 70189

Interlink Life Support Systems, Inc.
Suite 2323, 1010 2nd Avenue
San Diego, Calif. 92101

Sarmax Corp.
2207 Colby Avenue
Los Angeles, Calif. 90064

