

APPENDIX B

TIMED DOSED SAND FILTERS

I. Introduction

Time dosed sand filters (TDSF) are aerobic, fixed-film bioreactors that are capable of treating septic tank effluent (or in some cases effluent from aeration treatment units) before it is discharged into the soil (leaching trenches or sand mound system). Two types of TDSF can be used and are described within this appendix. A covered sand filter has walls which extend above the surface of the ground. The filter is contained in a rigid basin (typically concrete) and is protected from adverse weather conditions and temperatures, including precipitation, by a constructed cover. A buried sand filter is constructed below grade, covered with soil, and contained within a watertight PVC liner.

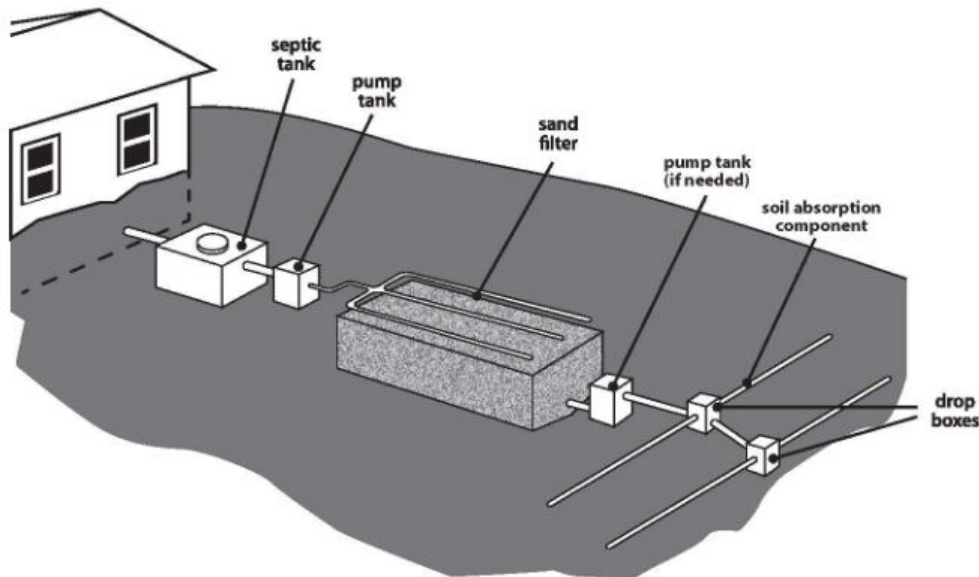


Figure 1. Time Dosed Sand Filter

II. Limitations and Conditions for use

- (A) A TDSF designed in compliance with this section shall be approved for meeting the BOD₅ and TSS standard for a reduction in the size of a soil absorption component and the one thousand cfu per one hundred milliliter fecal coliform standard for a twenty-four inch soil depth credit.

- (B) Although a septic tank or an approved pretreatment device (such as an aerator) must be used as primary treatment for a sand filter, the design may not combine reductions in the area of the soil absorption component or credits in the vertical separation distance.
- (C) In all cases, components must be watertight with sealed entries and exits for piping.
- (D) Sand filters shall never be placed in surface depressions.
- (E) Systems treating wastewater with high concentrations of grease may require the use of a grease trap, as determined by the designer or board of health.

III. Sand Filter Design

- (A) A fabricated tank or polyvinyl chloride liner may be used to construct the filter basin within the following specifications:
 - (1) A covered sand filter must use a fabricated tank. A fabricated tank and all connections must be structurally sound, watertight, and designed specifically for the purposes outlined in this Appendix. The walls of the filter must extend no less than six inches above natural grade.

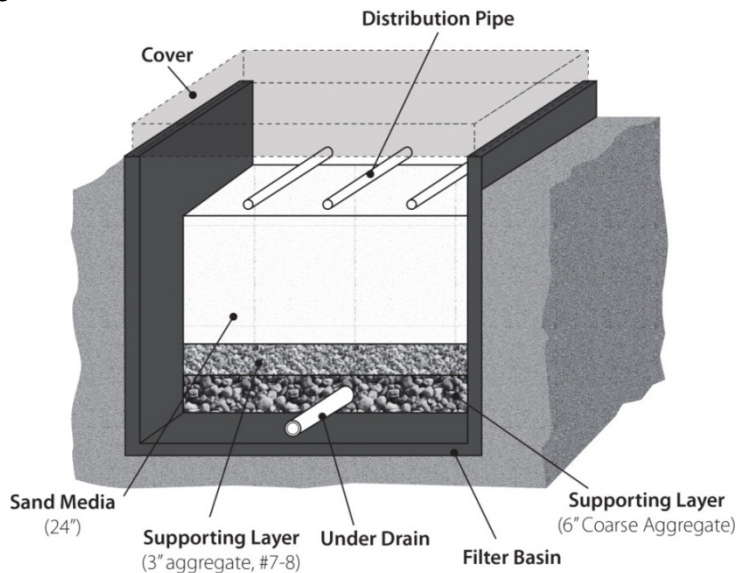


Figure 2. Covered time-dosed sand filter (fabricated tank)

- (2) A buried sand filter must use a polyvinyl chloride liner.
- (a) The polyvinyl chloride liner shall have a thickness of at least thirty mil, demonstrate adequate tensile properties, tear resistance, temperature resistance, resistance to soil burial, dimensional stability, and hydrostatic resistance to operate as a watertight liner for the buried sand filter.
- (b) The polyvinyl chloride liner must be installed over a three inch layer of sand. The liner must have factory-fabricated boots suitable for field bonding onto the liner to facilitate the watertight passage of piping through the liner.
- (c) Boots must be sized correctly and installed following the manufacturers requirements.

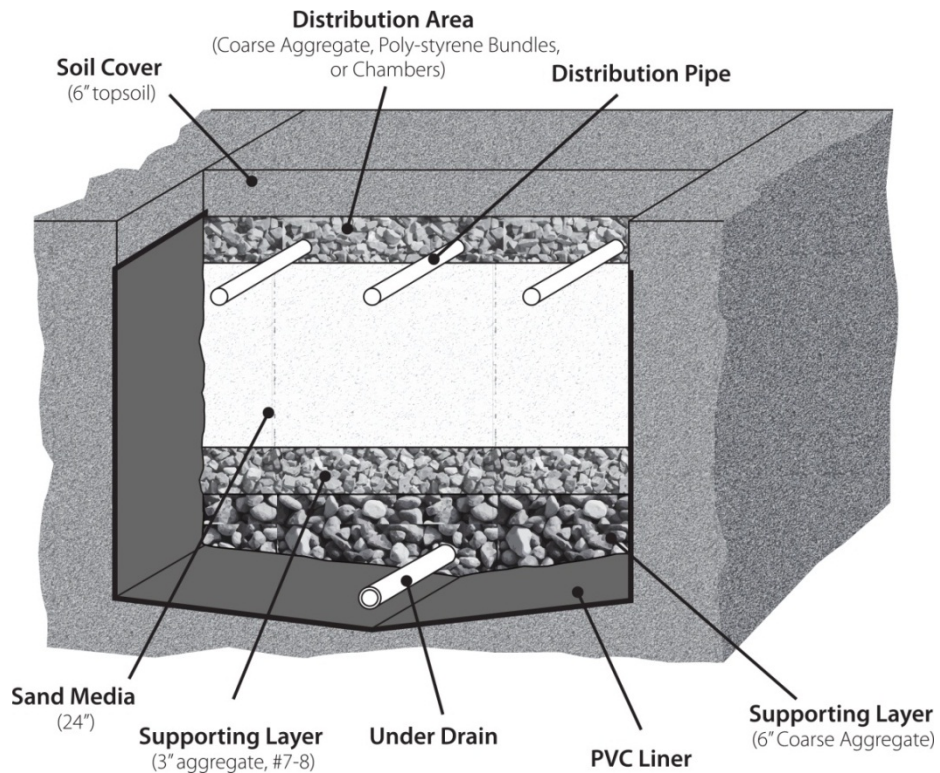


Figure 3. Buried Time Dosed Sand Filter

- (d) Patches, repairs, and seams must have the same physical properties as the parent material and be approved by the manufacturer of the liner.
 - (e) A support structure for the liner shall be constructed to be free of any sharp points protruding toward the liner. The space between the structure walls and the excavation shall be filled with sand or other flowable aggregate.
 - (f) Installation of the liner must take place during favorable weather conditions and meet the manufacturer's specifications.
 - (g) The liner shall extend to a height above saturated soil and must be sufficiently higher than any adjacent areas where surface water may pond.
- (B) The sand media used in the filter shall be natural, washed sand with not more than five per cent passing the No. 200 (75 μm) sieve as determined by ASTM C117, "Test Method for Material Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing." The sand must be installed to a depth of no less than 24 inches. For the purpose of this document, natural sand is defined as naturally deposited silica based sand not manufactured by mechanical processing such as crushing of rock or coarse aggregates.
- (1) Buried sand filters must use sand with an effective size of 0.5 to one millimeters and a uniformity coefficient of four or less.
 - (2) Covered sand filters shall use sand with an effective size of 0.3 to 1.0 millimeters and a uniformity coefficient of four or less.
- (C) An underdrain must be placed beneath the filter media for the purposes of collection and ultimate dispersal of effluent to the soil absorption unit.
- (1) The design shall specify the means by which the underdrain is protected from the infiltration of filter media.
 - (2) The addition of vent pipes to the underdrain will increase air flow through the filter and should be considered as part of the design. Vent pipes shall terminate above grade.

- (3) Designs using gravel-less chamber or bundled polystyrene products to construct the underdrain shall include and follow manufacturer recommendations.
 - (4) Designs using aggregate to bed the underdrain and construct supporting layers shall meet the following specifications:
 - (a) The underdrain shall be constructed with rigid perforated pipe and laid in good alignment and level. The underdrain must be installed with two layers of aggregate, herein referred to as the supporting layers.
 - (b) The underdrain shall be surrounded and covered with at least six inches of aggregate meeting the sizing requirement for coarse aggregate.
 - (c) A second, three inch layer of finer aggregate shall be washed with not more than five per cent passing the No. 200 (75 μ m) sieve as determined by ASTM C117, "Test Method for Material Finer than 75 μ m (No. 200) Sieve in Mineral Aggregates by Washing" and shall be durable with a hardness of 3 or greater on the Moh's Scale of Hardness, meeting a sizing requirements for AASHTO M 43 sizes 7 to 8 and shall be placed over the six inch supporting layer described in paragraph (III)(C)(4)(b) of this appendix. The sand shall be placed over this supporting layer.
- (D) Sand filters shall be covered to prevent the infiltration of precipitation and surface water. The covers shall meet the following specifications:
- (1) Covered sand filters must be equipped with a manufactured cover. Filter covers must be durable, secure, insulated, and vented. An air space of no less than twelve inches must be provided between the top of the sand filter media and the cover. Cover design must allow for easy access for routine maintenance.
 - (2) Buried sand filters shall meet the following requirements:
 - (a) A geotextile filter fabric shall be installed over the gravel, chambers or expanded polystyrene bundles;
 - (b) A six inch soil cover shall be installed over the geotextile filter fabric. The soil cover shall consist of topsoil, or similar soil mixture,

which allows for oxygen transfer, and is capable of supporting vegetative growth.

- (E) Sand filters shall include no less than two observation ports that extend to the interface of the sand and supporting layer. A sand filter shall also include no less than two observation ports that extend to the interface of the distribution area and sand when the surface is not exposed.
 - (1) Each observation port must be placed away from points of application and shall be installed with a valve cap or plug.
 - (2) Diversion collars may be installed to discourage applied effluent from short circuiting the filter along vent pipes.
 - (3) Installation of more than the minimum number of observation ports may be necessary for adequate observation of the sand surface and supporting layer surface during routine operation and maintenance for some designs.
- (F) Access, for the purposes of sampling, must be provided in the discharge line between the sand filter and the soil absorption component in accordance with paragraph (F)(1) of rule 3701-29-13 of the Administrative Code.

IV. Distribution Network

- (A) The design area loading rate for a timed dosed sand filter shall ensure the system remains aerobic, but shall not exceed one gallon per square foot per day. The daily design flow and design area loading rate shall be used to determine the overall dimensions of the sand filter.
- (B) Low pressure distribution with time dosing of effluent is required. All network piping and low pressure distribution piping and fittings shall be polyvinyl chloride meeting ASTM Standard D 1785 or ASTM D 2241, Schedule 13.5, 17, or 21 or equivalent. The installation of selected piping must prevent settling and damage under normal load and operating conditions. All distribution network connections shall be watertight. The design shall include the entire network configuration including pipe lengths and size, exterior control panel and alarm information, and calculations used to determine dose volume, orifice loading rates, dosing tank sizing and pump selection within the following specifications:

- (1) Distribution lines must be sized from one half to two inches in diameter. A design head of no less than five feet shall be maintained at each orifice with no more than a ten per cent difference in the operating head between the proximal and distal orifices. The system's design shall ensure a minimum fluid velocity of two feet per second is maintained in the manifold and supply piping during dosing.
 - (2) The orifice design loading rate shall not exceed one-fourth gallon per dose. Each dose shall deliver at least four times the void volume of the distribution lines to the distribution area but no greater than one-fourth the daily design flow. Orifice density shall be uniform and must result in no more than four square feet of sand per orifice with an orifice size of no less than one-eighth inch. Orifices must be spaced a minimum of twelve inches from the edge of the sand filter.
 - (3) The direction of orifices and the method of orifice shielding shall be specified in the design and shall allow for equal pressurization and depressurization of the laterals, and drain-back to prevent freezing.
 - (4) When the design uses the second compartment of a septic tank with a shared liquid level for the purposes of dosing, the pump must be contained in accordance with paragraph (J)(3) of rule 3701-29-12 of the Administrative Code.
 - (5) Controls must be installed in a location with an unobstructed view of both the sand filter and dosing tank, and a minimum of four feet above final grade.
- (C) A time-dosed sand filter design must specify how the uniform distribution of the effluent across the surface of the sand filter will be ensured.
- (1) Wastewater may be applied within a layer of coarse aggregate or bundled polystyrene above the sand media. Orifice orientation and shielding shall be specified in the design. If bundled polystyrene is to be used, the design shall include and follow manufacturer recommendations.
 - (2) If wastewater is to be sprayed upward against the top of gravel-less chambers, the design shall include and follow manufacturer recommendations.
 - (3) When orifices are positioned up in the twelve o'clock position, the effluent stream must be sprayed against an orifice shield, gravel-less

chambers, or similar device. When orifices are positioned down in the six o'clock position to facilitate draining after each pump cycle, a mechanism to disperse the effluent stream such as an orifice shield, a pad of gravel, or a splash plate shall be provided.

- (D) Turn-ups and valves, for the purpose of flushing the system, must be installed at the end of each distribution line. A valve box installed to grade must be provided for each turn-up and valve.

V. Site Preparation and Installation

- (A) Berms, surface grading or other site modifications shall be required as necessary to keep surface water from draining into the sand filter.
- (B) Aggregate and media delivered to the site should be tested against design-sizing specifications. All aggregate and media shall be stored, loaded, transported, and installed in such a way as to avoid contamination of the material.
- (C) Filter media shall be placed in such a way as to avoid internal layering. Placing the sand by slurry or dropping the sand from a height of several feet should be avoided, because it promotes segregation by grain size.
- (D) Sand should be placed into the sand filter in six to eight one inch lifts. Each lift should be wetted and then lightly settled. Light settling may be accomplished by walking on the sand.
- (E) The filter media surface shall be level and smooth.
- (F) The buried sand filters soil cover shall be graded to discourage the ponding of surface water and seeded to promote quick vegetation growth as soon as possible after construction and inspection of the sand filter.

VI. Operation and Maintenance

The TDSF shall be operated, maintained, and monitored as required by the operation permit issued by the board of health. A service agreement for a pretreatment component used in a system with a TDSF shall include the maintenance and monitoring of all system components. In conjunction with any operation permit conditions or O&M provisions required by the board of health, the O&M of a TDSF shall include but is not limited to:

- (A) Checking vegetative cover for erosion or settling and any evidence of seepage on buried TSDF.
- (B) Flushing of distribution laterals.
- (C) Checking for ponding in the distribution area.
- (D) Monitoring the dose volume and operating pressure head of the distribution system.
- (E) Checking for any surface water infiltration or clear water flows from the dwelling or structures into the system components or around the TSDF.