SeptiTech®
a subsidiary of Bio-Microbics, Inc.

Operation and Maintenance Manual

SeptiTech Wastewater Pretreatment System

Commercial Processor Units

STAAR 1.2 / STAAR 1.5 / STAAR 3.0 / STAAR 4.5

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Table of Contents

List of Tables

List of Figures

1. Introduction

This document describes the operation process and maintenance procedures used to control and maintain operation of the SeptiTech Wastewater Pretreatment System.

The SeptiTech pretreatment unit is comprised of a concrete tank, pumps, media, and required process piping. Each processor is controlled by a programmable logic controller (PLC), which can control the processor automatically or manually through the use of an operator interface terminal (OIT).

Operation of the processor can be divided into two process loops:

- The Treatment Loop – controls treatment of wastewater through operation of recirculation pumps that circulate water through the media in the processor tanks and operation of discharge pumps that discharge the treated wastewater to the disposal system.
- The Sludge Return Loop – periodically pumps solids produced by the SeptiTech treatment process back to the primary tank(s) for settling that are situated immediately upstream of the SeptiTech treatment unit.

In addition to the two process control loops, there is an alarm control loop that detects abnormalities and/or faults in the process loops and triggers an alarm sequence that notifies both the operator via audible and visual alarms and SeptiTech's on-call service department via a remote monitoring telemetry system.

2. Treatment System Design and Operating Theory

SeptiTech uses an enhanced recirculating biological trickling filter system in a treatment process that is optimized to remove a high percentage of BOD, TSS, and nitrogen from wastewater through an aerobic treatment process. The SeptiTech processor is added to a conventional system between the septic tank and disposal system (typically a leach field). The treatment capacities of each of the SeptiTech Commercial models are shown in the table below.

Table 1: SeptiTech Processor Treatment Capacities

Processor Model	Tank Capacity*	Avg. Treatment Capacity
STAAR 1.2	2,000 gal	1,200 gpd
STAAR 1.5	4,000 gal	1,500 gpd
STAAR 3.0	6,000 gal	3000 gpd
STAAR 4.5	8,000 gal	4,500 gpd

**Tank capacities and dimensions may vary depending on State codes and regulations*

The SeptiTech processor model required depends on several factors:

- Hydraulic loading (design flow, gpd)

- Biological loading (Biochemical Oxygen demand (BOD), mg/L)
- Nutrient removal (if required)

Initially, raw wastewater passes through a baffled septic tank, sized according to local state codes, where a portion of the solids and grease are separated out. Wastewater flows (typically via gravity) from the septic tank into the reservoir of the processing tank beneath the trickling filter. The SeptiTech treatment process uses unique characteristics of a patented filter media to construct a trickling filter in which the treatment occurs in the mixed-liquor as it passes though the filter. The filter consists of high surface area media situated over a reservoir into which the percolate drains. Within the reservoir is a pump that distributes a combination of percolate and newly added wastewater from the baffled septic tank to the top of the media bed.

SeptiTech commercial models use a combination of high surface area plastic media and polystyrene hydrophobic bead filter media. The surface area of the media provides the living space for the bacteria to grow while the open spaces within the media allow air to freely pass through, providing ample oxygen to support the microorganisms. The percolate from the filtering process drains into the treatment reservoir for further recirculation or discharge. Several times per day, a portion of the wastewater in the reservoir is pumped back to the septic tank. Within the septic tank, denitrification takes place. Nitrification of the ammonium in the wastewater occurs in the liquor as it passes through the media (refer to section 3.2 for further details on the denitrification process).

A programmable logic controller (PLC) controls the timing and sequence of the recirculation of wastewater in the lower collection reservoir, as well as the recirculation of a portion of the waste back to the septic tank. The PLC also controls the discharge to the leaching system. A more specific description of the process is provided as follows:

3. Treatment Loop Description

The treatment loop consists of two independently functioning processes:

- Recirculation Loop during which the contents of the process chamber are distributed over a column of treatment media and allowed to trickle back down to the underlying reservoir.
- Denite Mix Loop (Optional Configuration) during which nitrified wastewater is pumped from the processor tank back through a specially modified septic tank.
- Discharge Loop during which wastewater is pumped from the processor tank.

3.1. Recirculation Loop

Wastewater from the septic tank enters the processor and collects in a reservoir at the base of the tank where it mixes with treated water. Wastewater is pumped up to the treatment area above the reservoir where outside air is passively drawn into the wastewater stream. Oxygenated wastewater is uniformly sprayed over the media by low-pressure spray nozzles. The microbes residing within the media bed break down pollutants in the wastewater as it migrates downward through the media and back into the reservoir below. The wastewater can be circulated through the filter media 70 or more times in a 24-hour period by the recirculation pump.

Oxygen is supplied to the processor through venturis installed within the recirculation pump discharge header prior to the nozzles. The nozzle of the venturi causes the velocity of the water to increase, thus causing a decrease in pressure. This pressure drop draws air in the system through an outside air supply pipe.

A programmable micro-logic controller (PLC) activates the recirculation program that self adjusts these operations based on actual wastewater flow into the processor (as monitored by the PLC). The processor constantly evaluates the water usage and meters out the effluent discharge to the disposal system in equal doses over a 24-hour period (a dosing schedule can also be customized to the project specification).

SeptiTech processors are sized based on the projected design flow with additional capacity to accommodate wastewater surges (morning and evening flows, special events, etc). Under surge conditions, the PLC senses the increased flow into the system and adjusts the treatment process to gradually accommodate the accumulated surge flow while maintaining treatment effectiveness. If the PLC senses reduced flow, it will automatically ratchet the system down, and after several days enter "sleep mode" during which time the processor only operates long enough to maintain the microbe culture.

SeptiTech processing starts automatically with any wastewater input. The recirculation system then remains in operation, continuing to automatically reset as necessary, as long as wastewater is discharged into the processor or until the entire accumulated surge flow has been discharged.

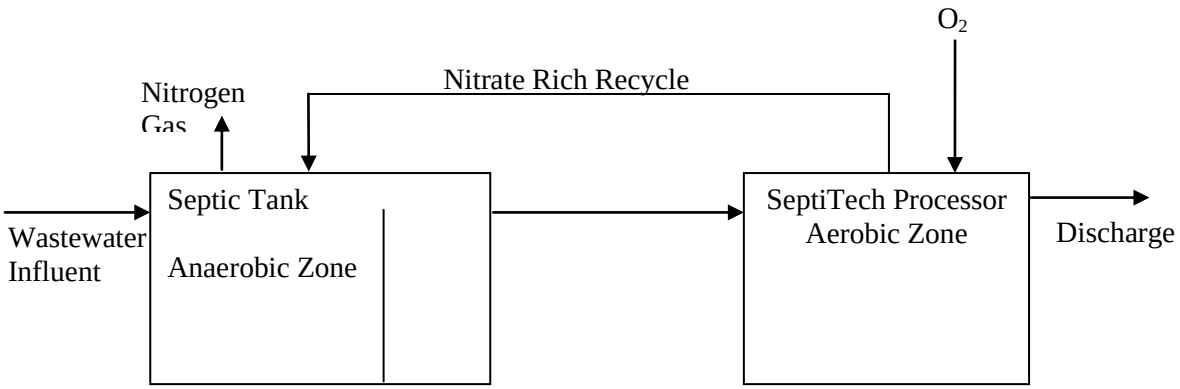
3.2. Denite Mix Loop (Optional Configuration)

Wastewater within the process chamber of the system undergoes several treatment processes. A few of these processes include the biochemical oxidation of organic matter and the nitrification of influent ammonia; both of which are aerobic processes (i.e. require the presence of oxygen). In order to achieve a reduction in the total influent nitrogen concentration, the influent ammonia must be nitrified from ammonia to nitrate within the aerobic SeptiTech processor tank. Then, the nitrified wastewater must be introduced into an anaerobic environment (i.e. no oxygen) in order for the nitrate within the wastewater to be converted to nitrogen gas. Once nitrogen gas is formed, it simply is released into the atmosphere through the natural venting of the septic tank.

SeptiTech offers an optional denitrification configuration, in which a denite-mix pump is used to recycle nitrified wastewater from the processor tank back to the septic tank. In order to aid in the denitrification process, SeptiTech adds heavy plastic media (refer to section 6.3 for details) to the septic tank to provide the necessary environment needed for the denitrifying bacterial culture to grow. Because this media is added to the primary septic tank, it is required that the primary septic tank be of a two-compartment configuration. That is, there must be a baffle wall installed within the septic tank in a 1/3 – 2/3 volume configurations. Figure 1 summarizes the nitrogen removal processes in schematic form.

The increased residence time provides sufficient time for any dissolved oxygen within the recycled wastewater to be consumed, thus creating a true anaerobic environment. It also allows time for the natural processes of denitrification to occur.

Figure 1 summarizes the nitrogen removal processes in schematic form.



DENITRIFICATION

Within the septic tank, baffles are installed to increase the hydraulic residence time and to ensure that the amount of dissolved oxygen in the water is sufficiently reduced to form the anoxic zone needed for denitrification. Carbon from the incoming waste stream is utilized to convert the recycled Nitrate to Nitrogen gas from the processor. Incoming ammonia passes through unchanged to the SeptiTech processor (Aerobic Zone).

NITRIFICATION

The SeptiTech processor is rich in dissolved oxygen. BOD is reduced and ammonia is oxidized to Nitrite and then to Nitrate. Water within the processor is recycled back to the head of the anoxic zone in the septic tank, which is rich in Nitrate. The recycle percentage can be adjusted anywhere in the range from 100-400% of the discharge volume in order to optimize the total nitrogen removal

Figure 1: SeptiTech Denitrification Process Description

3.3. Discharge Loop

After completing the prescribed treatment process in the processor, the treated wastewater flows into the final reservoir of the treatment tank known as the decant chamber. Within the decant chamber, a dual alternating submersible pump station is installed in order to discharge the treated wastewater out of the processor tank. The pumps are sized in accordance with the pump operating requirements that are specific to each job. The pumps will run in an alternating fashion such that no one pump operates more than the other, minimizing wear and tear on the pumps and thus increasing the life of the pumps. In the event of a lift pump failure, the full load of the lift station is automatically shifted to the remaining functional pump. The length of operating time that the pumps run can be adjusted to match the daily flows that the treatment system receives during an average 24-hour period in order to "tune" the system to achieve effective treatment of the wastewater.

The discharge pumps are operated based on a timed program. The default program is to have the discharge pump run once every hour throughout the day for a set amount of time in order to meet the daily flow. Both the pump activation cycle and pump run time can be adjusted from the OIT panel or from off site at the SeptiTech facility. Similar to standard pump stations, there are float switches (see section 6.6) within the decant section of the processor tank. However, these switches are used as safety switches rather than pump control switches.

4. Sludge Return Loop

Microbes have a short life cycle, flourishing and dying within a few hours. Due to the unique physical characteristics of SeptiTech's media, the wastewater and microbes do not wet or strongly adhere to the media surfaces, thereby reducing the potential for the media to clog. Biological growth on the treatment media builds up, eventually sloughs off into the reservoir of water underlying each of the process chambers.

The accumulated solids in the bottom of reservoir are collected and returned to the head of the primary septic tank via submersible pump-back pumps to settle out of suspension. These solids are removed when the septic tank(s) are pumped out during the regularly scheduled septic tank maintenance (every 2-5 years).

The pump-back pumps are operated twice each day at twelve-hour intervals. The total pump back flow is based on the daily flow as determined by the PLC. Initially, pump back will be set to equal 100 percent of the previous day's flow divided equally between the two pumping schedules.

5. Alarm Control Loop

Alarm control loops are provided in the control logic to alert the operator or SeptiTech to abnormal events or conditions in the process tanks or in the control system. In the event that an alarm condition is detected by the control system, the following actions are triggered:

- Activation of audible alarm horn located on the operator interface terminal (OIT);
- Activation of alarm light located on the front of the OIT; and
- Activation of the telemetry equipment to report that an alarm condition has occurred for the SeptiTech treatment system.

The controller is also equipped with telemetry that provides remote access to the control system. This allows an off-site attendant to evaluate the nature of the alarm and either take corrective actions via the connection to the PLC or notify operating personnel of the fault and arrange for an on-site inspection prior to initiating corrective actions. At any time, the operator can identify the nature of any alarm condition, including the possibility of multiple simultaneous alarm conditions, by viewing the Fault Status screens on the OIT.

The local audible alarm is silenced for a maximum of 24 hours by briefly (<2 seconds) pressing the illuminated red reset pushbutton on the operator panel. The alarm light in the pushbutton will

remain lit until the fault causing the alarm is cleared (i.e., the problem is fixed). If an alarm has been silenced but the fault has not been cleared after 24 hours, the local alarm will again sound. Note that this twenty-four hour silencing does not prevent the local alarm from sounding again during that period in response to any different fault conditions.

Fault conditions are cleared and reset by pressing and holding the Reset pushbutton for at least twelve (12) seconds. Following this action, all system alarms are cleared, and the visual alarm light will shut off. The alarm loop will then freely respond to any abnormal condition that remains uncorrected.

See section 7 for more details in reference to alarms and troubleshooting.

6. System Components

6.1. Concrete Tank

All SeptiTech commercial processors come housed within a precast concrete tank. The capacity of the concrete tank depends on the processor model that is being used. The concrete tank capacities are as follows:

Table 2: SeptiTech Concrete Tank Information

SeptiTech Model	Concrete Tank Capacity*
STAAR 1.2	2,000 Gallons
STAAR 1.5	4,000 Gallons
STAAR 3.0	6,000 Gallons
STAAR 4.5	8,000 Gallons

** Tank capacities and dimensions may vary depending on precast concrete provider*

All tanks come equipped with aluminum access hatches that are available in several configurations; pedestrian loaded, gas tight / water tight, and H20 loaded. The access hatches are installed in order to have access into the tanks for installing the processor within the concrete tanks, for performing maintenance, and for retrieving samples. The majority of the processor components can be maintained or replaced through the hatches without having to enter into the processor.

6.2. Piping & Fittings

The piping and fittings installed within the treatment processors are constructed of Schedule 40 and/or Schedule 80 PVC.

6.3. Media

The treatment processor contains two (2) different types of treatment media. One is plastic Cascade Bio-Ring media and the other is small polystyrene beads. The Bio-Ring media is a plastic high surface area media manufactured by Jaeger Products, Inc. (www.jaeger.com). For

every cubic foot of media, there is 30 square feet of surface area, providing the surface area needed for the attachment of biological growth.

Figure 2: SeptiTech Plastic Media
Picture courtesy of www.jaeger.com

The polystyrene hydrophobic bead filter media occupies the upper portion of the treatment unit. Due to the hydrophobic nature of the media, microbes present in the wastewater do not strongly attach to the media, but are rather entrained within the wastewater as it flows through the media. In this suspended state, the microbes use and transform the nutrients and organic materials provided by the constant supply of fresh wastewater to form new cell mass. The open spaces within the media allow air to freely pass through, providing ample oxygen to support the microorganisms.

Figure 3: SeptiTech Polystyrene Bead Media

6.4. Disinfection (Optional)

SeptiTech provides the option of disinfection with the pretreatment systems using Ultraviolet (UV) light to disinfect the wastewater. The processor discharge pumps convey the treated wastewater through the disinfection unit. Various configurations are available depending on the flow requirements that are specific to the job for a flow range of 10 GPM – 80 GPM. The manufacturers of the UV disinfection units that SeptiTech primarily uses are as follows:

- Atlantic Ultraviolet Corporation (Sanitron® Ultraviolet Water Purifier)
- Emperor Aquatics Inc. (Smart "High Output" UV Sterilizers)

Schematics of the UV units that are used are shown in Figure 4 and Figure 5.

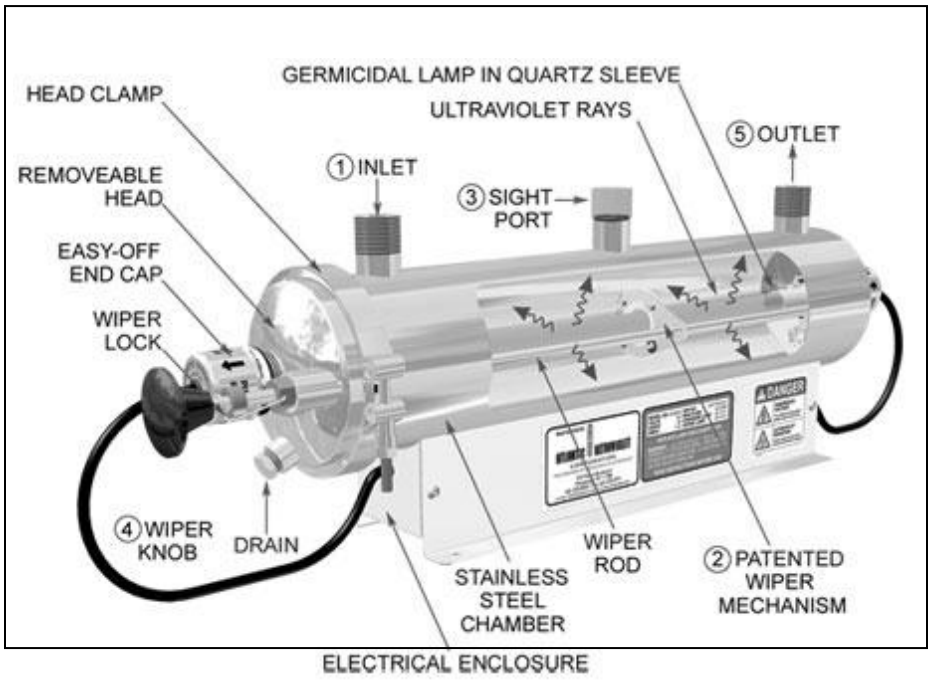


Figure 4: Sanitron Ultraviolet Water Purifier
Picture courtesy of www.ultraviolet.com

Figure 5: Emperor Aquatics (Smart HO UV Sterilizer)
Picture courtesy of www.emperoraquatics.com

6.5. Pumps

The pump of choice that SeptiTech uses within the commercial processors is the Tsurumi Pump VANCS series of fully submersible pumps. The pumps are constructed of stainless steel and fiberglass reinforced plastics (FRP) making them highly resistant to corrosion. The impellers are also constructed of FRP allowing for the passage of solids, stringy materials, and resistance to wear when pumping abrasive materials.

- Tsurumi, Inc. (www.tsurumiamerica.com): VANCS series of pumps

Figure 6: Tsurumi VANCS Series Submersible Pump (Typical)

The various processes in which the pumps are used are as described below:

- **Recirculation** – The recirculation of the wastewater from the reservoir portion of the processor up to the spray manifold that distributes the water over the top of the media.

- **Pump-back** – The removal of solids from the bottom of the tank back to the head of the primary septic tank.

- **Denite Mix** – (Optional) The recirculation of nitrified wastewater from the processor tank back to the custom denite septic tank.

- **Discharge** – Duplex pumping system that discharges treated water from the processor to the disposal system.

Table 3 lists the model numbers of the ***standard*** pumps that SeptiTech uses for each of the above processes for each SeptiTech model.

Table 3: SeptiTech Standard Pumps

Processor	**SeptiTech Standard Pump Models**			
	Recirculation Pump	**Pump-Back Pump**		**Discharge Pump**
STAAR 1.2	50PN2.4S	OM3		OM3
STAAR 1.5	50PN2.75S	OM3		OM3
STAAR 3.0	(2)50PN2.4S	OM3		OM3

STAAR 4.5	(2)50PN2.75S	OM3		OM3

In addition to the above standard discharge pumps, other models with various pumping capabilities are available that can be used on a case-by-case basis in order to meet pumping requirements depending on the project. Pumps are available in Single Phase 120/230 volt and Three Phase 208/230 volt arrangements.

6.6. Float Switches

SeptiTech uses float switches within the decant portion of the processor for process safety and to aid in the pump control process. These float switches are mechanical devices and do not contain mercury. The switches that SeptiTech uses are manufactured by Alderon Incorporated.

7. Alarms and Troubleshooting

The following table outlines SeptiTech alarm conditions and the associated reasons that could have caused the alarm to be generated. All alarm conditions on SeptiTech commercial systems will report to a SeptiTech technician or designated party via the telemetry system.

Table 4: Alarm Descriptions and Troubleshooting

Alarm	Description	Problem	Solution
High Float Alarm	High Float stayed ON for 60 minutes (default Alarm Delay)	1. High Float hung up unable to fall back freely	Move Float to allow free access
		2. Discharge Line broken/unhooked	Check with contractor
		3. Discharge Line blocked/frozen	Check with contractor
		4. Continuous high flow in excess of design	Reduce flow to normal
		5. Float failed	Replace Float
		6. Input failed on PLC	Replace PLC
Low Float Alarm	High Float came ON while Low float stayed OFF	1. Low Float hung up - not able to raise freely	Move float to allow free access
		2. Float Input failed on PLC	Move Wire #4 from X1 to X7, or replace PLC
		3. Float failed	Replace Float
Discharge Alarm	Discharge Pump told to run but no feedback (X Input)	1. Circuit Breaker tripped	Reset Breaker if continues replace Pump
		2. Failed neutral connection	Check connections
		3. Relay failed	Check voltage out of Relay, check Relay Pins
		4. Failed Current Sensor	Replace Current Sensor
		5. Pump failed open windings	Replace Pump
		6. Circuit breaker Off	Turn on Circuit
		7. Input failed On PLC	Replace PLC

Alarm	Description	Problem	Solution
Recirculation Alarm	Recirculation Pump told to run but no feedback (X Input)	1. Circuit Breaker tripped	Reset Breaker - if continues Replace Pump
		2. Failed neutral connection	Check connections
		3. Relay failed	Check voltage out of Relay, check Relay Pins
		4. Failed Current Sensor	Replace Current Sensor
		5. Pump failed open windings	Replace Pump
		6. Circuit Breaker off	Turn on Circuit
		7. Input failed On PLC	Replace PLC
		8. Thermal trip	Add water, check Float levels
Process Safe Float Alarm	Float dropped out (Low position)	1. Septic Tank pumped	Wait until septic tank has been refilled
		2. Pump-back pump runtime is too long	Adjust runtime within program
		3. Discharge pump runtime is too long	Adjust runtime within program
Alarm, With or without Fault Screen	Alarm sounding, reset button ineffective	1. Control Panel fuse blown	Replace Fuse if Continues Check for Shorts
		2. Relay failed	Check Voltage out of Relay, Check Relay Pins
		3. Failed neutral connection (missing or loose)	Check connections or add wire
		4. Wire #20 missing or loose (CR1 - Y0)	Tighten or add wire
		5. PLC stalled	Cycle power
		6. Button failed	Replace Button

7.1. Troubleshooting Guide: Frequently Asked Questions/Problems

7.1.1. Odor

- Check to be certain system is vented properly through building vent stack. Is there an impediment blocking air flow like a pump station or a septic tank effluent filter that does not allow free airflow? A pump station will require a separate ventilation line. More drastic measures include a separate vent for the septic tank or cut into the line between the septic tank and processor.

- Is the customer's vent positioned properly and is it tall enough? We have had very good luck eliminating most odors with simple vent pipe extensions.

- Sometimes a carbon stack filter can be inserted onto the vent stack to alleviate odor. These are typically available through a plumbing supply house.

- Are the system access ports tightened properly? Contact SeptiTech service for sealing suggestions.

- Be wary of natural downdrafts conditions. Septic odor can often be traced to poor vent pipe positioning and downdraft air currents.

- Make sure the customer locates the precise position of odor if possible. We have had some cases where odor has arisen from sources not associated with the system such as old buried septic tanks.

7.1.2. Power

- Can power be shut down? Customers should know that for seasonal businesses and applications where power may be suspended for extended periods of time, that the system will rebound quickly when power is applied. However, be certain that your customer is not planning to shut the power off regularly, since the system controller automatically accommodates for low/no flow status.

- Why did the alarm sound when the power comes back on? When system power is turned on it takes the PLC, 15-seconds or so to "boot-up," much like a computer. In this timeframe, the alarm will sound because the PLC, which controls the alarm function, is not yet operating.

7.1.3. Customer Maintenance

- SeptiTech systems are designed to operate without routine customer maintenance. While septic tanks must be pumped at regular frequencies (depending on flow and strength), the SeptiTech processor is not to be pumped as the Sludge return loop eliminates the need for pumping.

7.1.4. Air Intake

- The air intake pipe should be maintained in such a way to keep it clear of materials that could block airflow. (eg. deep snow, entangled brush).

- If an ear is placed next to the air intake pipe, you may be able to hear the sound of the water sloshing about in the processor.

- However, if installation directions were not followed and there is no positive pitch in the processor sloping toward the processor, or if there is a dip in the air line, there is a chance that water can accumulate in the air intake pipe. This is not good and a loud "gurgle" may signify such a condition. Usually, the contractor must be notified to correct this problem. Also, the strength of the air intake (during recirculation pump operation) may be weakened if there is water in this pipe, which you can test by placing a small piece of paper against the air intake pipe. Suction from the air intake should be able to hold a small piece of paper in place.

7.1.5. Pump Life

- We use high quality Tsurumi and Goulds pumps for all of our systems. However, lifespan of pumps is very hard to estimate due to conditions beyond our control. For instance, amount of

system use as well as quality of power (i.e. our pumps generally do not like "dirty power") can affect pump lifespan. In general, our pumpback and discharge pumps operate less than recirculation pump(s) during normal system operation and should last many years. Our recirculation pump(s) under normal use should last 3-5 years or longer.

7.1.6. Audible Alarm

- We have upgraded our alarm decibel level and alarms on newer systems should be loud enough to be heard if placed within reasonable distance of living/working space. However, if system configuration does not allow main controller to be placed within a reasonable distance, SeptiTech offers a remote alarm option, which allows alarm placement wherever the customer desires. Please contact SeptiTech for a current cost of this accessory, which must be installed by an electrician.

7.1.7. Access Lids.

- It is important to understand that access lids must be easily accessible by SeptiTech service personnel and must not be buried.

7.1.8. Can I drive over my system?

- As long as the tank(s) and access hatches that house the SeptiTech processor have been built to H20 loading requirements.

7.1.9. Care of System.

Proper care of system mirrors proper care for any onsite septic system and is reflected in the Customer Use section of the owner's manual. This is detailed below:

- Pumping Septic Tank:

  SeptiTech recommends that you pump your septic tank once every 3-5 years. Note: the septic tank is not the same unit as the SeptiTech processor. SeptiTech processors should never require pumping.

- Use of Bleach:

  Your septic tank and SeptiTech treatment system relies on bacterial action to work. Therefore, please avoid the heavy use of bleach as much as possible. If bleach must be used, use it sparingly and spread out its use over time so the bacteria in the system are not all depleted. Likewise, do not flush antibiotic pills into the system as they can also kill the bacterial action in the septic and processor tanks.

- Disinfecting a Well:

  Occasionally a contaminated well needs to be disinfected (usually with chlorine). If you need to do this, do not run the chlorinated water through your septic system. Open the outside water faucets and let the water run for several hours or as long as necessary to flush the chlorine out of the well. Pump the well for several hours after you no longer smell chlorine, in the meantime do not use any water in the house.

- Trash & Garbage Disposals:

  Always keep sanitary napkins, cigarette butts, coffee grounds, paper towels, excessive cooking grease, paints and non-biodegradable materials out of the system. Use of sink

grinders (garbage disposals) can result in heavy and inconsistent load of organic materials into the system and are therefore not recommended.

- Discharges from Potable Water Treatment Systems:

Discharges from water treatment systems, such as water softeners or water filtration systems that require back flushing, are not considered wastewater and should never be pumped into a septic system. This flow can and should to be diverted into a separate, properly constructed dry well (refer to state and local codes).

- Plumbing Fixture Maintenance:

Plumbing fixtures such as toilet bowl fill valves and faucets should be maintained to insure that leaks do not cause excess water to enter the septic system.

- Additives:

Refrain from using toilet tablets or products such as *Drain-O* as these products will deplete necessary bacteria from the septic system. Never use septic tank additives of any kind. Most are harmful to the system and do not have any positive effect.

- Alarm:

The computer in your SeptiTech® control panel monitors all the important functions of the SeptiTech processor. It will set off an alarm if any of several events occur such as a failure to discharge water from the tank. The system autodialer will alert a technician. Press the re-set button to silence the alarm and call SeptiTech® for service. A service telephone number for your area should be affixed to the cover of the panel.

7.1.10. System Operation Information

a. SeptiTech can provide our system data reports pulled at annual inspections or other intervals as arranged to fulfill local permitting requirements. Please contact SeptiTech or your SeptiTech distributor for details.

b. The SeptiTech controller is accessible for basic data gathering.

c. Most Control Panel functions are designed to be accessed by a SeptiTech-trained professional and are therefore password protected to prevent unauthorized access

8. O&M Agreements / Checklists / Maintenance Schedule

Many states, such as the State of Rhode Island, require an advanced treatment system owner to enter into an O&M agreement with a certified maintenance provider. The following is an **example** of a typical SeptiTech O&M Agreement between a customer and a SeptiTech authorized provider. Of course, state regulations differ and any agreement must be tailored to specific state requirements.

Eco-Tech Supply, Inc.
400 South County Trail – Suite A201
Exeter, RI 02822
Email: EcoTechSupply@cox.net

Phone: (401)-000-0000
Fax: (401)-000-0000

Operations and Maintenance Agreement

Eco-Tech Supply, Inc. proposed to perform the maintenance requirements prescribed for your SeptiTech Treatment System and Drainfield (Pressurized or non-pressurized) on property stated below.

Property Owners Name _____

RIDEM Permit # _____ SeptiTech Panel # _____

Street _____ City _____

State _____ Zip _____

Work Phone _____ Home Phone _____

Permanent Mailing Address (If different from site address)

Street _____ City _____

State _____ Zip _____

Inspection to include:

1. Inspect/Clean processing tank and treatment components and recommend pumping as required.
2. Inspect Control Panel for proper operation, including all floats, pumps and communication as applicable. Make appropriate adjustments as required.
3. For pumped discharge, Inspect/Clean discharge pump station and controls.
4. Inspect/Clean pressurized drainfield, as applicable.

5. If applicable, monitor system remotely through telemetry module and notify owner of any corrective action required for alarms.
6. If UV filter is present, Inspect/Clean UV basin and components. Owner must provide operator with means of disconnect to power off the unit for inspection. Bulb to be replaced every two years unless failure occurs before that time. Bulb is not included in contract price and will be billed at list price at time of replacement.
7. Evaluate condition and operation of overall system, and report findings.

Responsibility of the Owner

1. Provide access to water at the SeptiTech tank in the form of a hose and provide access to the system and control panel on the day of the scheduled maintenance visit.
2. Notify Eco-Tech Supply, Inc. of alarm conditions or problems that occur throughout the year.
3. If the system has a Telemetry Module, the System Owner shall arrange for the installation of a telephone line to the panel and maintain telephone service to the System address at all times.

Items NOT covered by this service contract

1. Corrective and/or repair maintenance if necessary.
2. Effluent sampling and/or analysis if required.
3. The cost of tank pumping if required.
4. Any emergency and or any other unscheduled maintenance and/or service calls to the System address.

This maintenance will be performed semi-annually and invoiced after each inspection for a total yearly fee of $_____. Any unscheduled maintenance services will be performed at the hourly rate of $_____ plus parts and travel. All invoices shall be due within 30 days of the date of invoice, unless agreed otherwise. Past due balances subject to a service charge of 1.5% per month.

The undersigned agrees to the terms of this contract, and understands that a contract is required for perpetuity. The owner is responsible to have the initial contract recorded at the local Town/City Hall on the property's deed at the town clerk's office. This contract is transferable to subsequent owners and must be disclosed at any and all transfers of ownership. This contract is valid for three years from the date below, or the date of system startup, which ever is most recent; and is renewable at the end of the three years.

_____ _____

Homeowner **Date**

_____ _____

Representative **Date**
Eco-Tech Supply, Inc.

Acknowledgment of Understanding

Owner Responsibility to Maintain/Convey SeptiTech Service Contract(s)

I/we, as owners of a SeptiTech Treatment System, understand that I/we have purchased from Septi Tech, Inc. Dealer or Dealer's agent an onsite wastewater treatment system that uses proprietary advanced wastewater treatment technology. I/we agree to purchase and maintain a Service Contract for this system from our Echo-tech Supply, Inc. Dealer or from Dealer's agent for the entire period of the warranty.

I/we also understand that this Service Contract must be maintained. Failure to pay any renewal fees within 30 days of the due date shall result in termination of all Maintenance of our SeptiTech Treatment System.

I/we also understand that failure to pay any renewal fees within 30 days of the due date will void all SeptiTech Treatment System warranties on any component of the SeptiTech Treatment System.

I/we also understand that I/we are obligated to disclose this information and this Service Contract requirement to subsequent property buyers. I/we also acknowledge that I/we have received a Homeowner's Manual (for preventive maintenance) and that I/we are obligated to pass this Homeowner's Manual on to subsequent property owners.

Site Address: Street _____City _____

State _____ Zip _____

_____	_____
(Printed Name)	(Printed Name)
_____	_____
(Signature)	(Signature)
_____	_____
(Date)	(Date)

9. Maintenance Schedule

The SeptiTech system is virtually a maintenance free system for the system owner. During annual inspections provided by a SeptiTech certified service provider, there are numerous system components and general system checks that are to be performed. Table 1 below provides a schedule for the maintenance of the SeptiTech system. Please note, some states/counties/cities require a more aggressive maintenance schedule and that should take precedence over our standard schedule.

Table 5: SeptiTech System Maintenance Schedule

(Note: Controller and OIT Operator Instructions are available to SeptiTech service providers)

System Component	Task	Frequency
Control Panel	1. Test that OIT screen illuminates and responds when touched	1. Annually
	2. Put system into maintenance mode and test that all hand switches work properly	2. Annually
	3. Ensure that all relays and contactors perform properly when testing hand switches	3. Annually
	4. Check that telemetry is working properly (if applicable)	4. Annually
	5. Visually inspect the panel for signs of wear, loose wiring, loose parts, and corrosion	5. Annually
Processor Tank	1. Check that there is still free access to the tank	1. Annually
	2. Inspect access hatches for signs of wear and ensure they open freely	2. Annually
	3. Visually inspect tank for signs of deterioration, structural damage, infiltration	3. Annually
	4. Inspect the ground around the tank for signs of sink-hole or wet spots that could be sign of tank leakage or broken pipes	4. Annually
Recirculation Pump	1. Check pump performance by manually operating the pump and checking spray pattern and air intake velocity	1. Annually
	2. Check and record pump amperage	2. Annually

	draw out of pump breaker and relay. (Normal operating range: 2.4-2.8A) 3. Check for any debris inside of recirculation pump support basket 4. Visually inspect recirc pump assembly for any signs of wear	3. Annually 4. Annually
Discharge Pump	1. Check that pump is operating by manually activating the pump and visually inspecting weep hole spray 2. Check and record pump amperage draw out of pump breaker and relay (Normal operating range: 2.4-2.8A) 3. Perform discharge calibration by performing pump-down test within tank and/or by checking pump discharge pressure 4. Visually inspect discharge pump assembly for any signs of wear	1. Annually 2. Annually 3. Annually 4. Annually
Solids Pump-Back Pump	1. Check that pump is operating by manually activating the pump and visually inspecting weep hole spray 2. Check and record pump amperage draw out of pump breaker and relay (Normal operating range: 2.4-2.8A) 3. Perform pump-back calibration by checking pump discharge pressure 4. Visually inspect pump-back pump assembly for any signs of wear	1. Annually 2. Annually 3. At system start-up and if/when pump is changed 4. Annually
Mechanical Floats	1. Check that floats are performing correctly by manually activating & deactivating floats and verifying that feedback is received by PLC 2. Visually inspect that floats are able to move freely and do not catch on any obstructions 3. Visually inspect floats and float clamps for signs of wear or corrosion	1. At system start-up and if/when float is changed 2. Annually 3. Annually
Media Bags	1. Visually inspect that bags are intact, no beads are found floating in the water 2. Ensure that bags are well distributed across the top of the rack 3. Visually inspect for any bags that may	1. Annually 2. Annually 3. Annually

	have fallen through the rack 4. Visually inspect amount of biological growth and color of the bags	4. Annually
Air Intake Snorkel	1. Visually inspect intake snorkel for signs of damage, broken pipe, insect nests, debris clogging intake 2. Place hand on end of intake snorkel and feel that air is flowing in while recirculation pump is operating 3. Using an anemometer, take reading of air intake velocity while recirc pump is running (should be > 80 ft./min.)	1. Annually 2. Annually 3. Annually
Spray Header/Nozzles	1. While the recirc pump is running, visually inspect spray pattern of spray nozzles. Clean nozzles and venturis if necessary 2. Inspect nozzles for clogging, clean if necessary 3. Inspect spray header to ensure header piping is clamped in proper position 4. Inspect spray header for signs of wear or damage 5. Inspect rubber couplings for signs of wear and corrosion	1. Annually 2. Annually 3. Annually 4. Annually 5. Annually
Processor Support Rack	1. Visually inspect support rack piping for signs of damage	1. Annually
Olfactory & Audible Checks	1. Check for any bad odors 2. Listen to processor while running to check for any loud or abnormal noises	1. Annually 2. Annually

9.1 Residual Removal

Microbes have a short life cycle, flourishing and dying within several hours. Due to the unique physical characteristics of SeptiTech's media, the wastewater and microbes do not wet or strongly adhere to the media surfaces, thereby reducing the potential for the media to clog. Biological growth on the treatment media builds up and eventually sloughs off into the reservoir of water underlying each of the process chambers.

The accumulated solids in the bottom of reservoir are collected and returned to the head of the primary septic tank, via a submersible pump-back pump, to settle out of suspension. These solids are removed when the septic tank(s) are pumped out during the regularly scheduled septic tank maintenance. The frequency of septic tank pumping depends on the flow volume and

strength of the wastewater discharge and can range from between one and five years, with the average being every two or three years. If you have a garbage grinder (not recommended, as noted in Owner Care & Maintenance instructions), more frequent sludge pump out will be necessary.

The pump-back pump is operated twice each day at twelve-hour intervals. The total pump back flow is based on the daily flow as determined by the PLC. Initially, pump-back will be set to equal 100 percent of the discharged flow divided equally between the two pumping schedules.

9.2 Visual Evaluation Techniques

The following section provides techniques to determine proper system function by performing visual inspections of the system.

9.2.1 Recirculation Pump

The recirculation pump can be accessed through the inlet access port on the processor tank. The pump itself is not always viewable since the media bags generally cover up the opening that allow removal of the pump (refer to Figure 7).

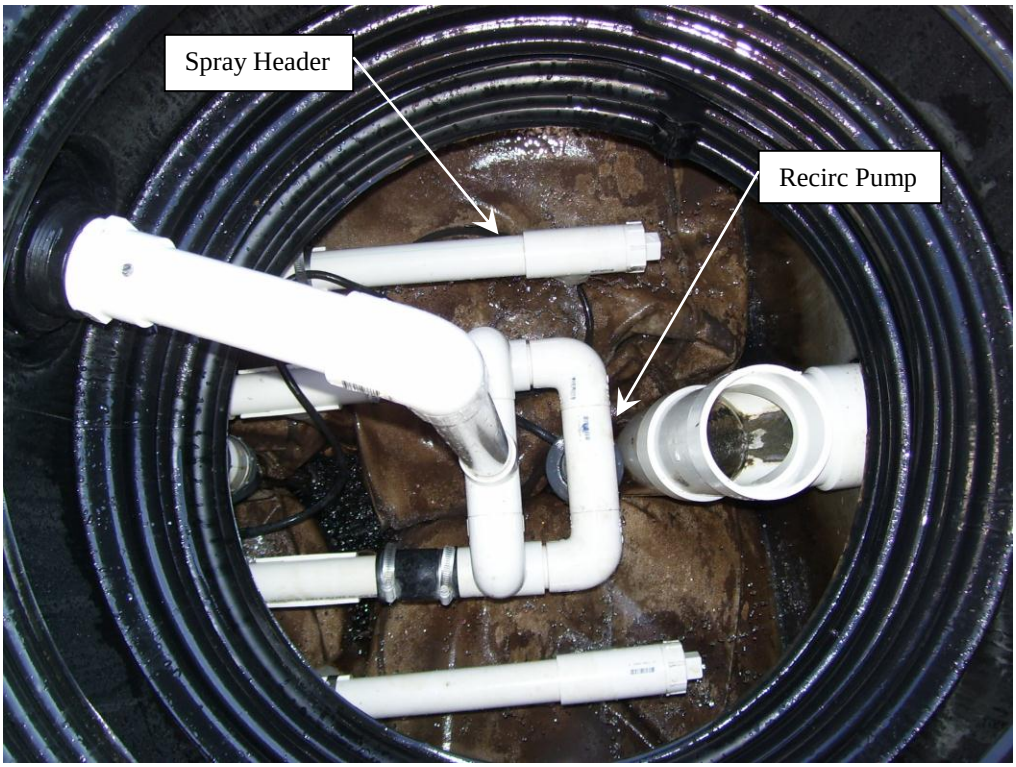


Figure 7: Recirculation Pump & Spray Header

However, the operation of the recirculation pump can be visually determined by checking the spray pattern of the individual spray nozzles.

In order to visually inspect proper recirculation pump performance, perform the following procedures:

1. Place the processor into “maintenance” mode and manually activate the recirculation pump.
2. View the spray pattern of the individual spray nozzles that can be seen through the processor access ports (both inlet and outlet ports).
3. The spray nozzles should have a uniform “fanned out” pattern (as shown in Figure 8) and cover the media bag surfaces in a well-distributed manner.

    a. If there is a good spray pattern that is well distributed, the pump is performing correctly and providing proper flow through the spray nozzle assembly.
    b. If not, the pump may not be performing properly, or the venturi nozzles are clogged.

Figure 8: Typical Spray Nozzle Spray Pattern

9.2.2 Discharge Pump

The discharge pump is accessed through the outlet access port of the processor tank and is located within the “decant” portion of the tank.

In order to visually inspect proper discharge pump performance, perform the following procedures:

1. Place the processor into “maintenance” mode and manually activate the discharge pump.

2. Inspect the discharge pump while it is running and look to see that there is a strong and steady stream of water coming from the weep hole (anti-siphon hole) near the top of the discharge pump pipe assembly.

Figure 9: Discharge Pump Assembly

a. If the weep hole spray is strong and steady with a good amount of pressure, then the discharge pump is operating properly.

b. If the weep hole spray is not a strong and steady stream, and the water is only "trickling" out, then this would indicate that there could be something wrong with the discharge pump.

9.2.3 Solids Pump-Back Pump

The solids pump-back pump can be accessed through the inlet access port on the processor tank.

The procedure for visual inspection of the solids pump-back pump is similar to that of the discharge pump. In order to visually inspect proper operation of the solids pump-back pump, perform the following procedures:

1. Place the processor into "maintenance" mode and manually activate the solids pump-back pump.

2. Inspect the solids pump-back pump while it is running and look to see that there is a strong and steady stream of water coming from the weep hole (anti-siphon hole) near the top of the pump-back pump pipe assembly.

    a. If the weep hole spray is strong and steady with a good amount of pressure, then the solids pump-back pump is operating properly.

    b. If the weep hole spray is not a strong and steady stream, and the water is only "trickling" out, then this would indicate that there could be something wrong with the solids pump-back pump.

3. Inspect the inlet pipe for the processor while the solids pump-back pump is running. There should be water entering into the processor from the septic tank indicating that the pump-back pump is in fact pumping water to the primary septic tank.

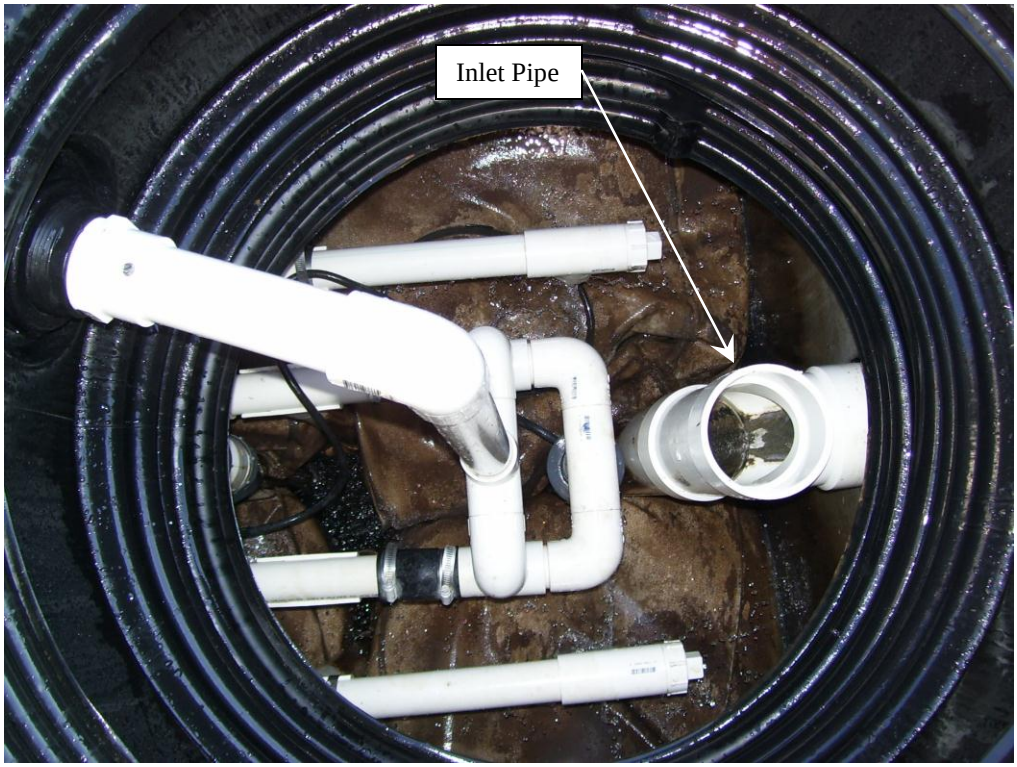


Figure 10: Processor Inlet Pipe

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9.2.4 Mechanical Floats

All processors are equipped with mechanical floats in order to monitor water levels within the processor tank. The floats can be accessed through the outlet access port and are located within the "decant" portion of the processor tank.

In order to visually inspect proper operation of the floats, perform the following procedures:

Visually inspect that the floats are free to swing up and down in the vertical direction without hitting any obstructions.

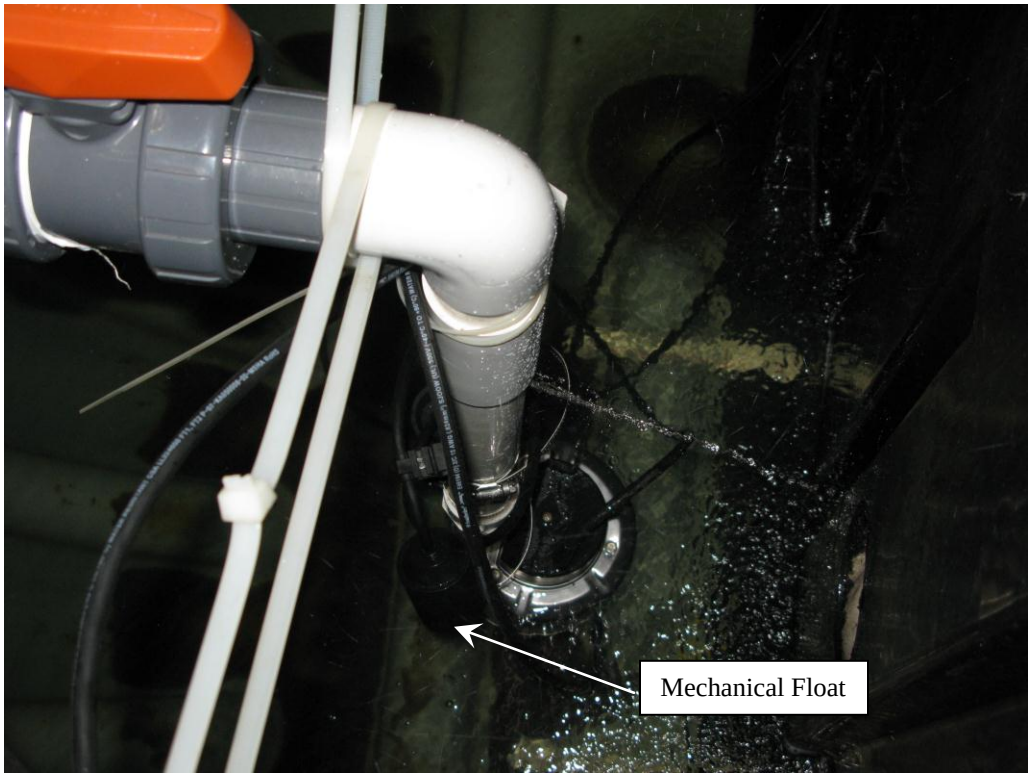

Figure 11: Mechanical Floats

10 Evaluation of Effluent & Mixed Liquor

Onsite determination of system treatment performance may be accomplished by viewing the system internally, inspecting the effluent that is being pumped out and smelling the system.

10.1 Visual Evaluation

The system is running correctly as long as the following visual signs are present:

1. Media Bags: The bags should be a light to dark brown color, which indicates good biological growth and activity.

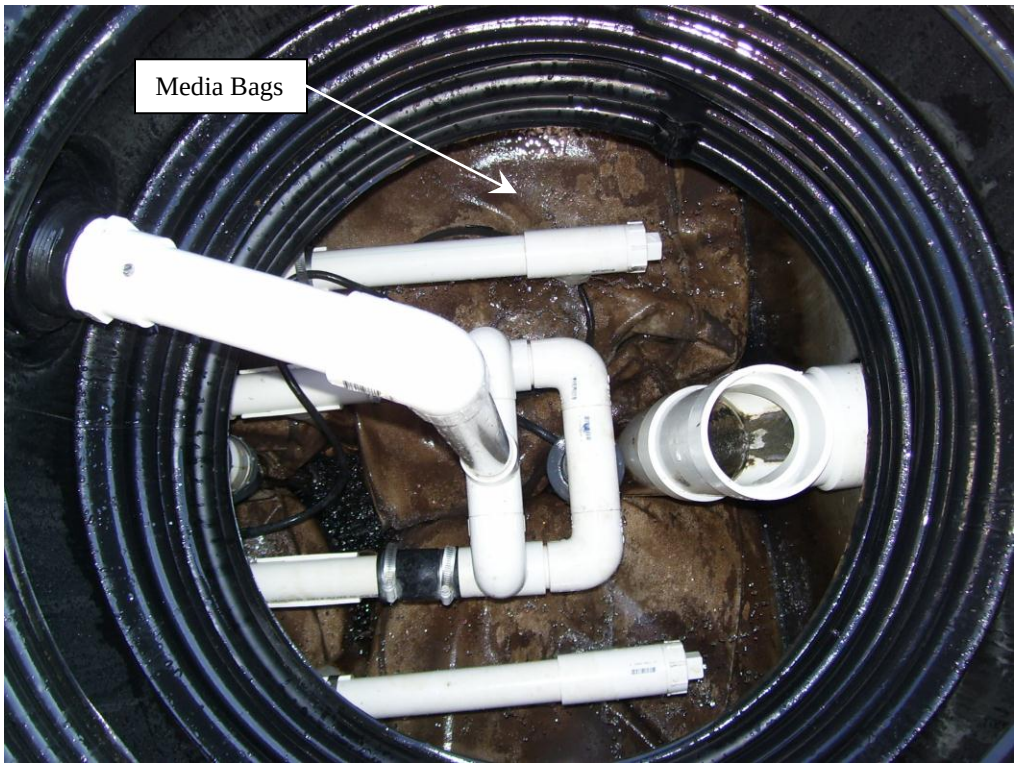

Figure 12: Media Bags

2. Processor internals: Bacteria are not bias as to what surface it grows and adheres. Therefore, there should be a light coating of light brown growth on most surfaces of the processor internals
3. Effluent: Using a clear glass container or clear plastic bottle, collect a sample of the effluent from the decant chamber near the discharge pump. The sample should be relatively clear (low turbidity) with minimal noticeable solids.

Figure 13: SeptiTech Effluent Example

10.2 Olfactory Evaluation

The SeptiTech system should have a non-offensive rich earthy odor, typical to that of a municipal aeration treatment plant. The processor at no time should smell similar to that of the septic tank, that is, a septic smell. If there is a strong offensive odor coming from the system or from the effluent, this is typically an indication that the system has turned septic, meaning there is little to no dissolved oxygen in the water and the biology has turned anaerobic.

If there is a septic smell coming from the processor, the following procedures should be completed:

1. Using an airflow meter (anemometer), measure the air intake nozzle to ensure proper free outside air flow, while recirculation pump is operating, to ensure and that there is no blockage. (typical airflow range should be greater than 80 ft. per minute.)
2. Inspect the venturi nozzles to ensure they have not become plugged.
3. View the spray pattern of the spray nozzles to ensure the recirculation pump is running properly. (See **Figure 8**).
4. Inspect the recirculation pump for proper performance and amperage draw. (Normal amperage draw should be in the 2.4 to 2.8A range. Refer to Controller Operating Manual in Appendix 1 for detailed instructions).

11 Sampling Protocol

Some states or regions require effluent sampling on a prescribed frequency. SeptiTech's sampling protocol is provided as follows:

11.1 Non-UV Systems

Sample will be taken using a gravity-filled sampling bottle to collect a grab sample directly from the effluent wet well directly under the discharge side access port. This location represents the endpoint of the treatment process just prior to discharge. The following sampling protocol shall be used to collect samples:

All samples should be collected in accordance with protocols described Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA, AWWA, WPCF, 1992. These sampling procedures are outlined below for grab samples:

11.1.1 Sampling Equipment and Supplies

- Sample Bottles of appropriate size and material – Recommend obtaining bottles from the laboratory that will perform the analyses. If required, bottles may contain appropriate chemical preservative or it can be added after samples are collected.
- Sampling Device – Sample dipper that can be plunged below the water surface to retrieve a representative water sample and exclude any floating matter.
- Field Preservation – Appropriate preservatives for specific analyses if not provided in sampling containers, sufficient ice to reduce and hold samples at 4 degrees Centigrade until delivered to the laboratory.
- Documentation – Field notebook or data sheets to record pertinent collection information, sample labels and Chain of Custody sheets.

11.1.2 Grab Sample Collection

- Open hatch over discharge/decant wet well and observe/note appearance of water and floating or suspended matter on sampling sheet.
- Prepare sample labels and affix to bottles.
- Plunge sample dipper below water surface (2-3 inches) and allow to fill.
- Retrieve and pour contents into respective sample bottles, cap bottles and place in cooler with ice.
- Several retrievals may be required to obtain the necessary sample volume.
- Transport to the laboratory as soon as practicable per respective holding times for the target analyses as shown in the Sample and Preservation Holding Time Table on Page 15.

11.1.3 Documentation

- Fill out the chain of custody sheet with all pertinent collection data and list all analyses to be performed in the appropriate columns on the form.
- Deliver to the lab within the specified holding times and sign per protocol of laboratory sample custodian. Retain a copy of the custody sheet for your records.

11.2 UV Systems

SeptiTech systems that include UV disinfection units shall be sampled as follows:

a. Pre-UV sampling will follow the sampling protocol listed in #1 above. (Sample will be taken using a gravity-filled sampling bottle to collect a grab sample directly from the effluent wet well directly under the discharge side access port. This location represents the endpoint of the treatment process just prior to discharge through the UV disinfection chamber.)

b. Post-UV samples will be drawn through a ¼" ballcock and Tygon tubing. Sampling protocol is as follows:

All samples should be collected in accordance with protocols described Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA, AWWA, WPCF, 1992.

11.2.1 Sampling Equipment and Supplies

- Sample Bottles of appropriate size and material – Recommend obtaining bottles from the laboratory that will perform the analyses. If required, bottles may contain appropriate chemical preservative or it can be added after samples are collected.
- Sampling Device – ¼-inch ball valve fitting (supplied by SeptiTech) and Tygon tubing.
- Field Preservation – Appropriate preservatives for specific analyses if not provided in sampling containers, sufficient ice to reduce and hold samples at 4-degrees Centigrade until delivered to the laboratory.
- Documentation – Field notebook or data sheets to record pertinent collection information, sample labels and Chain of Custody sheets.

11.2.2 Grab Sample Collection

- Open hatch over discharge/decant wet well and observe/note appearance of water and floating or suspended matter on sampling sheet.
- Prepare sample labels and affix to bottles.

- Cut new section of Tygon tubing.
- Install ball valve and Tygon tubing in discharge pressure port.
- Using the auto-handoff switch located on the inside front panel of the PLC panel, turn on pump and open valve to allow water to run for 60-seconds. Then open sample collection container, put Tygon tubing into sample collection container, fill container and immediately cap container and place in cooler with ice.
- Transport to the laboratory as soon as practicable per respective holding times for the target analyses as shown in the Sample and Preservation Holding Time Table.

11.2.3 Documentation

- Fill out the chain of custody sheet with all pertinent collection data and list all analyses to be performed in the appropriate columns on the form.
- Deliver to the lab within the specified holding times and sign per protocol of laboratory sample custodian. Retain a copy of the custody sheet for your records.

SeptiTech Inc.

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Sampling Preservation/Holding Times/Volumes

	Wastewater		
INORGANICS	container[1]	preservation[2]	holding time[3,4]
Alkalinity	P, G - 200 ml[5]	cool 4°C	14 days
Ammonia-N	P, G - 100 ml	H_2SO_4 to pH<2, cool 4°C [7]	28 days
BOD_5	P, G - 1000 ml	cool 4°C	**24 hours**
$CBOD_5$	P, G - 1000 ml	cool 4°C	**24 hours**
Chloride	P, G	cool 4°C	28 days
COD	P, G - 60 ml	H_2SO_4 to pH<2, cool 4°C [7]	28 days
Color	P, G - 100 ml	cool 4°C	**48 hours**
Conductivity/specific conductance/salt toxicity	P, G - 100 ml	cool 4°C	28 days
Hardness	P, G - 60 ml	HNO_3 to pH<2[6]	6 months
Nitrate-N	P, G - 60 ml	cool 4°C	**48 hours**
Nitrite-N	P, G - 60 ml	cool 4°C	**48 hours**
Oil & Grease	1000 ml amber glass, teflon lined cap	H_2SO_4 or HCl to pH<2, cool 4°C	28 days
Orthophosphate-P	P, G - 100 ml	Filter immediately,[10] cool 4°C	**48 hours**
pH	P, G - 100 ml	none required	**immediately**[6]
Phosphorus, total	P, G - 100 ml	H_2SO_4 to pH<2, cool 4°C[7]	28 days
Total Kjeldahl Nitrogen (TKN)	P, G	H_2SO_4 to pH<2, cool 4°C [7]	28 days
Turbidity	P, G - 100 ml	cool 4°C	**48 hours**
SOLIDS			
Settleable solids	P, G - 1000 ml	cool 4°C	**49 hours**
(TDS)	P, G - 200 ml	cool 4°C	7 days
Total suspended solids (TSS)	P, G - 1000/200 ml	cool 4°C	7 days
Total solids	P, G - 200 ml	cool 4°C	7 days
Total volatile solids (TVS) and Loss on Ignition (LOI)	P, G - 200 ml	cool 4°C	7 days
BACTERIOLOGY			
Total Coliform	P, G - 200 ml	cool 4°C	6 hours[7]
Fecal Coliform	P, G - 200 ml	cool 4°C	6 hours[7]

Sample Acceptance Criteria

Sample Documentation - The laboratory provides chain of custody forms for complete documentation including sample specific comments and the following information: client specific information, sample id, sampler name, sampling date and time and location , sample matrix, type of container and preservation, analytical parameters and custody signatures with date and time Sample Labeling – Samples must be assigned a unique identifier documented with indelible ink on a secure sample label and on the chain of custody form. Water resistant, permanent labels are available.

Temperature - EPA and MADEP require solid and aqueous samples be cooled to 4°C.

Notes:

1 P = high density polyethylene, precleaned (HDPE), G = glass, precleaned

2 Immediate preservation in the field is preferred. Preserve each aliquot at time of collection for composite sampling , if possible. When using an automatic sampler, cool sampler to 4°C until compositing is completed.

3 Holding times listed are the maximum that samples may be held before analysis or extraction.

4 Holding times listed start at time of sampling for grab samples and end of composite period for composites.

5 The volumes listed may be reduced or increased depending analyte combinations, detection limits and sample specific quality control . Contact the laboratory for minumum volumes for specific analytical combinations.

6 EPA defines "immediately" as within 15 minutes of collection. If not possible, analyze within 15 minutes of arrival at laboratory.

7 Deliver samples to the lab as soon as possible if 6 hours is not achievable. Add 0.008% sodium thiosulfate if the presence of residual chlorine is indicated by potassium iodide test paper.

12 SeptiTech Warranty Agreement

Period of Coverage

SeptiTech warrants each treatment unit sold to be free of defects in material, workmanship and performance for a period of two years from date of delivery.

Obligations of SeptiTech

SeptiTech at their sole expense will service and repair the installed unit including all parts and labor that show evidence of defect or unacceptable performance for any reason when operated within design parameters, provided that all financial obligations of the owner/purchaser are in compliance with the Purchase & Sale Contract.

Exclusions

This Warranty does not apply to SeptiTech units that have been tampered with or altered by unauthorized persons, improperly installed or have been subject to external physical damage or acts of God. Further, this Warranty does not cover systems that have been flooded by external means or damage done by altered or improper wiring or overload protection. Additionally, this Warranty does not apply if the system has been operated beyond its maximum design capacity or permit, if the approved design has been altered after the fact, or if the system has been contaminated with disinfecting tablets, pipe cleaners, excessive use of bleach or other chemicals injurious to biological growth. All alarms must be called in within 24 hours. Lastly, it is imperative that the system is initially "started up" by either a SeptiTech employee or authorized representative or the warranty will not be valid.

Other Provisions

This Warranty only applies to the SeptiTech treatment processing system and does not include any wiring, plumbing, drainage, disposal or leaching systems. SeptiTech also reserves the right, to furnish a component part which, in its judgment, is equivalent to the company part replaced. Further, owner agrees to provide to SeptiTech with clear access to the processor covers on a year round basis.

Under no circumstances will SeptiTech be liable for direct or consequential damages including but not limited to lost profits, lost income, labor charges, delays in production or idle production time or habitability which results from any defects in material and/or workmanship of SeptiTech's system or units. This Warranty is expressly in lieu of any other expressed or implied warranties. Further, any implied warranties for merchantability and fitness for a particular purpose are hereby disclaimed. This Warranty provides the owner/purchaser specific legal rights. You may have other rights, which vary from state to state.