Public Facility

Maintenance Manual

Clivus Multrum, Inc.
15 Union Street
Lawrence, MA 01840

800.425.4887

clivusmultrum.com

clivusmultrum Incorporated

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Table of Contents

How the Process Works

The Clivus composter uses natural biological decomposition to convert human wastes into reusable end-products. The composter is the containment vessel for a living ecosystem: a forest floor in a polyethylene tank.

This ecosystem needs nitrogen, carbon and oxygen to thrive. The mixture of toilet waste (nitrogen) and bulking material (carbon), exposed to a constant flow of air (oxygen), allows bacteria and other beneficial organisms to convert the organic material to safe, usable compost and liquid fertilizer. Nature's way.

The compost end-product is rich in organic matter, with a bacterial composition similar to top soil. The liquid end-product (which begins as urine) becomes a concentrated fertilizer rich in plant nutrients after passing through the compost layers. The system releases two gases, carbon dioxide and water vapor, the same gases humans exhale.

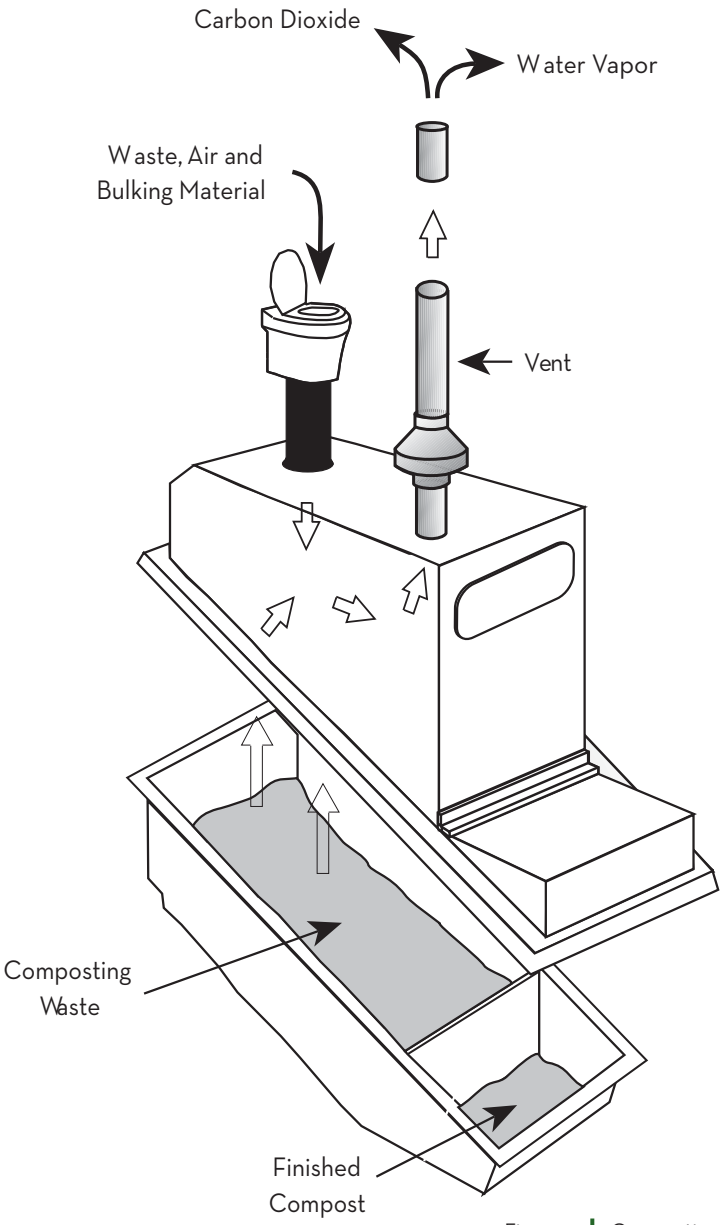

Figure 1. | Composting Process

Typical & Exploded Views

Clivus Multrum composting systems are certified by the National Sanitation Foundation under Standard 41 (day-use, park).

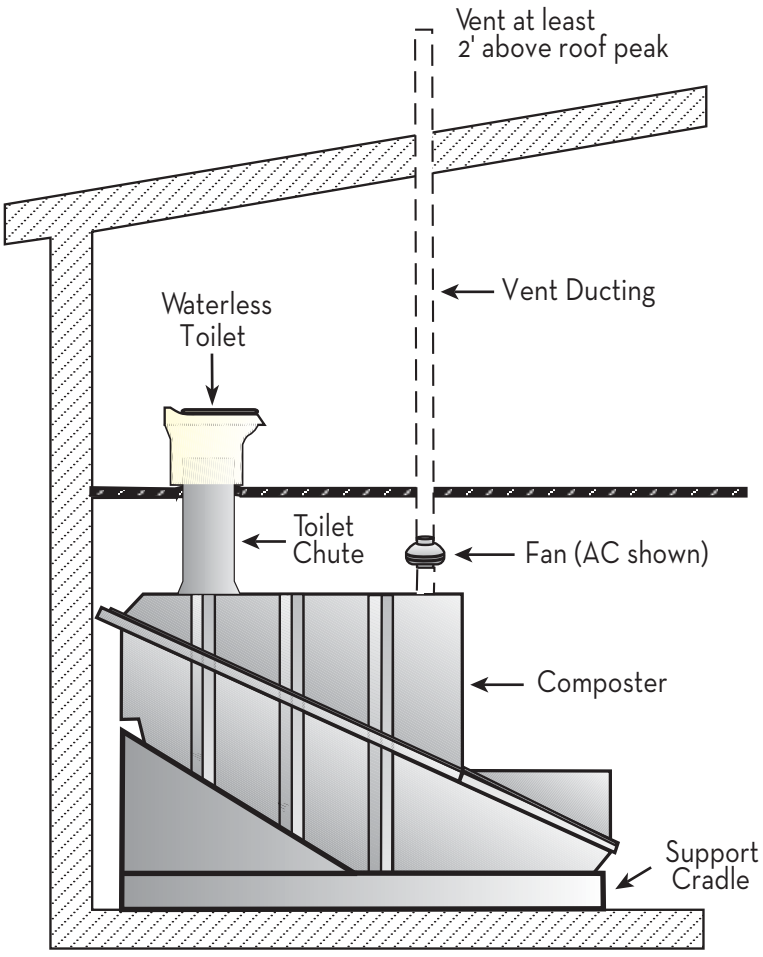

Figure 2. | Typical Configuration

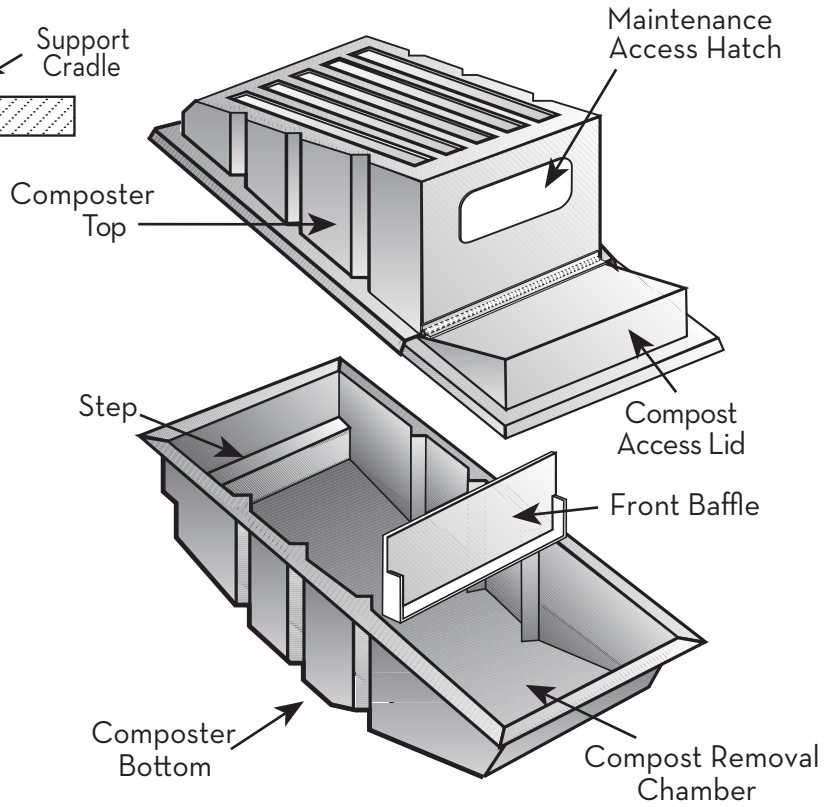

Figure 3. | Exploded View

Maintenance

The Clivus composter is designed to require minimal maintenance, but this maintenance is essential if long-term functioning is to be assured. Please study the following recommendations thoroughly.

Tools & Supplies

• bucket, 1 gallon

• gloves, latex or rubber

• dust mask

• rake

• bulking material (planer shavings or medium-textured bark mulch)

• Multrum bacteria

• Multrum cleaner

• water (for manual moistening and for cleaning)

Safety Guidelines

Simple precautions should always be taken when dealing with untreated human wastes. We recommend the following when maintaining the composter:

• wear latex or rubber gloves;

• wear long-sleeved shirt or coveralls;

• wear a dust mask if the compost pile is dry;

• wear safety glasses.

Daily or Weekly Procedures

Clean Fixtures

• use MC100 Multrum Cleaner

• clear urinal drain lines

Make a solution of water and cleaner (such as MC100 or other mild soap.) Use a toilet brush to clean the inside of the fixture. When finished, do not pour excess solution into toilet. To avoid sediment build-up in urinal drain lines, pour 2 tablespoons of MD100 bio-compatible drain cleaner down urinal fixture and add only 4 oz. of water to slowly flush cleaner through pipe.

Add Bulking Material

• approximately one gallon per roll of toilet paper used

Bulking material is needed to give the waste mass a crumbly and porous texture, to allow air and compost organisms to penetrate the mass and to provide a carbon source for the decomposition process.

Clivus strongly recommends softwood planer shavings as the preferred bulking material because they trap air, do not pack down and are easily biodegradable. A medium-textured pine bark mulch is also suitable. DO NOT USE redwood, cedar, other aromatic woods or treated lumber shavings. Do not use large wood chips, material that mats easily (such as newspaper or leaves) or long, fibrous material (such as tall grass or corn stalks) that can form rigid barriers within the pile.

A volume of bulking material equal to one gallon for each roll of toilet paper used should be added to the waste cone that builds up beneath the toilet chute. In the case of the dry toilet fixture, bulking material may be poured down the toilet chute; with the Foam-toilet fixture, it is necessary to add the bulking material through the maintenance access hatch on the compost unit. The quantity to be used may vary with toilet usage and moistness or dryness of the mass. Facilities experiencing lighter use and a lower feces-to-urine ratio need less bulking material than those with higher ratios of solids to liquids.

Add Fresh Water

• inspect pile for adequate moisture content

• automatic system: increase or decrease spray time as needed

• manual system: spray 1-3 gallons per day onto compost pile

• non-pressurized system: check level in water tank and refill if empty

A small amount of fresh water is needed to enhance composting activity. One to three gallons per day is sufficient depending upon the ambient temperature and humidity.

Open the maintenance access door and visually inspect the composting material. The proper amount of water will make a mixture of waste and bulking material that is damp but not soupy. The aim is a mass that is moist throughout. If it is too dry (hard or crusty on top, dry toilet paper), increase spray time. If there are puddles on top of the waste mass, this likely indicates an insufficient amount of bulking material or that it is time to mix and level the waste mass, not an excess of fresh water.

The AC moistening controls (see Fig. 4, next page), which consist of a 7-day clock and timer, are preset to spray for 20 second intervals, 4 times per day. If conditions are such that the pile is kept too dry at this setting, adjust the timer for longer operation. The timer controls the duration of spraying; the clock controls the frequency of spray events. Each line on the timer indicates 5 seconds of spray time. If more fresh water is needed, adjust the spray time, not the frequency of spray events. (Remove and clean spray heads yearly to maintain proper flow. To clean, soak spray heads in Lime-away or brush across face of head. Do not insert anything into opening.)

To verify moistening system function, open cover on timer box and slowly turn the outside of the clock dial until a set point is reached. Solenoid valve should open and spray should begin and end according to the settings on the timer.

Monthly Procedures

Remove Non-Biodegradables

• pull large objects to hatch; remove from tank

Remove large objects such as cans, bottles, plastic bags, disposable diapers and feminine hygiene products that can restrict compost aeration, that take up significant space or which may cause matting of the pile or slow the composting process. Small items such as tampon applicators or bottle caps are not large enough to need removing.

Use the long-handled maintenance tool or any other suitable means to bring these items to the maintenance hatch for removal and proper disposal.

Mix and Level

• push cone over and level pile

• add bulking material if needed and mix

The frequency of leveling depends on system usage. Over time, a cone will build up in the tank beneath the toilet fixture. Open the maintenance hatch and inspect the cone (or cones). If it is 18-24" in height, level it using the maintenance tool. If bulking agent was not added regularly, add the proper quantity at this time and mix it in as you level.

The aim of mixing is to create a loose, porous texture. Mix in enough bulking material so that all waste, toilet paper and bulking material are thoroughly incorporated. There should be no clumps of waste or paper; the mixture should not be sticky but should fall off the rake. Except during periods of extremely high use, a 24" waste cone may take about a month to accumulate. Each mixing and leveling event should involve only the new waste. This should be mixed and leveled over the older waste so that, over time, the waste is layered, older below newer. Avoid 'turning' the waste, as this may cause uncomposted matter to reach the removal area prematurely.

Add Compost Enhancer

• add MB100

Air-dried bacteria are manufactured for enhancing the aerobic composting process. Use it at the rate of one scoop per month (mixed with one gallon of warm water and rested for 20 minutes), sprinkled as evenly as possible over the pile, to keep the decomposition process fully functioning. Use extra bacteria if the system has experienced extremely high usage, a high usage cycle is about to begin, or if the facility is opening for the season. Available as MB100 from Clivus.

Monitor Compost Liquid End-product Level

Most Clivus systems are designed with an automatic compost liquid end-product removal and storage system comprised of an automatic pump (in an isolation chamber located under the compost access lid) with a check valve, and a stand-along liquid storage tank. The compost liquid end-product is a stable, nearly odorless solution, generated at a rate of about 1 gallon for every 20 uses.

The automatic liquid removal pump is engaged by a level switch when 3-5 inches of liquid have accumulated in the compost tank. The check valve prevents back-flow into the composter. The pump will shut off when the level in the compost tank is down to about 2 inches. Therefore, there will always be 2-5 inches of liquid in the compost tank. More liquid than this may indicate pump or switch failure or a faulty check valve. Test the pump by disengaging the piggy-back pump/switch plug, and plugging the pump directly into an outlet.

The level in the compost liquid storage tank should be monitored to avoid spillage. Remove periodically and use as a fertilizer as allowed by regulations. Contact Clivus Multrum to discuss application rates.

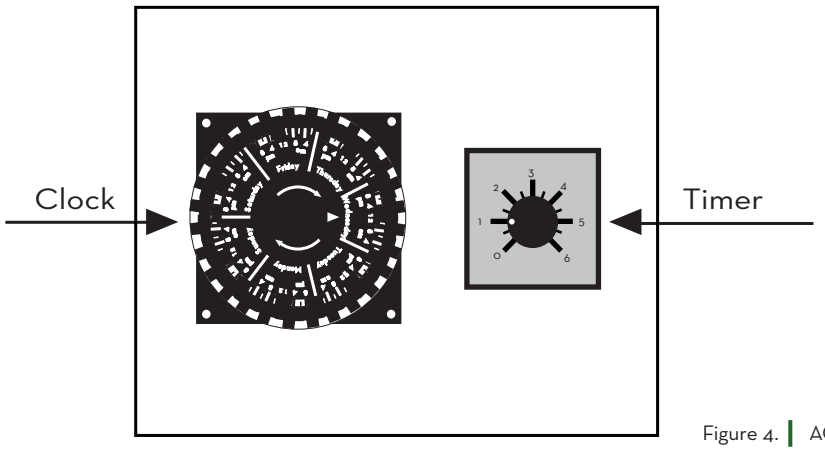

Figure 4. | AC Moistening Timer

Annual Procedures

Inspect Liquid Removal System

• clean pump and float switch

• unscrew check valve, remove cover from isolation chamber and inspect pump for corrosion or debris on bottom inlet screen

• remove debris from inlet screen on the bottom of the pump

Clean Moistening System Spray Heads

• remove and clean spray heads using two crescent wrenches to remove spray heads. If mineral deposits are severe, soak in Lime-away. With a wire brush, gently brush across the face of the spray head. Do Not insert anything into the opening.

Clean Vent System

• inspect and clean interior of vent ducting

• inspect, clean and ensure proper operation of fan

The fan must operate 24 hours per day for the system to remain odor free. The vent system should be inspected and cleaned annually, or when odors are present. This includes the vent pipe, fan and the air inlet to the basement. Maintain free air flow above the roof by trimming trees if necessary.

Remove the fan, inspect for the presence of foreign objects and clean. Ensure proper functioning when reinstalled. If odors are present, see Troubleshooting Guide.

Compost Removal

• remove finished compost to create more space

It is not necessary to remove compost from the tank until the leveled waste mass has reached the bottom of the maintenance access hatch. In some cases, it may be several years before this level is reached; no material should be removed sooner than one year from start-up of the system. When it becomes necessary, compost can be taken out via the compost removal chamber at the bottom front of the tank. The amount removed will vary depending on the size of the composter: for the M12, 15, 18, 22, 25 and 28 up to 30 cubic feet and for the M32 and 35, up to 50 cubic feet.

Remove compost using a long-handled spade. The front baffle height intentionally limits access to the oldest material only. To ensure that no uncomposted material becomes available during removal, use the long-handled rake through the upper maintenance door to push the top 6-12" of waste toward the rear of the composter.

(The built-in slope of the composter means that material at the very rear of the tank will always remain and serve as a filter for urine. See Figure 6.)

The volume of material removed should be sufficient to drop the level in the composter approximately 2 feet. This should offer a year or more until the next removal event.

The remaining material should fill the space left by the excavated compost. If necessary, push down on the top of the pile through the maintenance door or toilet chute using the maintenance tool, a board or other blunt instrument.

Use finished compost on ornamental plantings, shrubs, trees, etc. or as directed by local agencies and codes.

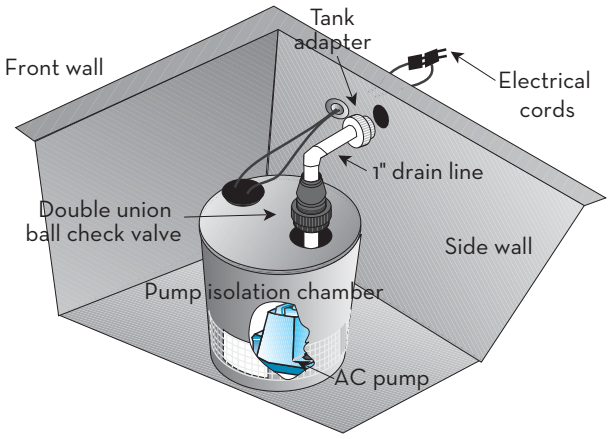

Figure 5. | AC Liquid Removal System

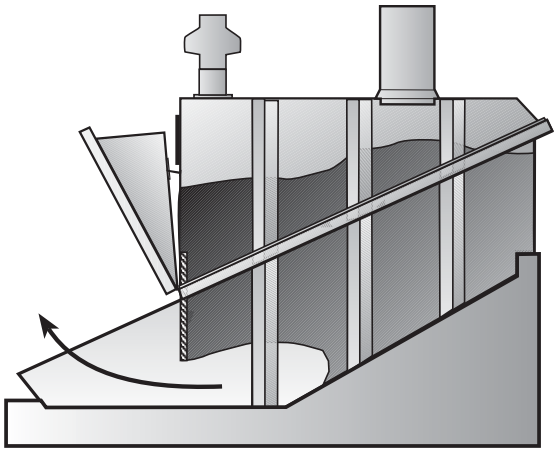

Figure 6. | Compost Removal

Maintenance (continued)

Other Considerations

Provide proper receptacles for disposable diapers and feminine hygiene products. Trash cans and recycling bins should be available.

Keep loose objects such as extra toilet paper rolls out of the restroom or in a locked cabinet where they cannot be dropped down the toilet chute.

Avoid accidental fires in the compost tank. A caution label warning against lit materials is attached to the inside of the toilet seat cover and compost access lid. “No Smoking” signs should be posted in conspicuous locations. Provide ashtrays outside the restroom building.

Assure user cooperation by maintaining clean, well lit and pleasant restrooms. For all toilets and urinals, affix Clivus “1-2-3” user plaques within easy view of the user. Provide signs explaining the system to users.

Vermiculture

• add composting worms after three months

The addition of Redworms, "Red Wigglers" (Eisenia foetida), will help reduce maintenance and accelerate the rate of decomposition by aerating and digesting the waste mass. The population of worms will be largely self-regulating in the presence of sufficient heat and fresh water. (Worms are most effective in composters with the automatic moistening system.)

Worms should not be introduced until the system has been in active operation for a three month period. Open the maintenance access hatch and place the worms in a front corner of the tank, away from the waste cone. The worms will migrate on their own throughout the compost pile. (Worms may not survive sustained subfreezing temperatures.) Available as MW100 from Clivus.

You are using a recycling toilet by Clivus®

1 *This toilet uses no water or chemicals.*

2 *Waste is being composted in the equipment below this building.*

3 *Do not throw cigarettes, plastics, bottles or cans into this recycling toilet.*

THANK YOU FOR HELPING US PRESERVE THE ENVIRONMENT

Clivus Multrum®, Inc.
15 Union Street
Lawrence, MA 01840

1-800-4-Clivus

Quick Guide to Maintenance

Daily or Weekly

- clean restroom using only bio-compatible cleaners
- add bulking material: approximately one gallon per roll of toilet paper used
- check fresh water supply for non-pressurized or manual moistening systems
- check level in fresh water tank; refill if necessary
- use 1 gallon per day as guide for manual spraying

Monthly

- remove non-biodegradables for proper disposal in trash
- check pile moisture, texture should be damp throughout, not soupy or dry
- check pumps and drains; maintain proper operation and free flow
- mix and level waste when cone reaches 18-24" in height
- monitor compost liquid end-product levels in composter and liquid storage tank
- add MB100 Multrum Bacteria: one scoop moistened with 1 gallon of water

Annually

- service pump and float switch; clean and assure proper functioning
- remove and clean moistening system spray heads
- clean vent system and remove any obstructions inside ductwork
- remove compost if necessary (only enough to make room for new material)

Winterization

If the composter will be used in winter and will be subjected to temperatures below 40°F, it is important to be aware that the decomposition process will cease. Therefore, the tank will fill more rapidly than under warmer conditions. If the pile does not freeze, regular maintenance can still be performed. Note: attaching heating devices to the composter or placing them inside the tank will void the warranty.

If it is likely that the pile in a mature tank will freeze solid, it is necessary to dig out an area beneath the toilet chute that will provide sufficient space for cold season accumulation of material. Line the depression with fresh bulking material to make it possible to roll the waste cone to the side even after it is frozen. In a new tank, there will be plenty of space available without digging out an area. Continue to add bulking material to the composter as per regular maintenance.

Drain fresh water supply lines and remove automatic liquid removal pump.

Drain the liquid end-product storage tank, if full.

The fan must remain operational for the restroom to remain odor-free.

If the composter will not be used during periods of freezing temperatures, follow these procedures:

End of Season Shut-down

- Drain the fresh water and liquid end-product storage tanks and any water lines.
- Remove, clean and store the pump(s).
- After the date of last use, shut off electricity to the composter, which will shut down the ventilation fan and moistening timer.
- Make sure there is no more than 5" of standing liquid in the compost removal chamber.
- Remove fans if there is a possibility of rain water entering the vent stack.

Beginning of Season Start-up

- Install the pump(s).
- Restore electrical service to all fans, pumps and controls.
- Refill fresh water tanks, if any.
- Check all components for proper functioning.
- Add MB100 Multrum Bacteria.

Troubleshooting

Bulking Material Omitted

Possible causes:

• inadequate maintenance

Action steps:

• Knock cone down, adding water if necessary.

• Add enough bulking material all at once and mix it into the pile until it is well incorporated and aerated.

• Add MB100 Multrum Bacteria.

Pile Too Dry

Possible causes:

• empty fresh water tank

• moistening timer mis-set or failed

• solenoid valve failure

• spray heads clogged

Action steps:

• Spray the pile with water and mix. Repeat daily until the texture is moist but not saturated.

• Refill fresh water tank.

• Check operation of moistening timer and solenoid valve. Be sure timer is set to operate for at least 20 seconds 4 times in 24 hours.

• Remove spray heads and check for blockage.

Waste Cone Build-up

Possible causes:

• heavy usage over a short period of time

• inadequate regular maintenance

Action steps:

• Knock the cone over and break up the pile.

• Moisten if necessary.

• Add bulking material if needed and mix it into top 6".

• Add MB100 Multrum Bacteria.

• Review maintenance procedures.

Pile Too Wet

Possible causes:

• moistening timer mis-set or failed

• solenoid valve failure

• insufficient bulking material added

Action steps:

• Add bulking material to the pile and mix well to absorb excess moisture and aerate.

• Add MB100 Multrum Bacteria.

• Check operation of moistening timer and solenoid valve. Make sure valve closes completely and according to timer setting.

Composter Too Full

Possible causes:

• dryness of mass

• ambient temperature too low

• overuse of system

• inadequate regular maintenance

• excessive addition of bulking material

• time to remove compost

Action steps:

• At least once a week, level cones and aerate pile.

• Using the maintenance tool, turn over material to a depth of 18-24" to get oxygen deep into the pile.

• Make sure compost is sufficiently moist.

• Add MB100 Multrum Bacteria at each raking.

• Remove finished compost.

When severely overused, the tank can fill faster than the material can decompose. The facility's hours of operation can be limited or another unit can be added to relieve the burden.

Odor in the Restroom

Possible causes:

• air flow direction reversed through fan

• air leak in vent stack

• blockage in the vent stack

• competing HVAC device

• feces/urine on floor, fixtures or walls

Action steps:

• Hold a strip of toilet paper in front of the closed toilet seat. If it is not pulled inward towards the chute, check the fan for proper installation and function.

• Check every duct seam and joint for leaking air. Tape leaks.

• Clean out vent duct.

• Check to see if the room/building design creates a situation which defeats or competes with the normal Clivus air flow pattern. (Examples: air vent grates, chases, cupolas, exhaust fans, HVAC systems.)

• Clean using MC100 Multrum Cleaner.

Odor outside the Restroom

Possible causes:

• vent too short

• obstructions around vent opening

• inadequate maintenance

Action steps:

• Should odor be detected at ground level, the vent should be extended further above the roof ridge line.

• Make sure no trees are blocking free air flow. Trim if necessary.

• Review maintenance procedures.

Troubleshooting (continued)

Odor in the Basement

Possible causes:

• liquid build-up

• overuse

• improper maintenance

Action steps:

• Review maintenance procedures.

• Improve the overall condition of the pile with proper addition of bulking material, regular moistening and use of Multrum Bacteria and Multrum Composting Worms.

Liquid Build-up or Leakage

Possible causes:

• pump, float switch or check valve failure

• clogged drain

• inadequate maintenance

Action steps:

• If using a manual pump, empty the composter of liquid more frequently.

• Check gravity drain (if present) for clogging and remove blockage.

• Check electric pump float switch for proper operation.

• Check pump for proper operation. If the pump is running but not removing liquid, replace.

• If there is leaking from any openings or connections, repair or re-caulk as necessary.

• Review maintenance procedures.

Flying Insects

Possible causes:

• temporary imbalance in composter environment

Action steps:

• The presence of a wide variety of organisms is necessary to the proper function of the composting system. Making sure the fan is operating properly and the vent is not clogged will help keep flying insects from becoming a nuisance.

• If further treatment is needed use a pressurized garden sprayer and wet the exposed surfaces of the compost pile and inside walls of the composter with the natural insecticide pyrethrum. Mix according to label directions and repeat application daily until the problem is resolved.

• Install Clivus Bug Light to direct insects up and out of the vent stack.