
COMPOSTING TOILETS AND URINE DIVERSION

COMPOSTING TOILET SYSTEMS

DEFINITIONS

Commode. A fixture without connection to a plumbing drainage system used for collecting, containing, or transporting excreta to a compost processor. (also dry toilet, urine diverting dry toilet [UDDT], vacuum flush toilet, foam flush toilet)

Compost Additives. Any material such as sawdust, wood shavings, and other compostable material added to maintain operational conditions within the composting toilet system.

Composting Toilet System. A system designed to safely collect and process excreta and compost additives into humus through aerobic decomposition.

Compost Processor. The site of aerobic decomposition transforming excreta and compost additives into humus

Diverted Urine. Urine that has been collected separately from fecal matter.

Excreta. Includes but is not limited to urine, feces, menses, and other human body emissions, as well as toilet paper and biodegradable cleaning products.

Humus. The biologically decomposed, soil-like output of the compost processor.

Leachate. Liquid draining from a compost processor.

Operation and Maintenance Manual. A manual containing instructions for management of all aspects of a system.

Secondary Composting. Additional retention and continued decomposition of humus removed from compost processors in order to meet the required retention time.

Treated Urine. Diverted urine that has been treated for beneficial use.

Urine Diverting Commode. A commode that separates urine from other excreta and directs urine to a urine diversion system. (also urine diverting dry toilet)

Urine Diverting Toilet. A fixture connected to a plumbing system that separates fecal matter and urine into separate piping. (also urine diverting flush toilet, urine diverting water closet)

Urine Diversion. Collection of diverted urine that occurs at the fixture.

GENERAL

The provisions of this section shall apply to the design, construction, performance, alteration, and repair of composting toilet and urine diversion systems.

Design and Construction Requirements. Composting toilets and composting toilet systems shall meet the design, construction, and performance requirements of either Listed Composting Toilets and Composting Toilets Systems or Alternative Design Systems.

Listed Composting Toilets and Composting Toilet Systems. Composting toilets and composting toilet systems shall be listed to NSF/ANSI Standard 41; or

Alternative Design Systems. Composting toilet systems for residential and commercial applications complying with the provisions of this section shall be permitted where approved by the Authority Having Jurisdiction.

System Materials and Components. Pipe, pipe fittings, traps, fixtures, material, and devices used in composting toilet systems that are expected to contact leachate or diverted urine shall be listed (third-party certified) by a listing agency (accredited conformity assessment body) or labeled, unless otherwise approved by the Authority Having Jurisdiction. Materials and components shall conform to approved applicable recognized standards referenced in this supplement and the plumbing code, and shall be free from defects.

Maintenance and Inspection. Composting toilet systems and components shall be maintained and inspected in accordance with the following Sections Maintenance Responsibility, Operation, and Inspection.

Maintenance Responsibility. The required maintenance and inspection of composting toilet systems shall be the responsibility of the property owner, unless otherwise required by the Authority Having Jurisdiction. The property owner is responsible for retaining test result records in accordance with the Section 'Humus' and making such records available to the Authority Having Jurisdiction upon request. Upon transfer of property or tenancy, all test records shall be transferred to the owner or tenant, and humus shall be re-tested after its first treatment period and a record retained by the property owner.

Operation. Composting toilet systems shall be operated in a safe and sanitary condition in accordance with the Section Operation and Maintenance Manual.

Inspection. If there is suspicion or documentation of an unsafe or unsanitary condition, the composting toilet system shall be made available for inspection. The owner or owner's agent shall conduct sufficient repairs or alterations. If the Authority Having Jurisdiction determines that new tests are required following repairs or alterations, tests shall be conducted at the owner's expense and in accordance with Section Testing.

Operation and Maintenance Manual. An operation and maintenance manual shall be transferred to the new owner upon transfer of property or tenancy. The manual shall include the following items:

1. Schedule for addition of necessary compost additives;
2. Source or provider of necessary compost additives. Source may be on-site;
3. Schedule for all regular maintenance tasks;
4. Instructions for all regular maintenance tasks;
5. Expected input of and capacity for excreta and compost additives to compost toilet system specifying loading of commode(s) and compost processor(s);

6. Plan for container transfer and cleaning where transfer is used;
7. Treatment period and expected schedule for removing humus from composting processors and secondary composting bins, where used;
8. Plan for on-site disposal of humus or professional removal;
9. Plan for managing leachate; and
10. Plan for microbial testing in accordance with Section Humus.

SYSTEM DESIGN REQUIREMENTS

The design and installation of composting toilet systems shall be in accordance with Section Materials through Section Humus Removal.

Materials. All components expected to contact excreta or leachate shall be constructed of corrosion-resistant material such as stainless steel or durable polymers. Concrete in contact with excreta or leachate shall meet requirements of Section Concrete Construction.

Screening. Where screening is required to prevent the entry of insects and vermin, screening shall have penetrations with a maximum size of 3/32 inches (2.5mm). Screening shall be made of materials compatible with the system components in contact with screen materials. Screen materials shall not generate galvanic corrosion of system components.

Concrete Construction. Concrete construction shall be reinforced, watertight, and able to withstand loading. Where drainage is required, the processor floor shall be sloped not less than ¼-inch per foot (20mm per meter), or 2 percent. The flange of each sub-drain shall be set level.

Commodes. Commodes shall comply with Sections Structure through Urine Diversion.

Structure. Commodes shall be designed to support users of a weight not less than 300 pounds (136 kg). Commodes shall transport

Contact. Commodes shall transport excreta into the compost processor or contain excreta for transfer as designed according to the operation and maintenance manual.

Urine Diversion. Urine diversion piping shall be connected to a urine diversion system per Section Urine Diversion.

Compost Processors. Compost processors shall be designed in accordance with Sections Leachate through Sizing and shall maintain unsaturated aerobic composting conditions within the compost mass, through the drainage, absorption, or desiccation of leachate, and aeration of the processor.

Leachate. Leachate shall be collected for removal or recirculation within the processor, evaporated, or drained to an approved plumbing drainage system or other location approved by the Authority Having Jurisdiction. Leachate storage tanks shall be constructed and installed in accordance Section Venting through openings.

Venting. Leachate storage tanks shall be vented as required for pressure equalization. When required, vents shall be installed on leachate storage tanks and shall extend from the top of the tank. Storage tank vents shall be permitted to connect to the plumbing venting system at least 6 inches (150mm) above the flood level rim of the highest fixture. Vents extending to the outdoors shall terminate no less than 12 inches (300mm)

above grade. The vent terminal shall be directed downward and covered screening to prevent the unintentional entry of insects and vermin.

Vent Size. Pressure equalization vents that prevent nitrogen loss by the use of restrictions, or of piping or tubing that is less than the minimum pipe diameter required in the plumbing code, shall be approved by the Authority Having Jurisdiction.

Overflow. Where storage tank overflows are installed, they shall be connected to the plumbing drainage system.

Backwater Prevention. Storage tank overflows shall be provided with a backwater valve or check valve at any point of connection to a plumbing drainage system or private sewage disposal system subject to backflow. The backwater valve shall be accessible for inspections and maintenance.

Construction. Leachate storage tanks shall be constructed of corrosion resistant materials, or shall be tanks listed or certified as UN Portable Tanks as designated by US 49 CFR Section 178.274 or other standards of the Authority having Jurisdiction (such as Canadian standards CSA B625:20 and TP14850).

Above Grade. Where subject to freezing conditions, storage tanks shall be provided with an adequate means of freeze protection. Above grade leachate storage tank shall be provided with a high-water sensing device and alarm system. The alarm shall report when 80 percent volume is reached.

Below Grade. Leachate storage tanks installed below grade shall be structurally designed to withstand all anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (150 kg/m²) when the tank is designed for underground installation. Below grade leachate tanks installed underground shall be provided with manholes. The manhole opening shall be at least 20 inches (500 mm) in diameter and located at least 4 inches (100 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined hold-down capacity of the tank and hold down system shall meet or exceed the buoyancy force of the tank. The below grade leachate storage tank shall be provided with a high-water sensing device and alarm system.

Marking. Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following words: "DANGER—CONFINED SPACE." The letters shall be not less than 0.5 inch (12.7 mm) in height and shall be of a color in contrast with their background.

Openings. All openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent insect and vermin infiltration and be protected against unauthorized human entry.

Transfer. Where unfinished excreta or diverted urine is transferred between processors or from commode to processor, transfer and cleaning of containers and provisions for limiting user exposure shall be according to the operation and maintenance manual.

Watertightness. Processors shall be constructed of watertight material in accordance with Section Durability.

COMPOSTING TOILETS AND URINE DIVERSION

Insects and Vermin. The compost processor shall be protected to prevent unintentional the entry of insects and vermin. No unsecured opening other than vents, drainage, or commode may exceed ½-inch (12mm) in the least dimension.

Treatment Period. The compost processor or processors shall be sized to compost excreta for a treatment period with a minimum of one year of biologically active conditions.¹ Biologically active conditions are at or above a daily average of 42°F (6°C).

Exception: Systems with shorter treatment periods shall be permitted where either:

1. Humus from the compost processor has been tested in accordance with Section Humus and there is a secondary composting stage where humus is retained in a well maintained compost bin or other facility designated for the exclusive purpose of containing humus removed from the compost processor; or
2. Humus is removed off site for processing or disposal at an approved facility.

Secondary Composting. Humus transferred to secondary composting shall first be tested according to Section Humus. Secondary composting shall be labeled and protected from human contact. Contact with precipitation and surface waters shall be prohibited.

Venting. Negative pressure between the commode and compost processor shall be provided where the compost processor is connected directly to the commode without a trap.

Exception: Commodes shall not require a vent if they are not connected to a compost processor.

Vent Terminals. Vent stacks shall terminate to the exterior of the building as required by the plumbing or mechanical code.

Sizing. Compost processors shall be sized to accommodate the maximum daily adult usage as specified by the manufacturer's or designer's published ratings. Compost processors shall be sized to hold at least 10 gallons (38L) of material per person per year while allowing for the removal of the humus, or as specified by the system designer.

TESTING

Composting toilet systems shall be tested in accordance with Sections Compost Processors and Humus.

Compost Processors. Compost processors shall be tested for water tightness by filling the system to the maximum designed liquid storage capacity of the unit for a duration of 24 hours.

Humus. The owner or owner's agent of the composting toilet system shall verify compliance with the operation and maintenance manual after the first treatment period and before removal of humus from the compost processor. A sample of the humus from the first treatment period shall be submitted to a certified laboratory. Where multiple compost processors are used, the humus sample shall be removed from the last compost processor. The sample shall be tested in accordance with EPA/625/R-92/013, Appendix F, Section 1.2. Humus shall not have a

¹ One year is approximately twice as long as the survival time of *Ascaris* (Roundworm) eggs under active composting, per Table 6-2 of the National Research Council's 2002 [Biosolids Applied to Land](#).

COMPOSTING TOILETS AND URINE DIVERSION

moisture content exceeding 75 percent by weight, and the most probable number (MPN) fecal coliform assay shall not exceed 200 MPN per gram (dry weight basis).²

Humus Removal. Humus shall be removed in accordance with the operation and maintenance manual. Humus from the compost processor shall be permitted to be used around ornamental shrubs, flowers, trees, or fruit trees and shall be mixed with soil or mulch and covered with at least 3 inches (76mm) of cover material. Depositing humus from any composting toilet system around any edible vegetable or vegetation shall be prohibited.

² This is the testing standard for the outputs of composting toilets tested under Part 14.3 of NSF/ANSI Standard 41: [Non-Liquid Saturated Treatment Systems](#).

Urine Diversion Systems

DEFINITIONS

Commode. A fixture without connection to a plumbing drainage system used for collecting, containing, or transporting excreta to a compost processor. (also dry toilet, urine diverting dry toilet [UDDT], vacuum flush toilet, foam flush toilet)

Diverted Urine. Urine that is collected separately from fecal matter.

Excreta. Includes but is not limited to urine, feces, menses, and other human body emissions, as well as toilet paper and biodegradable cleaning products.

Nutrient Management Plan. A nutrient management plan (NMP) outlines the quantity, timing, locations, methods and other aspects of applying plant nutrients and soil amendments to the land in order to prevent or minimize environmental impacts while maximizing horticultural requirements.

Operation and Maintenance Manual. A system manual containing instructions for all management aspects of that system.

Treated Urine. Diverted urine that has been treated for beneficial use.

Urine-Derived Product. A product that is derived from urine, such as an agricultural amendment, fertilizer, or diesel exhaust fluid.

Urine Diversion. Collection of diverted urine that occurs at the fixture.

Urine Diverting Commode. A commode that separates urine from other excreta and directs urine to a urine diversion system. (also urine diverting dry toilet)

Urine Diverting Toilet. A fixture connected to a plumbing system that separates feces and urine into separate piping. (also urine diverting flush toilet);

GENERAL

The purpose of this section is to enable the installation of urine diversion and collection systems to prevent nutrient pollution of ground and surface waters and enable beneficial use of urine constituents.

Design and Construction Requirements. The design and installation of urine diversion systems shall be in accordance with Section Purpose through Section Disposal and Use.

SYSTEM DESIGN REQUIREMENTS

The design and installation of urine diversion systems shall be in accordance with Section Materials Requirements through Section Disposal and Beneficial Use.

Material Requirements. Material used for urine diversion shall be corrosion resistant, such as stainless steel or durable polymers. Concrete piping is prohibited.

Maintenance and Inspection. Urine diversion systems and components shall be maintained and inspected in accordance with the following Sections Maintenance Responsibility, Operation, and Inspection.

Maintenance Responsibility. The required maintenance and inspection of urine diversion systems shall be the responsibility of the property owner, unless otherwise required by the Authority Having Jurisdiction.

Operation. Urine Diversion Systems shall be operated in a safe and sanitary condition in accordance with the Section Operation and Maintenance Manual.

Inspection. If there is suspicion or documentation of an unsafe or unsanitary condition, the urine diversion system shall be made available for inspection. The owner or owner's agent shall conduct sufficient repairs or alterations.

Operation and Maintenance Manual. An operation and maintenance manual shall be transferred to the new owner upon transfer of property or tenancy. The manual shall include all of the following items:

1. Storage capacity for urine, flush water, and additives;
2. Design loading of the system and expected inputs;
3. Expected schedule of additives;
4. Sources or provider of necessary additives. Source may be on-site.
5. Comprehensive maintenance schedule, including a pipe cleaning schedule;
6. Cleaning agents and instructions for each;
7. Instructions for all maintenance tasks;
8. If container transfer is used, container transfer plan and container cleaning instructions; and
9. Disposal or beneficial use plan consisting of the following items, as necessary:
 - a. Removal schedule and service provider,
 - b. Instructions for diversion to sewer or private sewage disposal system,
 - c. Treatment plan and treatment system operations,
 - d. Plan for licensing, certification, or labeling of urine-derived products, or
 - e. Land application following a nutrient management plan.

Screening. Where screening is required to prevent the entry of insects and vermin, screening shall have penetrations with a maximum size of 3/32 inches (2.5mm). Screening shall be made of materials compatible with the system components in contact with screen materials. Screen materials shall not generate galvanic corrosion of system components.

Identification. All urine diversion piping shall be identified.

Change of Direction. Changes in direction of urine diversion piping shall be made by a long-sweep 90 degree fitting or other approved fittings of equivalent sweep.

Sizing. Pipe sizes shall be in accordance with the plumbing code. Each urine diversion fixture shall be rated as one drainage fixture unit. Piping or tubing for urine diversion that is less than the minimum pipe diameter required in the plumbing code shall be approved by the Authority Having Jurisdiction.

Traps. Fixtures discharging into urine diversion piping shall be trapped and vented with a backflow seal.

Slope of Horizontal Piping. Urine diversion piping shall be installed at a slope of at least ¼-inch per foot (20 mm per meter), or 2 percent toward the point of storage or disposal.³

Cleanouts. A cleanout shall be provided at the upper terminal of each drain line, every 50 feet (15 m), and at any aggregate horizontal change of direction exceeding 135 degrees.

Venting. Urine diverting water closets shall be vented per the plumbing code. Urine diverting commodes shall be vented to a composting toilet system vent.

Exception: Where the Authority Having Jurisdiction determines urine storage tank venting or air admittance valves are sufficient to vent fixtures, venting of fixtures shall not be required.

Discharge. A urine diversion system shall be directed to a storage tank or discharged to an approved plumbing drainage system.

Urine Storage Tanks. Urine storage tanks shall be constructed and installed in accordance with the following: Section Volume through Openings.

Volume. Total urine tank storage volume shall be in accordance with the following equation⁴. Where treatment by retention in accordance with Section Treatment is specified, days in use for collection (D) shall be at least 365.

$$V = (C + (N \times (U + F) \times O)) \times D$$

V = Total tank volume
 C = water used per fixture per day for cleaning
 $C = (c + w + t)/7$
 c = water used per cleaning
 w = cleanings per week
 t = total urine diversion fixtures
 N = Number of users
 U = Urine per person per day (0.4 gallons, 1.5L)⁵

³ Per the requirements of K.3.4 Urine-afvoerleidingen, Appendix K, Gescheiden Sanitatie, 2023 [ISSO Standard NTR 3216](#), Riolering van Bouwwerken. An ideal slope may be higher than 2 percent; “at least 2% (ideally 3%),” per Section 3.1 of the *Urine Diversion System with LAUFEN Save! WC Installation Guide* Version No. 01, LAUFEN, 2022. “For larger systems (several toilets connected to one urine tank), the slope of the pipe should be at least 1% to minimise urine precipitation. For individual toilet systems, the slope should be at least 4%,” per von Münch and Winker’s 2011 [Technology Review of Urine Diversion Components](#) from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. A 4% slope is also recommended by Kvarnström, et. al. in the Stockholm Environment Institute’s 2006 [Urine Diversion: One Step Towards Sustainable Sanitation](#).

⁴ This equation derived from the tank volume calculator of [Appendix K, Gescheiden Sanitatie, of the 2023 ISSO Standard NTR 3216](#), Riolering van Bouwwerken.

⁵ The quantity of urine specified (0.4 gallons, 1.5L) is based on 550L per year, a number widely used in European guidance, including Munch and Winkler. It is originally from Jönsson et. al’s 2005 [Composition of Urine, Faeces, Greywater, and Biowaste for Utilisation in](#)

F = Flush water per day

$$F = f \times e$$

f = water volume per flush

e = visits to toilet per day (5.9)⁶

O = Occupant fraction

D = Days in use for collection

Venting. Urine storage tanks shall be vented as required for pressure equalization. When required, vents shall be installed on urine storage tanks and shall extend from the top of the tank. Storage tank vents shall be permitted to connect to the plumbing venting system at least 6 inches (150 mm) above the flood level rim of the highest fixture. Vents extending to the outdoors shall terminate no less than 12 inches (300 mm) above grade. The vent terminal shall be directed downward and covered with a 3/32 -inch (2.5mm) screen to prevent unintentional entry of insects and vermin.

Vent Size. Pressure equalization vents that prevent nitrogen loss by the use of restrictions, or of piping or tubing that is less than the minimum pipe diameter required in the plumbing code shall be approved by the Authority Having Jurisdiction.

Traps. Urine storage tanks shall prevent odors and nitrogen loss from the tank inlet by means of a P-trap, mechanical trap, submerged inlet piping, or other means approved by the Authority Having Jurisdiction. Submerged inlet piping shall remain submerged during use and after pumpout.

Exception: Tanks of 5.5 gallons (20 L) or less connected to a fixture with active venting.

Overflow. Where storage tank overflows are installed, they shall be connected to the plumbing drainage system.

Backwater Valve. When connected to a public sewer system or private sewage disposal system and where subject to backflow, storage tank overflows shall be provided with a backwater valve or check valve at the point of connection to the plumbing drainage. The backwater valve shall be accessible for inspections and maintenance.

Water Level Monitoring and Warning. Storage tanks shall be provided with a water level monitoring device connected to an alarm system. The alarm system shall provide a visual and auditory report when 80 percent volume is reached.

Exception: Systems meeting one of the following requirements:

1. Where tank volume does not exceed 5.5 gallons (20 L) and the tank is located within the toilet room, a visible indicator of tank volume shall be provided.

[the URWARE Model](#), published by the Mistra Programme for Urban Water, Chalmers University of Technology, Gothenburg, Sweden.

⁶ 5.9 flushes per day for urine is from NTR 3216, which references [Vewin](#) 2010; this Dutch language publication has not been identified.

2. Where the tank has no direct connection to urine diversion piping, is filled manually, and has a visible indicator of tank volume.

Construction. Urine storage tanks shall be constructed of corrosion resistant materials such as stainless steel or durable polymers, or shall be tanks listed or certified as UN Portable Tanks as designated by US 49 CFR Section 178.274 or other standards of the Authority having Jurisdiction (such as Canadian standards CSA B625:20 and TP14850).

Above Grade. Where subject to freezing conditions, above grade storage tanks shall be provided with an adequate means of freeze protection, or fitted with high level alarms that are suitable for detecting a high level condition in the presence of ice.

Below Grade. Urine storage tanks installed below grade shall be structurally designed to withstand all anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1500 kg/m²) when the tank is designed for underground installation. Below grade urine tanks installed underground shall be provided with manholes. The manhole opening shall have a diameter of at least 20 inches (500 mm) and located at least 4 inches (100 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined hold down force of the tank and hold down system shall meet or exceed the buoyancy force of the tank.

Marking. Where openings are provided to allow a person to enter the tank, the openings shall be marked with the following words: "DANGER—CONFINED SPACE."

Openings. All openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent insect and vermin entry and be protected against unauthorized human entry.

Transfer. Where urine is transferred between tanks, cleaning of tanks and provisions for limiting user exposure shall be according to the operation and maintenance manual.

Treatment. Approved methods of treatment shall include:

1. Retention of diverted urine without addition for six months before usage⁷. Two or more holding tanks shall be required for retention;
2. Heat sanitization with one of the following methods⁸; or

⁷ Table 5.3, [WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater: Volume 1: Policy and Regulatory Aspects](#), 2006.

⁸ The time and temperature equations are per US EPA [Processes to Further Reduce Pathogens](#) from the 1992 EPA document [Technical Support Document for Reduction of Pathogens and Vector Attraction in Sewage Sludge](#) (EPA 822/R-93-004)..

COMPOSTING TOILETS AND URINE DIVERSION

- a. Heat treatment for not less than 15 seconds and not greater than 30 minutes at a temperature calculated using Equation 1; or
- b. Heat treatment for not less than 30 minutes at a temperature of at least 122°F (50°C) for a period calculated using Equation 2

$$\text{Equation 1:} \quad D = \frac{131,700,000}{10^{0.14T}}$$

$$\text{Equation 2:} \quad D = \frac{50,070,000}{10^{0.14T}}$$

D=duration (days)

T = Temperature (degrees Celsius)

3. Other method approved by the Authority Having Jurisdiction.

Disposal and Beneficial Use. Urine diversion systems shall have a plan for disposal or shall have a plan for beneficial use with one of the following methods. The plan shall be recorded in the operation and maintenance manual.

1. **Disposal.** Urine shall be removed by:
 - a. A service provider approved by the Authority Having Jurisdiction;
 - b. Discharge to a public sewer system or private sewage disposal system; or
 - c. Discharge to the compost processor of a composting toilet system.
2. **Urine Derived Products.** Urine shall be processed into urine-derived products for commercial product licensing, certification, and labeling as required by the Authority Having Jurisdiction; or
3. **Land Application.** Urine complying with Section Treatment above shall be land applied following an approved nutrient management plan as required by the Authority Having Jurisdiction.