SeptiTech®
a subsidiary of Bio-Microbics, Inc.

RIDEM OWTS

Design and Tech Information

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Manufacturer:

SeptiTech - 69 Holland St – Lewiston – Maine- 04240

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October 21, 2021

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Dear Professional:

We appreciate your interest in SeptiTech. Hopefully the enclosed information will answer many of your questions. We are always available to answer additional questions, do on-site visits, or meet you in the field or in your office. Thank you for the opportunity to explain how SeptiTech's technology can assist you.

SeptiTech Patented Technology

SeptiTech treatment technology is designed to solve septic problems on most difficult sites by cleaning wastewater to very high levels before discharge to a leach field. A few of the resulting benefits include:

- SeptiTech treated water is so clean that a leach field will not foul up or fail.
- Rapid system start-up (less than 1 week for single digit BOD/TSS numbers) makes it the ideal system for seasonal homes.
- Most States allow a smaller and less expensive leach field with SeptiTech treatment technology.
- No owner maintenance required. No filters, no chemical additives, no records to keep or report.
- SeptiTech technology can be used in conjunction with virtually any subsurface disposal system, including proprietary systems such as driphose.

Treatment Process

SeptiTech uses a patented enhanced recirculating biological trickling filter system to clean wastewater; the enclosed process science sheet summarizes this technology. A Programmable Logic Controller (PLC) is custom designed to optimize the removal of pollutants from wastewater. All systems *consistently* remove 98+% of pollutants (as measured by $CBOD_5$ and TSS) and SeptiTech technology is an industry leader in the removal of E. coli from the wastewater stream. In addition, processors with dedicated denitrification units are available for total nitrogen reduction down to 14 mg/L and below. Effluent from SeptiTech processing looks like fresh water and is virtually odorless. A test result summary sheet from ETV/EPA is included in this package. SeptiTech technology is also NSF 40 and 245 certified.

Leach Field Reductions

In various states, SeptiTech has successfully requested and received approval for a reduction in the square footage of required leach field necessary to effectively dispose of SeptiTech-treated effluent. Approvals for reduction are based on empirical studies showing the correlation between acceptable loading rates and various soil types under a range of effluent quality, and the ability of time dosing to increase the infiltrative capacity of soils.

Leach fields are designed with water loading rates to fit a variety of soil types taking into account the daily flow volume, depth to limiting factor, and strength of the effluent. When pretreatment produces a highly treated water, such as of the quality that SeptiTech can achieve, numerous studies have

demonstrated that there is virtually no biological mat formation and effluent loading rates can approach natural soil infiltration rates.

Typically, states allow septic effluent loading rates ranging from 0.2 to 0.7 gpd/sq ft[1] (gallons per day per square foot). James Converse has recommended loading rates for highly treated water that range from 0.4 to 13 gpd/sq ft depending on soil types[2]. SeptiTech's state approvals dictate a conservative loading rate equivalent on the very low end of these measures for both clay type and well drained soils.

SeptiTech's controlled timed dosing has also been found to reduce the potential for hydraulically overloading soil. Research shows that to maximize the soil infiltration rate, leach fields should be lightly flooded evenly, frequently and sparingly with small doses of water on frequent intervals and allowed to rest in-between.

Residential Systems

SeptiTech's residential systems are available in either HDPE or concrete tanks. Beginning with the residential model STAAR 0.5 that treats up to four bedrooms, the SeptiTech residential line includes models that treat up to eight bedrooms. (See residential system technical specification sheet for details). Residential systems also require a 2-compartment septic tank sized to code. Installation is straightforward and no more difficult than installing a standard septic tank.

Commercial & Engineered Systems

Commercial SeptiTech models include Models STAAR 1.2, STAAR 1.5, STAAR 3.0 and STAAR 4.5 (see commercial system technical specification sheet for details). Commercial systems use the same treatment technology as the residential units and are set in reinforced concrete tanks sized according to flow volume and loading strength. All tanks are sealed and buried to assure odorless, noise-free operation. SeptiTech has commercial systems installed and operating in schools, apartment buildings, island communities, restaurants, inns, retail stores, business parks, subdivisions, multiple-family housing units and a brewery.

Engineered systems are custom designed by SeptiTech to address more unique situations. For instance, SeptiTech engineered systems are for larger flows (up to 200,000+ gpd), for high-strength wastewater characteristics (e.g. a microbrewery in Maine with influent BOD_5 of 2,700+ mg/l) and for situations where specific effluent parameters must be met (e.g. Total Nitrogen for residential denitrification systems of <19 mg/l). SeptiTech will evaluate system needs and provide an estimate in a timely manner.

System Controller

Both commercial and residential systems rely on a Programmable Logic Controller (PLC) to control the treatment process. The units are built and programmed by SeptiTech technicians. The PLC ensures consistent high levels of treatment and minimizes energy consumption for all levels of flow. The PLC includes:

a. Custom software package that continuously evaluate incoming flows and determines recirculation, pump-back, and discharge cycles for the most effective treatment. The PLC controls all system functions as well as monitors and sets alarms for high float, low float, float failures, all circuit breakers, all pumps, and if UV is applied (optional), UV bulb failure, and UV bulb intensity. Discharge dosing to soil absorption field is also managed to accommodate low permeability soils and shallow depths to limiting zones.

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[1] Tyler, E.J, and J. Converse. 1994. Soil Acceptance of Onsite Wastewater as Affected by Soil Morphology and Wastewater Quality.

[2] Tyler, E.J, and J. Converse. 1994.

b. Telemetry programmed to automatically notify SeptiTech should there ever be a problem with the system (standard on commercial; optional on residential). SeptiTech provides highly responsive 7-days per week, 24-hours per day service coverage.

c. Telemetry to accommodate regularly scheduled SeptiTech off-site system monitoring as well as provide flow and operational summary (standard on commercial; optional on residential).

Maintenance[3]

SeptiTech systems are essentially operationally maintenance free. Designed to be operationally simple, the system is manufactured of non-corrodible materials such as stainless steel fittings and hardware, PVC piping, high-density polyethylene or pre-cast concrete tanks, and industrial hardened electronics (PLC). All pumps have been carefully selected to be of the highest quality and longest service life possible. There are no chemicals to add, filters to clean, or media to replace. The pump-back mitigates the need to ever pump the SeptiTech processor. (Note: periodic pumping of the primary septic tank is still required). As such, annual maintenance entails a diagnostic review of the PLC, visual inspection of the processor vessel and internal parts, a check of the effluent clarity to assure the system is operating at maximum efficiency, and a visual check of the disposal area.

Warranty

A two-year parts and service warranty combined with the best customer service in the industry is standard with every unit and a reasonably priced extended warranty is available following the two-year warranty.

Experience

SeptiTech has installed systems serving thousands of facilities. These include systems with flows ranging from 200-gpd to 76,000-gpd. A winner of the EPA's environmental technology award, the company has earned a stellar reputation for consistent high-level treatment, innovation, versatility, and customer-friendly solutions to wastewater problems, highly dependable operation and top-flight service.

Thank you for your interest in SeptiTech. We look forward to working with you to *solve* your septic problems!

[3] State-specific maintenance requirements vary. Please consult SeptiTech for requirements in your state.

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The Process Science of the SeptiTech® System:

Summary

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 aerobic and anaerobic degradation. The SeptiTech processor is added to a conventional system between the septic tank and final soil absorption system (typically a leach field).

Initially, raw wastewater passes through a baffled septic tank, sized according to state code, 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 a bed of highly permeable hydrophobic 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.

SeptiTech residential models use polystyrene hydrophobic bead filter media, which occupy 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. The percolate from the filtering process drains into the reservoir for further recirculation (approximately 70 times/day) or discharge. Several times per day, a portion of the wastewater in the reservoir is pumped back to the septic tank where denitrification occurs. Nitrification of the ammonium in the wastewater occurs in the liquor as it passes through the media.

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, is controlled by a programmable logic controller (PLC). The PLC also controls the discharge to the leaching system. A more specific description of the process is provided as follows:

How the Standard SeptiTech® System works:

Step 1 Wastewater is discharged from the home or business to a partitioned septic tank where solids settle and begin to undergo anaerobic decomposition. The decanted effluent flows into the SeptiTech processor tank for treatment.

Step 2 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 media consists of polystyrene beads that provide a hydrophobic surface and an exceptionally high treatment area to wastewater volume ratio. The microbes residing in the pore spaces of the filter beads 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.

A programmable micro-logic controller (PLC) activates the recirculation and discharge pumps through a 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 soil absorption system in equal doses over a 24-hour period (a dosing schedule can 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 ratchet the system down, and after several days enter "sleep mode" during which 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.

Microbes have a short life cycle, flourishing and dying within a few hours. Due to the unique physical characteristics of SeptiTech's patented media, the wastewater and microbes do not wet or strongly adhere to the media surfaces, thereby reducing the potential for the media clogging. Instead of being stationary, the microbes migrate along with the wastewater increasing their degradation effectiveness. Dead microbes are flushed through the media with the wastewater and drain into the reservoir at the base of the processor tank. A "pump-back" system periodically pumps them back to the septic tank for additional anaerobic digestion (denitrification). As such, sludge and flock do not accumulate and the processor does not require pumping.

Step 3 After completing the prescribed treatment process in the processor, the treated water is time dosed to the disposal field to insure small frequent dosing of the field and proper absorption by the soil. In addition, pressurized delivery to the field allows placement of the disposal trenches all in one area or in several mini-disposal areas on the same lot.

Step 4 Finally, SeptiTech disposal trenches lie nearer to the surface of the ground than in a standard leach field to enable the action of soil microbes to further polish the effluent.

In addition to our standard biological trickling filter processor, SeptiTech systems can provide enhanced pathogen destruction and can further reduce total nitrogen through the use of complimentary ultraviolet (UV) sterilization and Denitrification processes, respectively.

UV Sterilization

Typical residential wastewater carries fecal coliform at a concentration of 10^7 to 10^9 colonies per 100 milliliters (col/100 ml) of wastewater[1]. Standard SeptiTech processors reduce this concentration to levels ranging from less than 10 to 1,000 col/100 ml.

However, in certain applications (e.g., close proximity to surface water, water supply wells, irrigation disposal, etc.) a further reduction of *bacteria and viruses* may be desired. Due to the clarity of the effluent from the SeptiTech processor, UV sterilization technology can be used to destroy the majority of the pathogens remaining. This technology is currently installed in over sixty SeptiTech systems in a number of states including several coastal islands. Fecal coliform concentrations typically range from non-detectable to 0.5-col/100 ml and average 0.1-col/100 ml. Actual concentrations depend on variations in wastewater strength and clarity. To produce a more consistently low coliform concentration (less than 0.05 col/100 ml), SeptiTech has developed an enhanced UV process that is being used in several commercial systems.

Denitrification

For critical resource areas that exhibit a high degree of sensitivity to the effects of nitrogen loading, SeptiTech has developed a denitrification process to further enhance total nitrogen removal during pretreatment. The SeptiTech denitrification systems have been proven to remove a larger percentage of total nitrogen by combining the nitrifying capabilities of our aerobic biological trickling filter system with an enhanced denitrification procedure.

The SeptiTech nitrogen reduction technology first nitrifies wastewater by the SeptiTech aerobic trickling filter process. Nitrification of the ammonium (NH_4) in the wastewater occurs in the processor as it passes through the media. Nitrified wastewater is then passed into an anoxic (>2 mg/l dissolved oxygen) environment where a culture of anaerobic bacteria satisfies their need for oxygen by chemically stripping the oxygen off other compounds, such as NO_3. To promote denitrification within the anoxic environment, SeptiTech has developed zones of submerged media with the required conditions of temperature, alkalinity, and BOD levels. Similar to the aerobic process, the denitrification process is self-adjusting based on demand and controlled by the PLC to provide consistent results.

SeptiTech's nitrogen reduction technology has completed a full year of verification testing under the US EPA Environmental Technologies Initiative, Source Water Protection Program. This testing was designed to verify nutrient reduction of the SeptiTech treatment technology and was being conducted by the Barnstable County Department of Health at the Massachusetts Septic System Test Center in Bourne. During the testing, the SeptiTech system was loaded with influent wastewater from a sanitary sewer. SeptiTech's nitrogen reduction capability was measured by constituents that demand oxygen for treatment (BOD and CBOD), and nitrogen species (TKN, NH_4, NO_2, and NO_3). Operational characteristics such as labor to perform maintenance, maintenance tasks, durability of the hardware, noise and odor production were also monitored. Effluent testing showed CBOD5 and TSS was 98% removed. Average Total Nitrogen in effluent was 14 mg/l. A full report for this testing is posted on the EPA (www.epa.gov/etv) and NSF (www.nsf.org/etv) web sites.

SeptiTech is also ASNI/NSF-40 and 245 certified. Information on these certification programs is available on the National Sanitation Foundation website; http://www.nsf.org/.

[1]Design Manual - Onsite Wastewater Treatment and Disposal Systems, Environmental Protection Agency, Washington, D.C. 1980.

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POWER REQUIREMENTS

RESIDENTIAL

Models	Control Circuit	Mechanical Circuit	
	110V	110V	220V
STAAR 0.5	2 Amps	10 Amps	5 Amps
STAAR 0.75	2 Amps	10 Amps	10 Amps
STAAR 1.0	2 Amps	15 Amps	10 Amps
Options			
Heater and or UV		Add 5 Amps	Add 5 Amps
Discharge Pump Upgrades			
2.4		Add 5 Amps	Keep as Same
2.75		Add 5 Amps	Keep as Same

STAAR™
Smart Trickling Anaerobic/Aerobic Recirculating Filter Systems

COMMERCIAL

Models	Control Circuit	Mechanical Circuit	
	110V	220V	208V 3 Phase
STAAR 1.2	2 Amps	15 Amps	10 Amps
STAAR 1.5	2 Amps	15 Amps	10 Amps
STAAR 3.0	2 Amps	20 Amps	10 Amps
STAAR 4.5	2 Amps	20 Amps	15 Amps
Options			
Heater		Keep as Same	Keep as Same
UV		Add 5 Amps	Keep as Same
Discharge Pumps Upgrades			
2.25		Keep as Same	Add 5 Amps
2.4		Add 5 Amps	Add 5 Amps
2.75		Add 5 Amps	Add 5 Amps

NOTE * All systems require two separate power circuits
Circuit #1 is 110v used for the controls
Circuit #2 is 110v/220v/208v depnding on system size and pump power requirments

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SeptiTech Sizing Information

For Residential Flows Serving up to 8-bedrooms

SeptiTech Standard Residential Models STAAR .5, STAAR .75 & STAAR 1.0

Desired Treatment Capacity	Standard Model (Concrete or Plastic)	Models with Ultraviolet Disinfection	Models with Denitrifaction	Processor Tank Volume	Number of Access Ports	Discharge Head (Standard)	Recommended 2-Compartment Septic Tank with Filter (Preceding Processor)
Up to 4 bedrooms / 500gpd	STAAR .5	STAAR .5UV	STAAR .5D	1,000-gallons	2	14-feet @ 25gpm	1000-gallons (or State code)
Up to 6 bedrooms / 750gpd	STAAR .75	STAAR .75UV	STAAR .75D	1,250-gallons	2	14-feet @ 25 gpm	1,500-gallons (or State code)
Up to 8 bedrooms / 1000gpd	STAAR 1.0	STAAR 1.0UV	STAAR 1.0D	1,500-gallons	2	14-feet @ 25 gpm	1,500-gallons (or State code)

For Commercial System Flows up to 4,500 gpd

SeptiTech Standard Commercial Models STAAR 1.2, STAAR 1.5, STAAR 3.0 & STAAR 4.5 (Concrete)

Hydraulic Capacity (gal/day)	Standard Model	Models with Ultraviolet Disinfection	Models with Denitrifaction	Processor Tank Volume	Number of Access Ports	Discharge Head (Standard)	Recommended 2-Compartment Septic Tank with Filter (Preceding Processor)
1,200 (nominal)	STAAR 1.2	STAAR 1.2UV	STAAR 1.2D	2,000-gallons	3	14-feet@ 25-gpm	1000-gallons (or State code)
1,500 (nominal)	STAAR 1.5	STAAR 1.5UV	STAAR 1.5D	4,000-gallons	3	14-feet@ 25-gpm	1,500-gallons (or State code)
3,000 (nominal)	STAAR 3.0	STAAR 3.0UV	STAAR 3.0D	6,000 – gallons	3	14-feet@ 25-gpm	1,500 – gallons (or State Code)
4,500 (nominal)	STAAR 4.5	STAAR 4.5UV	STAAR 4.5D	8,000-gallons	3	14-feet@ 25-gpm	1,500-gallons (or State code)

For Commercial System Flows Over 4,500 gpd Systems Requiring Special Considerations (i.e. high strength)

SeptiTech Engineered Systems

Please contact SeptiTech's Engineering staff for consultation. System specifications and quotes promptly available.

Other Sizing / Specifying Considerations:

1. Commercial denitrification units require a 2-compartment denite septic tank sized according SeptiTech specifications. Please contact a SeptiTech representative for assistance.

2. For all SeptiTech systems, H-10 is standard tank loading configuration. Contact your precaster for H-20 tanks.

3. For design assistance, please have available a minimum of the following data:

a. Application (e.g. school, apartment, restaurant, subdivision etc.)
b. Design flow data
c. Discharge flow and pressure (e.g. total dynamic head, pressure required for leaching system)
d. Effluent quality limits including organic, solids, nutrients and bacterial removals
e. Available power
f. Water table elevation (requirements for tank anti-floatation)
g. Features required including but not limited to control panel heaters, telemetry
h. Type of usage (seasonal / year-round)

4. Please consult discharge pump curves for discharge pump requirements other than SeptiTech standard discharge models. SeptiTech Engineering can provide assistance.

Technical Specification Sheet

SeptiTech HDPE Plastic Residential Models

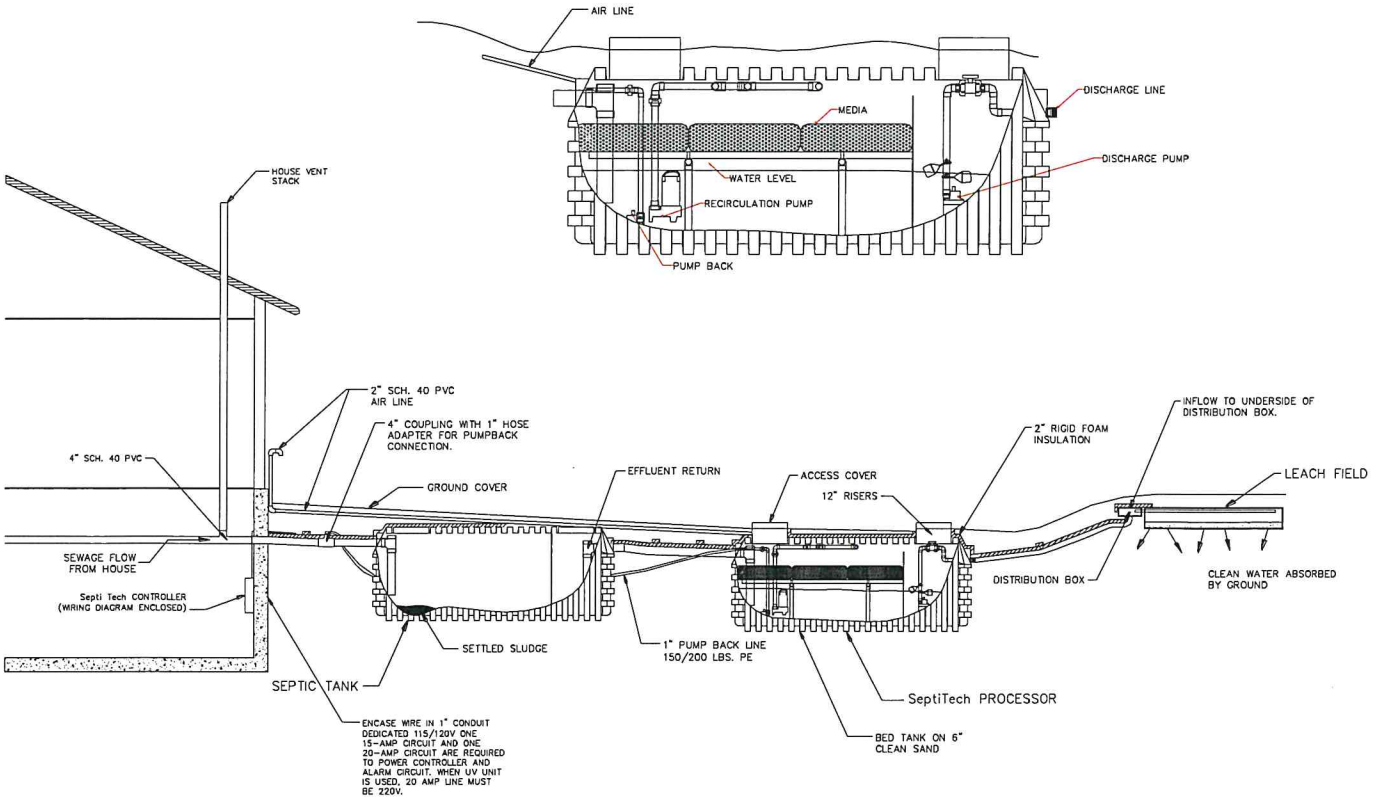
SeptiTech Residential Models STAAR 0.5, STAAR 0.75 & STAAR 1.0 (HDPE Plastic)

Standard Model	Models with Ultraviolet Disinfection	Models with Denitrifaction	Treatment Capacity	Tank Material	Tank Volume	Tank Dimension	Number of Access Ports	Weight	Inlet Invert	Discharge Head (Standard)
STAAR 0.5 / 500 GPD	STAAR 0.5UV	STAAR 0.5D[1]	Up to 4 bedrooms / 500 gpd	HDPE Plastic	1,000-gallons	11'-1" (l) x 5'-2" (w) x 4'-3"(h)[2]	2	540 lbs.	43"	14-feet[3]
STAAR 0.75 / 750 GPD	STAAR 0.75UV	STAAR 0.75D[1]	Up to 6 bedrooms / 750 gpd	HDPE Plastic	1,500-gallons	14'-9" (l) x 5'-2" (w) x 4'-3"(h)[2]	2	761 lbs.	43"	14-feet[3]
STAAR 1.0 / 1000 GPD	STAAR 1.0UV	STAAR 1.0D[1]	Up to 8 bedrooms / 1000gpd	HDPE Plastic	1,500-gallons	14'-9" (l) x 5'-2" (w) x 4'-3"(h)[2]	2	811 lbs.	43"	14-feet[3]

[1] Residential denitrification units require a special denite septic tank sized according to local specifications
[2] Height does not include 12" risers, which are standard unless specified otherwise
[3] Higher head pump available upon request

Recommended Septic Tanks (HDPE Plastic)

Tank Volume	Baffle	Effluent Filter	Access Ports	Tank Dimension	Tank Material	Weight	Inlet Invert	Outlet Invert
1000-gallons	2-Chambered	Zabel or Equivalent	24" Diameter 2 each	11'-1" (l) x 5'-2" (w) x 4'-3" (h)	HDPE Plastic	460 lbs.	43"	40"
1500-gallons	2-Chambered	Zabel or Equivalent	24" Diameter 2 each	14'-9" (l) x 5'-2" (w) x 4'-3" (h)	HDPE Plastic	586 lbs.	43"	40"



Technical Specification Sheet

SeptiTech Residential Concrete

SeptiTech Residential Models STAAR 0.5, STAAR 0.75 & STAAR 1.0 (Please Note: Tank specifications may vary from state to state)[1]

Standard Model	Models with Ultraviolet Disinfection	Models with Denitrification	Treatment Capacity	Tank Material	Tank Volume	Tank Dimension	Access Ports	Weight	Inlet Invert	Discharge Head (Standard)
STAAR 0.5 / 500 GPD	STAAR 0.5UV	STAAR 0.5D[2]	Up to 4 bedrooms / 500 gpd	Reinforced Concrete	1,000-gallons	8'(l) x 5'-4"(w) x 5'-4"(h)[3]	2	8,700 lbs.	54"	14-feet[4]
STAAR 0.75 / 750 GPD	STAAR 0.75UV	STAAR 0.75D[2]	Up to 6 bedrooms / 750 gpd	Reinforced Concrete	1,250-gallons	10'-5"(l) x 6'-2.5"(w) x 5'-5.5"(h)[3]	2	12,900 lbs.	54-1/2"	14-feet[4]
STAAR 1.0 / 1000 GPD	STAAR 1.0UV	STAAR 1.0D[2]	Up to 8 bedrooms / 1000gpd	Reinforced Concrete	1,500-gallons	10' 5"(l) x 6' 2.5"(w) x 5'-5.5"(h)[3]	2	12,900 lbs.	54-1/2"	14-feet[4]

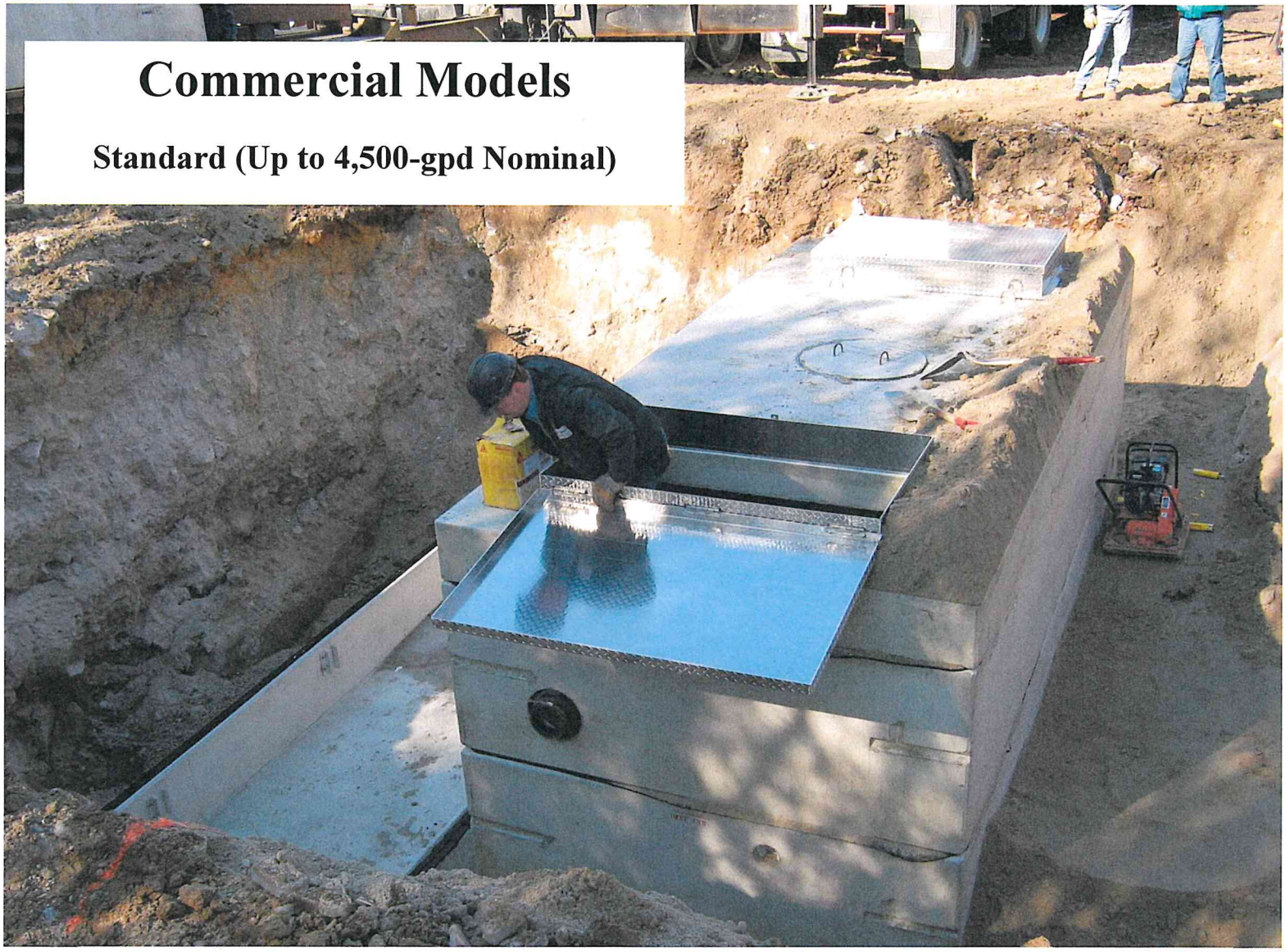
[1] Please check with your local SeptiTech distributor for exact tank specifications
[2] Residential denitrification units require a baffled septic tank with effluent filter
[3] Height does not include 12" risers, which are standard unless specified otherwise
[4] Higher head pump available upon request

Recommended Septic Tanks (Please note: Tank specifications may vary from state to state)

Tank Volume	Baffle	Effluent Filter	Access Ports	Tank Dimension	Tank Material	Weight	Inlet Invert	Outlet Invert
1000-gallons	2-Chambered	Zabel or Equivalent	2 each	8' 6"(l) x 4'10"(w) x 5' 4"(h)	Reinforced Concrete	8,700 lbs.	54"	51"
1500-gallons	2-Chambered	Zabel or Equivalent	2 each	10' 5"(l) x 6' 2.5"(w) x 5' 5-1/2"(h)	Reinforced Concrete	12,900 lbs.	54-1/2"	51"

Commercial Models

Standard (Up to 4,500-gpd Nominal)



SeptiTech Commercial System Specifications

All precast tanks constructed of reinforced concrete. Fiberglass-reinforced plastic is available in select markets.

SeptiTech Model	Hydraulic Capacity (gal/day Commercial Strength Wastewater)	Nominal Organic Loading (lbs BOD_5 per day)	Tank Volume[3]	Number of Access Ports	Discharge Head (Standard)[4]
STAAR 1.2 STAAR 1.2 UV[1] STAAR 1.2D[2]	1,200-gpd Nominal	4.6	2000-gal.	3	14'
STAAR 1.5 STAAR 1.5UV[1] STAAR 1.5D[2]	1,500-gpd Nominal	5.8	4000-gal.	3	14'
STAAR 3.0 STAAR 3.0UV[1] STAAR 3.0D[2]	3,000-gpd Nominal	7.5	6000-gal.	3	14'
STAAR 4.5 STAAR 4.5UV[1] STAAR 4.5D[2]	4,500-gpd Nominal	12.5	8000-gal.	3	14'

[1] SeptiTech systems with Ultraviolet Disinfection

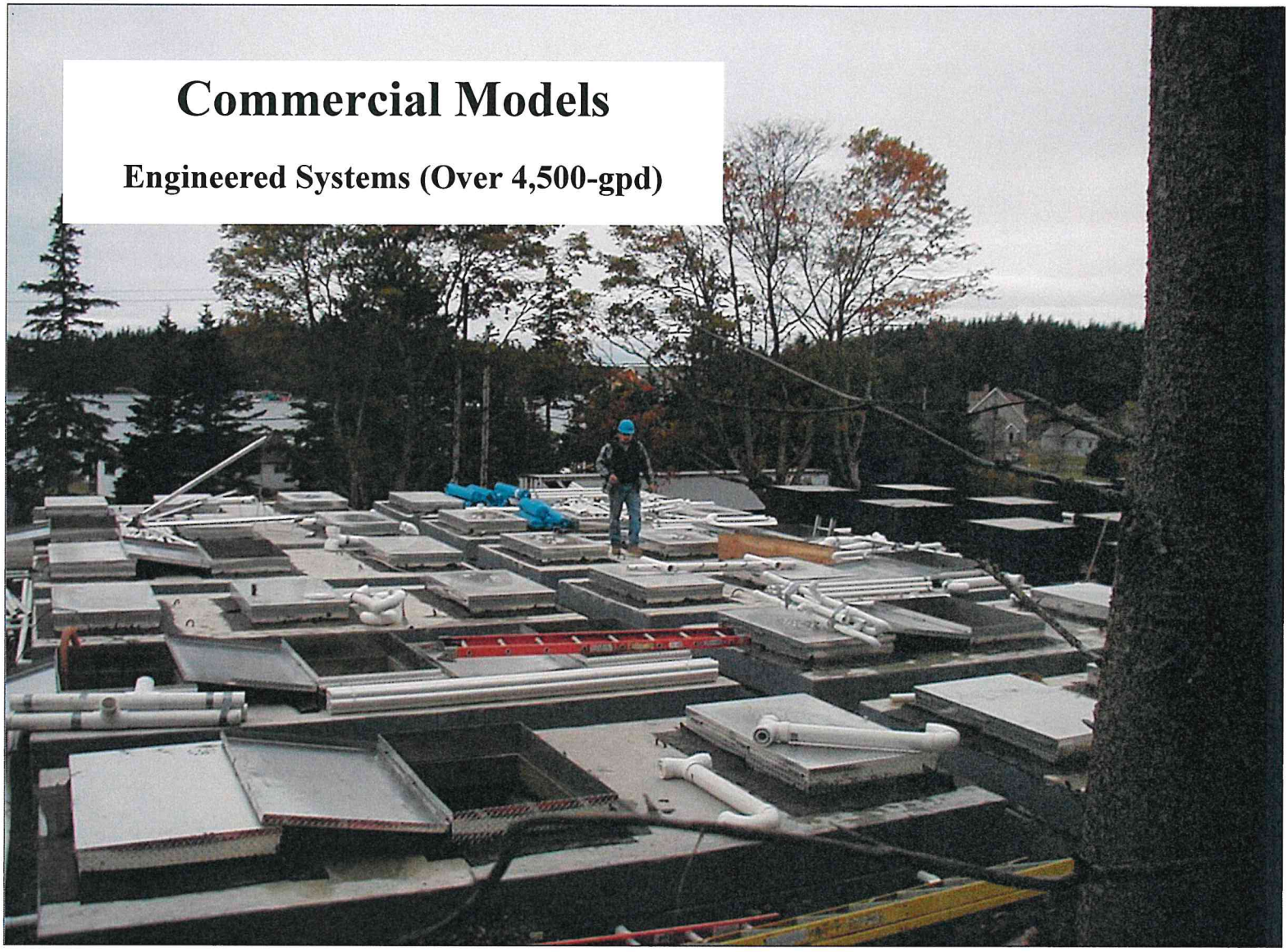
[2] SeptiTech Denitrification systems. Denite systems also require special septic tank(s), sized per SeptiTech specification.

[3] Tank dimensions vary from region to region. Please contact SeptiTech or your distributor for dimensions in your area.

[4] Higher head pump(s) available upon request

Commercial Models

Engineered Systems (Over 4,500-gpd)



- **In-house engineering design team**
- **Experience with high-strength and difficult wastewater flows**
- **Field supervised installation**
- **Controller flexibility to provide customized treatment**
- **Autodial & modem for remote monitoring and control**
- **Ultraviolet (UV) and denitrification models available**
- **Low profile for maximum site flexibility**
- **Built-in discharge pump eliminates need for pump station**
- **Experience with systems up to 76,000-gpd**
- **Modular design maximizes system flexibility**

Installation Manual
SeptiTech® Residential System CONCRETE TANK
Equipment and Components
Rev 10-1-2015

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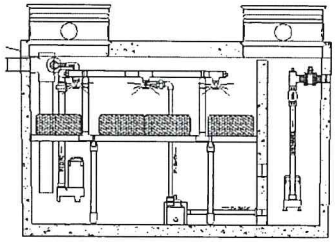
System Components Supplied by SeptiTech

1. SeptiTech Processor (M400, M550, M750) in concrete tank with pre-installed equipment.

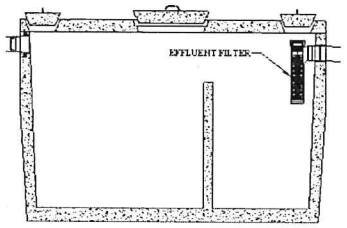


2. NEMA 4X rated Controller with built-in alarm functions and wiring diagram for licensed electrician to install and connect.

3. Pump-back "Tee" (4" x 4" x 2") with 1-1/2" bushing for Schedule 40 pipe.

4. Air Intake

5. Two-compartment (2/3-1/3) Septic Tank (when called for in contract. Otherwise supplied by contractor).



System Components Supplied by Contractor

Piping

a. 4-inch, Schedule 40 PVC for inlet piping and connection between Septic Tank and Processor.

b. 2-inch, Schedule 40 PVC for airlines, piping and fittings,

c. 1-1/2" Schedule 40 PVC for pump-back line. (Also acceptable is 160/200 psi PE with appropriate fittings

d. 2" Schedule 40 PVC for pump-back line. (Also acceptable is 160/200 psi PE with appropriate fittings

Electrical

a. Wire: #14 AWG minimum, THHN, THWN or TFFN (per Code)

b. 1-inch PVC electrical conduit

c. Two (2) 110-volt circuits, one (1) 15-amp and one (1) 20-amp for most applications. (A 220-volt circuit may be required for systems that require a large discharge pump).

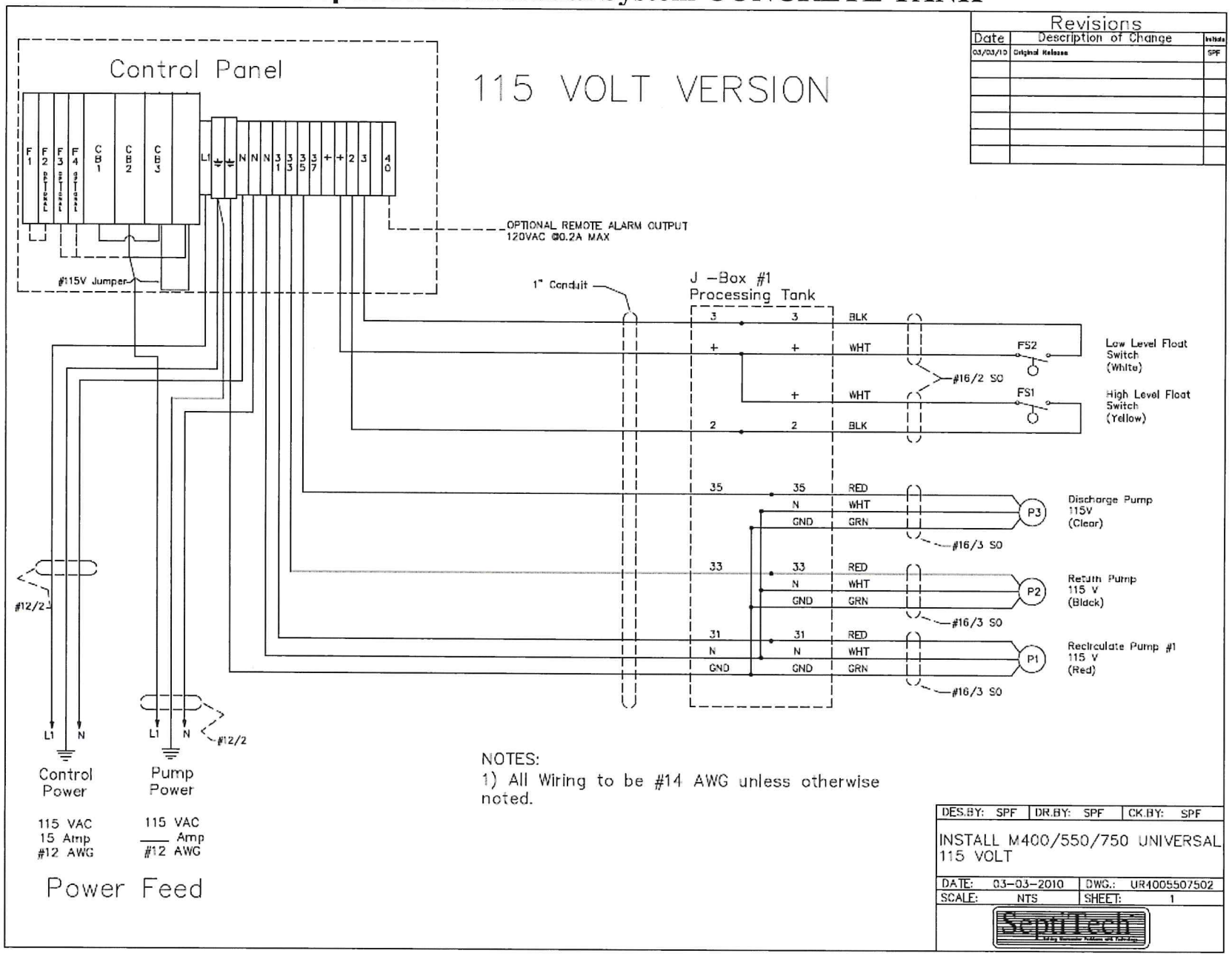
Stone, Fill, Loam, Seed etc.

Important Notes

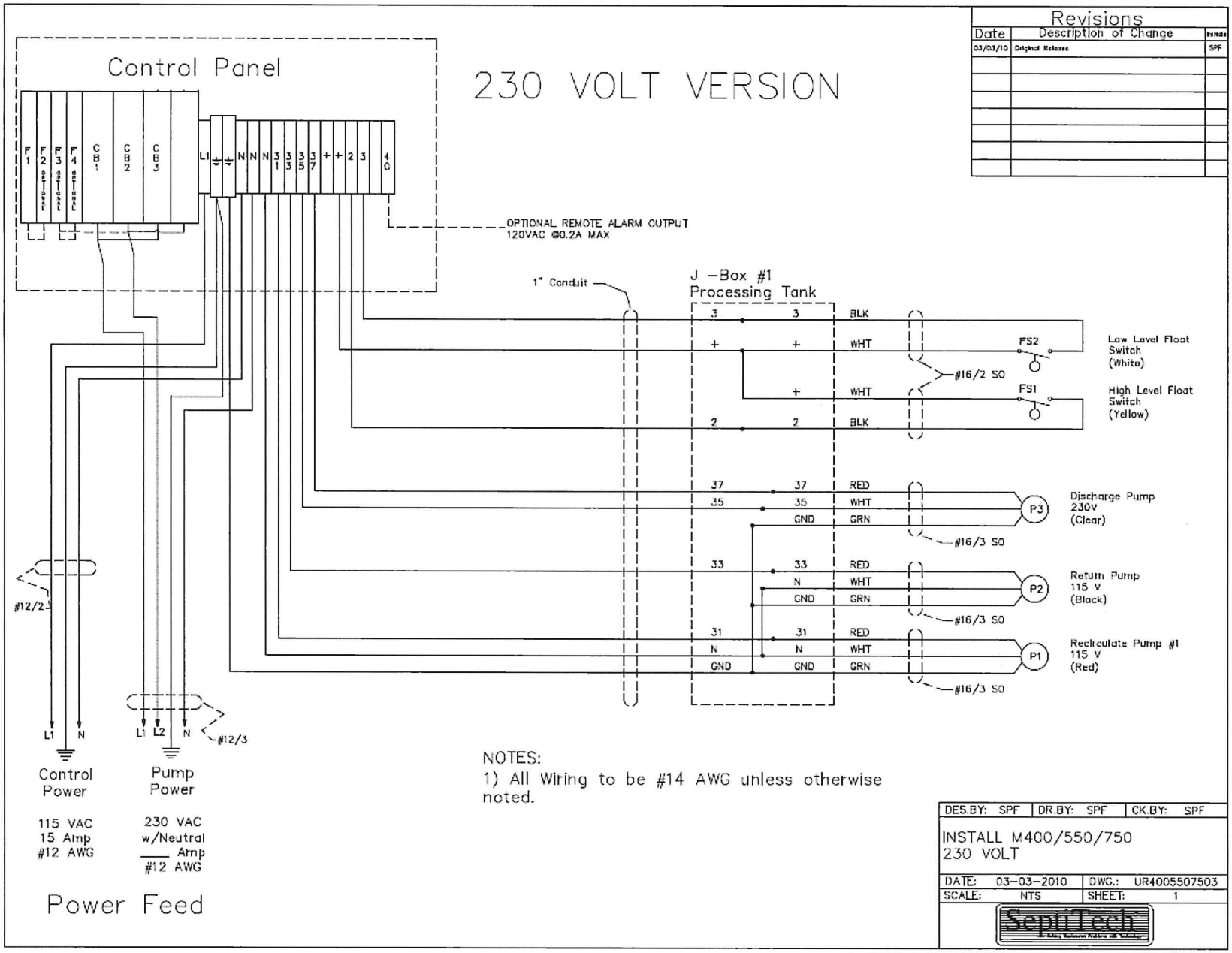
A. SeptiTech is not responsible for design or installation of disposal field.

B. Where saturated soil or high seasonal high water tables are indicated between the bottom of the tank and the ground surface, immediately fill tanks to levels specified on Page 9.

Installation Manual
SeptiTech Residential System CONCRETE TANK



Installation Manual
SeptiTech Residential System CONCRETE TANK
Wiring Schematics – 230 Volt Install



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Installation Manual
SeptiTech Residential System CONCRETE TANK
Off-loading and Unpacking

Offloading and Pre-Installation Procedures

1. Inspect tank(s) for any damage during transportation.

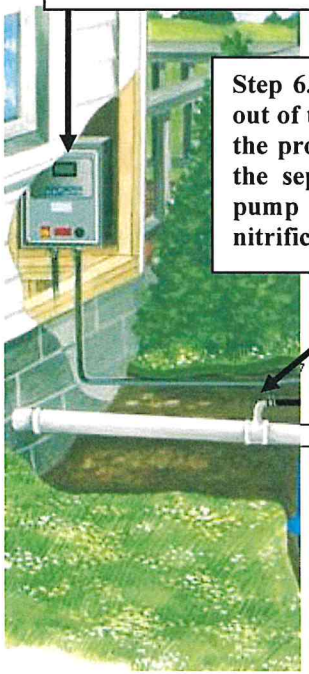
2. Remove SeptiTech Processor access lids to be sure there is no obvious internal damage. (eg. broken PVC piping). Re-secure lids.

3. Set SeptiTech Processor as level as possible. (Maintain adequate pitch between septic tank outlet and SeptiTech Processor inlet invert – a minimum of ¼" pitch per foot).

4. Secure the Controller, Air Intake Pipe and Pump-back "Tee" in a safe, protected area until build-out and installation.

Installation Manual
SeptiTech Residential System CONCRETE TANK
Process Overview

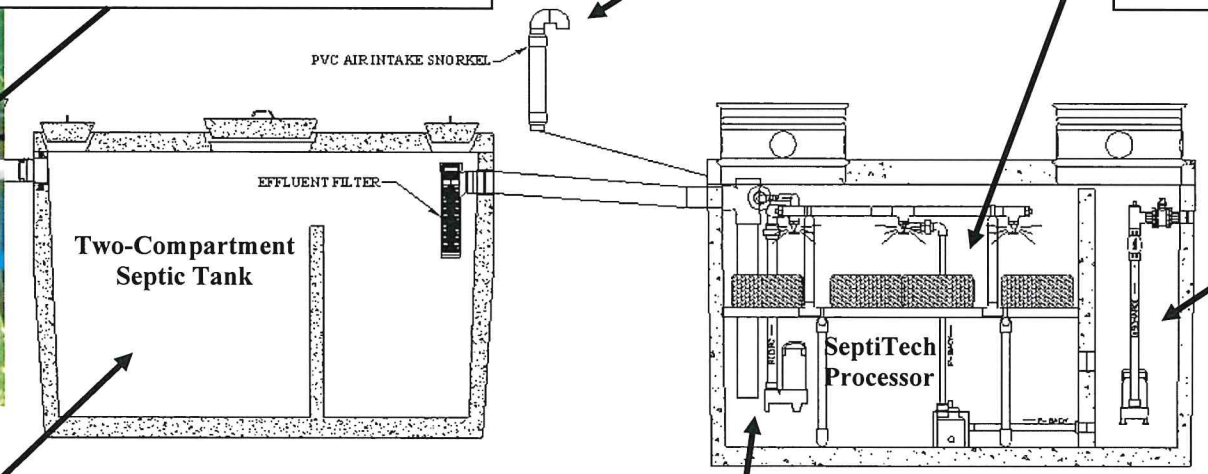
Step 3. When enough water enters the Processor, a float activates the treatment process, all phases of which are governed by the Programmable Logic Controller.



Step 6. Dead microbes and flock are washed out of the media pillows and into the bottom of the processor where they are pumped back to the septic tank via a Pumpback Tee. This pump back process also assists with the de-nitrification process

Step 5. Microbes also require oxygen to live, and fresh air from the outside is drawn in during the recirculation process through the Air Intake Snorkel.

Step 4. During trickling filter processing, wastewater is repeatedly sprayed over and trickles through the "filter media," which offers an ideal living environment for millions of colonies of nutrient consuming microbes to grow, reproduce and consume waste. In cooler climates (see page 13), the Processor is insulated to help maintain processor heat, which is conducive to efficient microbe growth.



Typical 2-Compartment Septic Tank (Provided by Others)

SeptiTech M400 Processor

Step 7. After treatment by microorganisms in the media, the clean effluent flows to a decant chamber where it is pumped to the leach field in frequent and measured doses to maximize the absorptive surface area in the leach field

Step 1. Wastewater flows from the house to the 2-compartment Septic Tank. Solids settle. Grease floats. Anaerobic (without oxygen) decomposition begins.

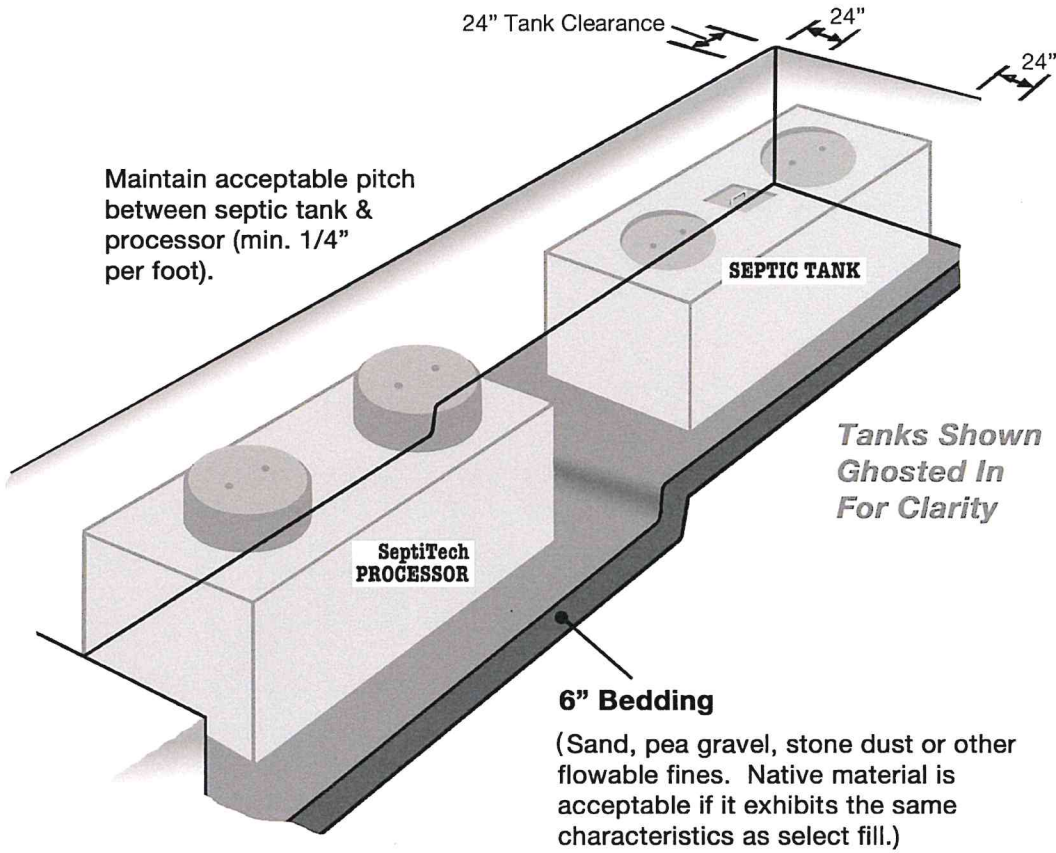
Step 2. Liquid effluent from the septic tank then flows to the SeptiTech Processor where it mixes with a treated water reservoir in the base of the tank.

Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Requirements

Access Ports on SeptiTech Processor	Must be no more than 24" from lid to top of tank. (This is necessary for service access).
Piping and Fittings	Schedule 40 or Schedule 80 PVC, or 160/200 psi PE hose are all acceptable
Electric Power	For most residential applications, two (2) 110-volt circuits, (one 15-amp for the controller/alarm and one 20-amp for the pumps are required. Larger discharge pumps may require one 220-volt, 20-amp circuit)
Electrical (Other)	Wire size: #14 AWG minimum. Wire type: THHN, THWN or TFFN. Wire Conduit: 1" PVC (All electrical work to comply with local and National code)
Ventilation	If Septic Tank is fed via pump station, or for some reason tanks cannot vent freely up house vent pipe, a separate air vent in septic tank must be installed.
Air Intake Protection	The air intake assembly must be at least 36" above grade.
Bedding	Tanks must be bedded in 6-inch bedding consisting of sand, pea gravel, stone dust or other flowable fines. Native material is acceptable if it exhibits the same characteristics as select fill.
Slope	Tanks must be installed in a level position with final grade sloped away from access ports to divert water.
Start-Up	SeptiTech system start-up must be completed or overseen by SeptiTech certified personnel.

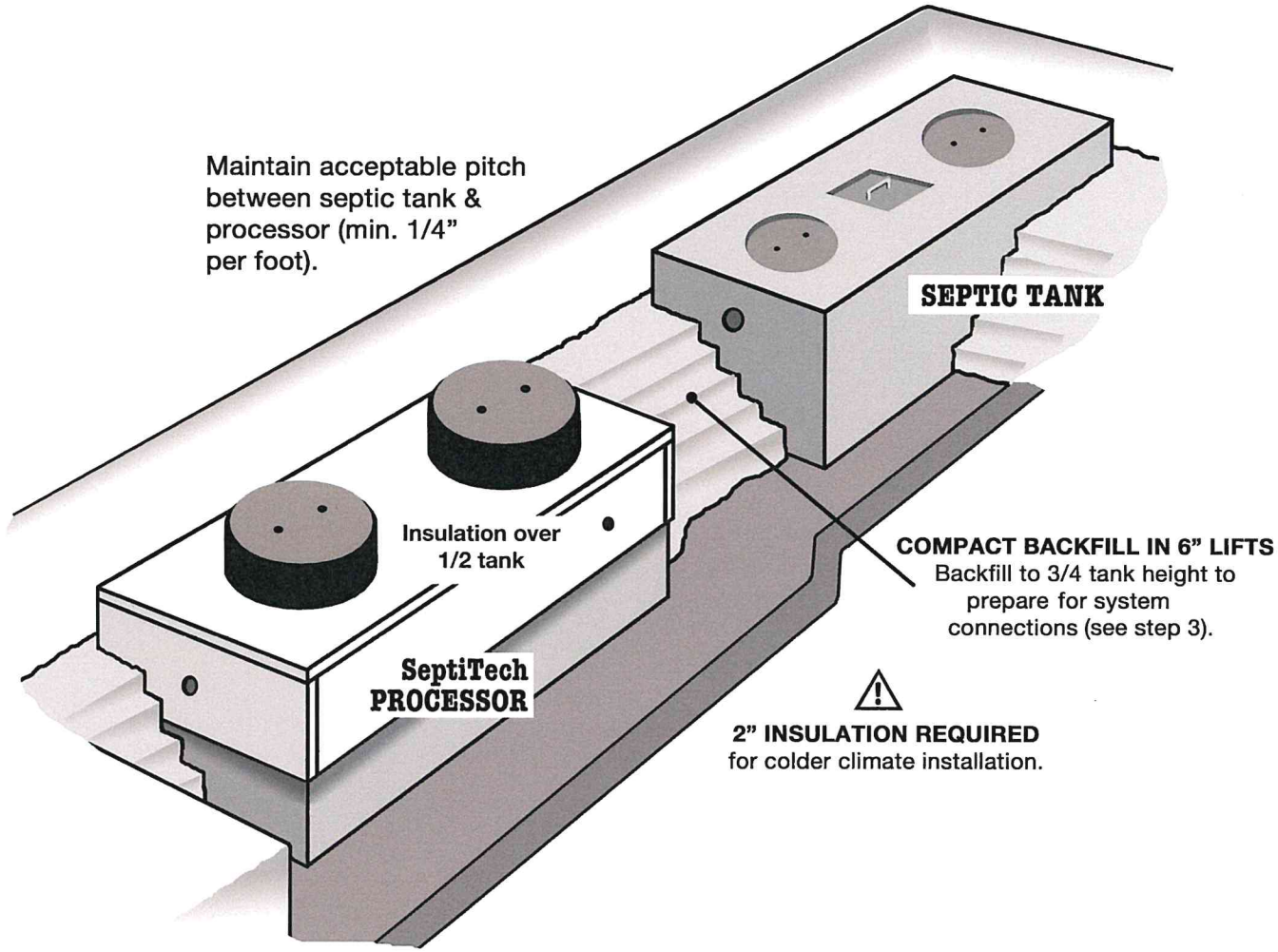
Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Procedure – Step 1. Site Preparation

- Identify and mark tank excavation location. The excavation should be sized with at least 24 inches around tanks and 6 inches below tank to allow for proper backfilling.
- Step Processor tank down to achieve required pitch.
- Installer shall comply with all federal, state and local regulations.
- Standard tanks are not rated for vehicular traffic, unless an H-20 rated tank is specifically ordered.
- Verify no underground utilities or pipes are located in the elevation vicinity.



Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Procedure – Step 2. Set and Partially Backfill Tanks

- Ensure both Septic Tank and Processor Tank are level.
- Following backfill, fill SeptiTech Processor tank with clean water to level just below the PVC platform (about 1/3 full). Fill Septic Tank to outlet invert.
- In high groundwater areas, fill both tanks immediately to levels specified above.

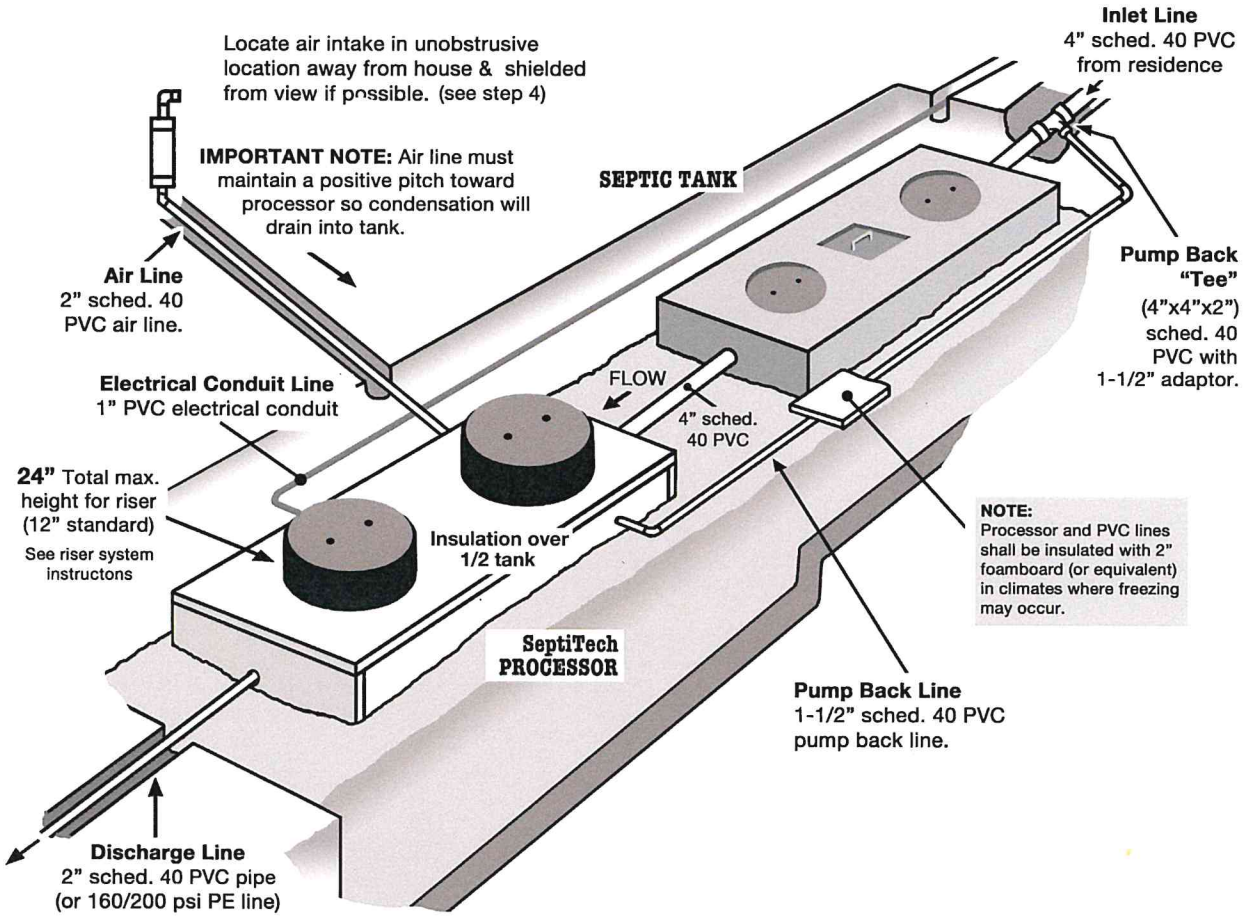


Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Procedure—Step 3, Make System Connections

- **Important Note**: If Septic Tank is fed via pump station, or for some reason tanks cannot vent freely up house ventpipe, install a separate vent in septic tank or septic tank inlet line.

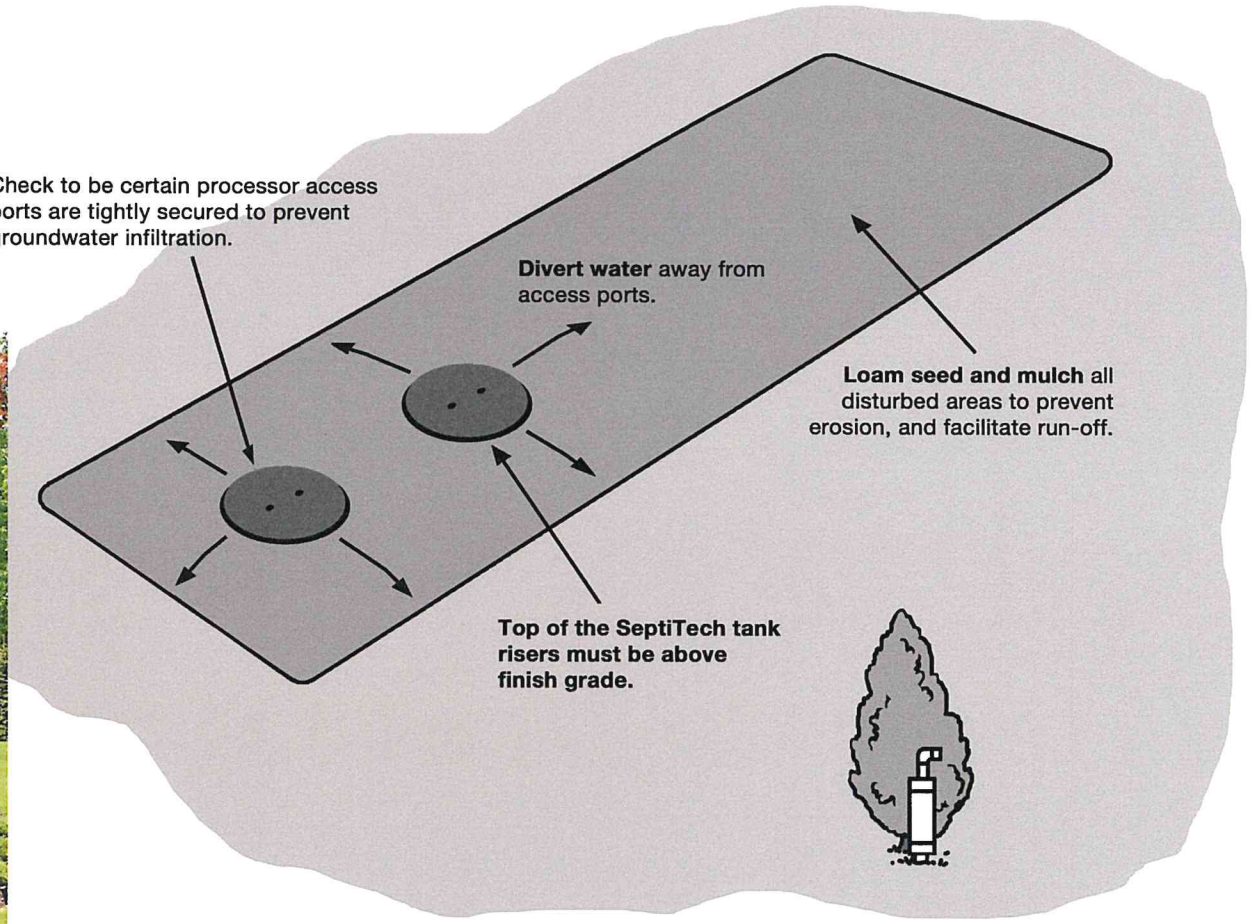
- Compact soil beneath all exterior piping for support.

- Mount Controller in protected heated area (maintain operational temp minimum of 50˚) or contact SeptiTech for installation of panel heater. (Panel is NEMA 4X rated for outdoor mounting if necessary).



Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Procedure—Step 4, Final Site Preparation

- Please contact your SeptiTech representative for final testing and start-up.
- Be certain clean water is in tanks and Controller is mounted and wired.



Installation Manual
SeptiTech Residential System CONCRETE TANK
Installation Procedure—
SeptiTech Processor Cold Weather Installation Recommendations, cont.

1. The SeptiTech processor depends on the activity of bacteria in order to effectively treat the wastewater. Temperature has an affect on this activity in that colder temperatures will slow the bacterial growth and thus the efficiency of the treatment process. Therefore, it is recommended that in cold weather regions that the SeptiTech processor tank be insulated using 2-inch thick rigid foam board insulation (R-21 insulating factor) across the top of the tank, within the access hatches (is applicable), and halfway down the sides of the tank. This will help to capture as much heat as possible from the processor in order to maximize bacteria activity.

2. The SeptiTech processor uses multiple pumps in order to accomplish various tasks. Therefore, there are several external pipes to the system that have the potential for freezing in cold weather climates. These pipes include the following:

   - Solids pump-back pipe from the processor back to the head of the primary septic tank
   - Discharge pipe from the processor out to the disposal field
   - Denite recycle pipe (if applicable) from the processor to the head of the primary septic tank.

   In order to aid in the prevention of freezing of these pipes, SeptiTech recommends the following:

   - Install the piping below frost level (typically 4-feet minimum) in order to get the pipe out of the freezing zone of the earth.
   - Backfill the pipe with proper fill material (crushed stone or select compact fill).

   Figure 1 (page 14) shows a typical pipe trench installation detail for forcemains that should be followed for cold weather climate installations:

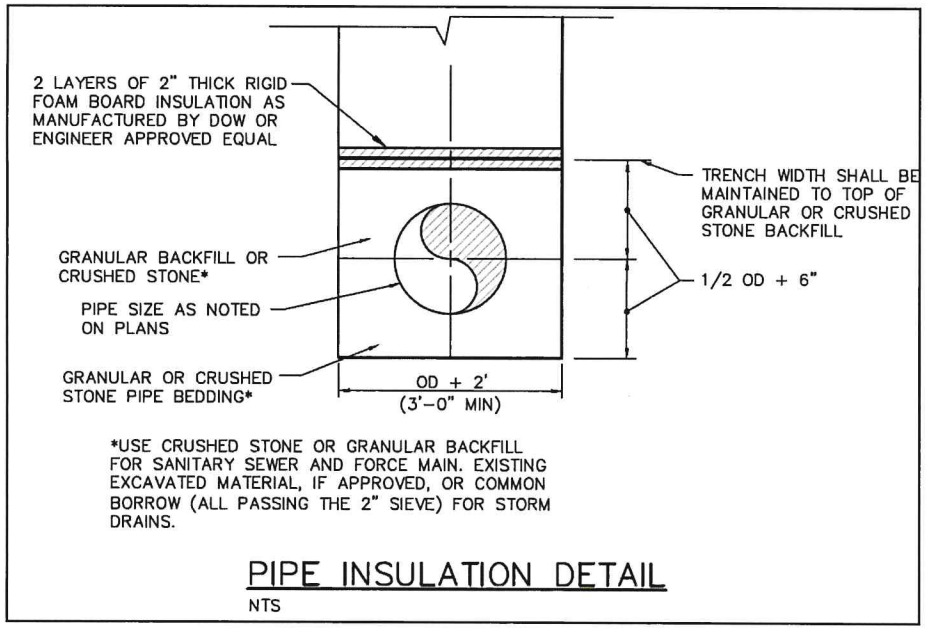
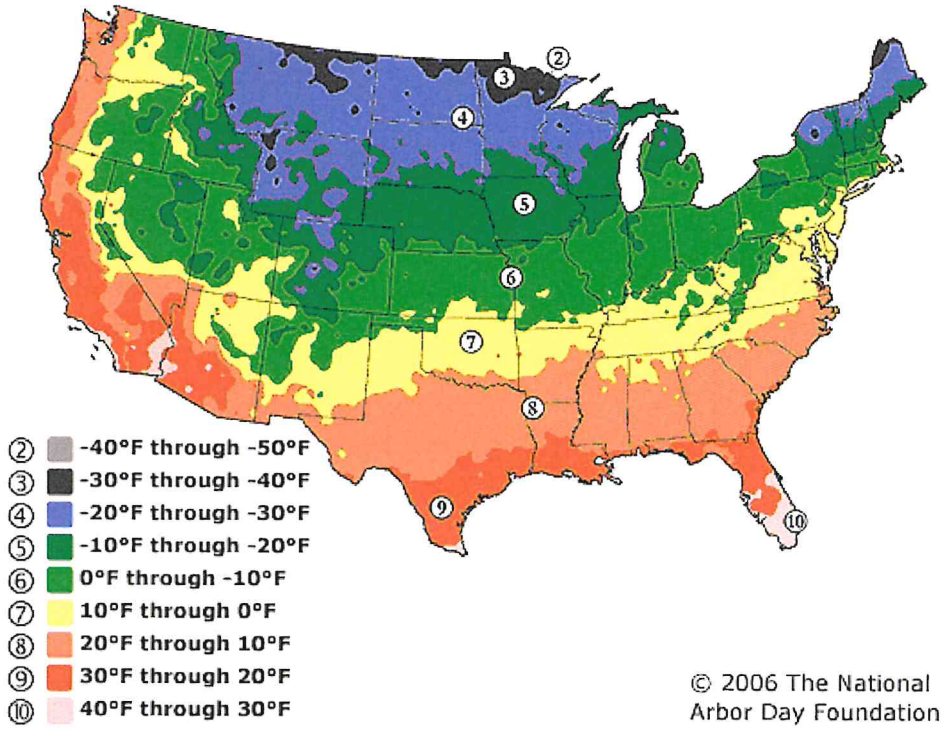


Figure 1: Typical Force Main Installation Detail



3. **Cold Weather Climate:** SeptiTech recommends following the USDA Plant Hardiness Zone Map as an indication of "cold weather climates". Installation of the SeptiTech processors within USDA Zones 3-6 should be considered "cold climates". A sample map of the USDA Zones from the National Arbor Day Foundation is provided below. Further information can be obtained at www.usna.usda.gov/Hardzone/ushzmap.html

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Operation and Maintenance Manual

SeptiTech Wastewater Pretreatment System

Residential Processor Units

M400 / M550 / M750

Revised: 9-8-14

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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 or plastic 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. In addition, SeptiTech offers the option of a complete telemetry package, which includes telemetry, that will activate and call the SeptiTech on-call service department whenever there is an alarm. The telemetry package also allows for SeptiTech service personnel to remotely connect to the treatment system in order to diagnose the problem.

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 residential models are based on the number of bedrooms of the home that the treatment system is to be installed on. The table below shows the capacities of each system.

Table 1: SeptiTech Processor Treatment Capacities

Processor Model	Bedrooms
M400	4
M550	6
M750	8

The SeptiTech processor model that should be used depends on several factors:

- Hydraulic loading (number of bedrooms, state codes)
- 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.

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. 2 times per day, a portion of the wastewater off of the bottom of the tank within the reservoir is pumped back to the septic tank for solids removal. Nitrification of the ammonium in the wastewater occurs in the liquor as it passes through the media, and denitrification of the nitrified wastewater takes place within the septic tank (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 recycle 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 below:

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; and
- 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 previously 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 is circulated through the filter media many 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 across the venturi. This pressure drop draws air into the system through an outside air supply pipe that sticks up above the ground surface.

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).

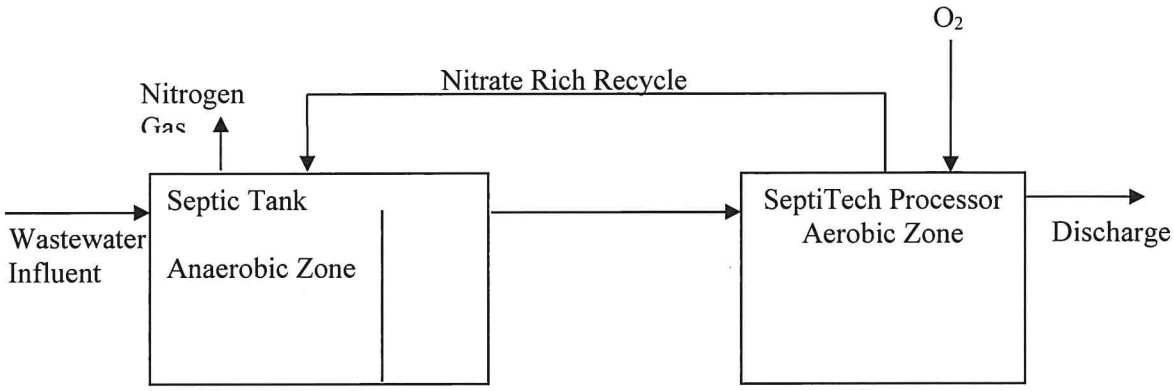
SeptiTech processors are sized based on the number of bedrooms with additional capacity to accommodate wastewater surges (morning and evening flows, special events, etc). Under surge conditions, the PLC senses the increased flow into the system and adjusts the treatment process to gradually accommodate 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 the solids pump-back pump is utilized to recycle nitrified wastewater from the processor tank back to the septic tank. There must be a baffle wall installed within the septic tank. 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 submersible pump is installed in order to discharge the treated wastewater out of the processor tank. The pump is sized in accordance with the pump operating requirements that are specific to each job. 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 if the telemetry package option is used. Similar to standard pump stations, there are float switches (see section 6.7) 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 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 (every 2-5 years).

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.

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 front of the control panel
- Activation of alarm light located on the front of the the control panel
- Activation of *optional* Telemetry, which will notify pre-programmed contacts and report that an alarm condition has occurred for the SeptiTech treatment system.

When there is an alarm condition, a fault flash code utilizing the red reset button on the front of the panel enclosure is activated. When there is an alarm, the control panel will signal the fault through an audible horn and through a red light. In order to silence the alarm, the owner/operator must push the reset button. This will silence the horn and start the flash code sequence. The owner/operator must count the number of times the red reset button flashes. There will be a delay at the beginning of each flashing sequence. For example, a low float fault will have 2 flashes. The reset button will flash twice, pause, flash twice, pause, etc.

The flash code will continue to flash for 24-hours. If the fault condition is still true at the end of the 24-hour period, the alarm will sound again and the owner/operator will have to push the reset button to silence. If the fault condition is no longer true, the flashing light will stop.

The flash codes and the associated fault condition are listed below:

Fault Flash Codes

0 - NO FAULTS
1 - HIGH FLOAT FAULT
2 - LOW FLOAT FAULT
3 - DISCHARGE PUMP FAULT
4 - RECIRCULATION PUMP FAULT
5 - RETURN PUMP FAULT (Pump Back / Denite Recycle)
6 - UV FAULT

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

6. System Components

6.1. Concrete Tank

SeptiTech residential processors come housed within a precast concrete tank or within a plastic 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*
M400	1,000 Gallons
M550	1,250-1,500 Gallons**
M750	1,500 Gallons

** Tank capacities and dimensions may vary depending on precast concrete provider.*
***Tank capacity of 1,250 or 1,500 gallons depends on availability from precaster.*

All tanks come equipped with two (2) 24-inch diameter plastic access hatches that are rated for pedestrian loading. Figure 2 below displays the plastic hatches typically used.

Figure 2: Typical Plastic Access Hatch
Picture courtesy of www.fralo.net

Heavy duty traffic loading (H20) is also available in which case 24-inch diameter steel frames and manhole covers are used. The 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. Plastic Tanks

In addition to concrete tanks, Septitech residential processors can also be installed within plastic septic tanks. FRALO, Infiltrator, Graf, etc. can be used as SeptiTech processors. The size and capacities of the plastic tanks used are listed in Table 3, and Figure 3 displays a typical FRALO tank.

Table 3: SeptiTech Plastic Tank Information

SeptiTech Model	Plastic Tank Capacity*	Plastic Tank Dimensions*
M400	1,000 Gallons	118" L x 62" W x 51" H
M550	1,250 Gallons	148" L x 62" W x 51" H
M750	1,500 Gallons	177" L x 62" W x 51" H

** Tank capacities and dimensions may vary depending on manufacturer.*

Figure 3: Typical Fralo Plastic Tank
Picture courtesy of www.fralo.net

All tanks come equipped with two (2) 24-inch diameter plastic access hatches that are rated for pedestrian loading. Plastic tanks can only be used for non traffic areas, and H20 loading design is not available.

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.

6.3. Piping & Fittings

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

6.4. Media

The treatment processor contains polystyrene bead filter media that occupy the upper portion of the treatment unit. Due to the 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 4: SeptiTech Bead Media

6.5. Disinfection (Optional)

SeptiTech provides the option of disinfection with the pretreatment systems using Ultraviolet (UV) light to disinfect the wastewater. The processor discharge pump conveys the treated wastewater through the disinfection unit. The rated flow rate of the UV disinfection unit is 10 gpm. The UV disinfection unit that SeptiTech uses is a system manufactured by Emperor Aquatics model 025050/50 which is rated for 25 gpm @ 20 psi. (www.emperoraquatics.com)

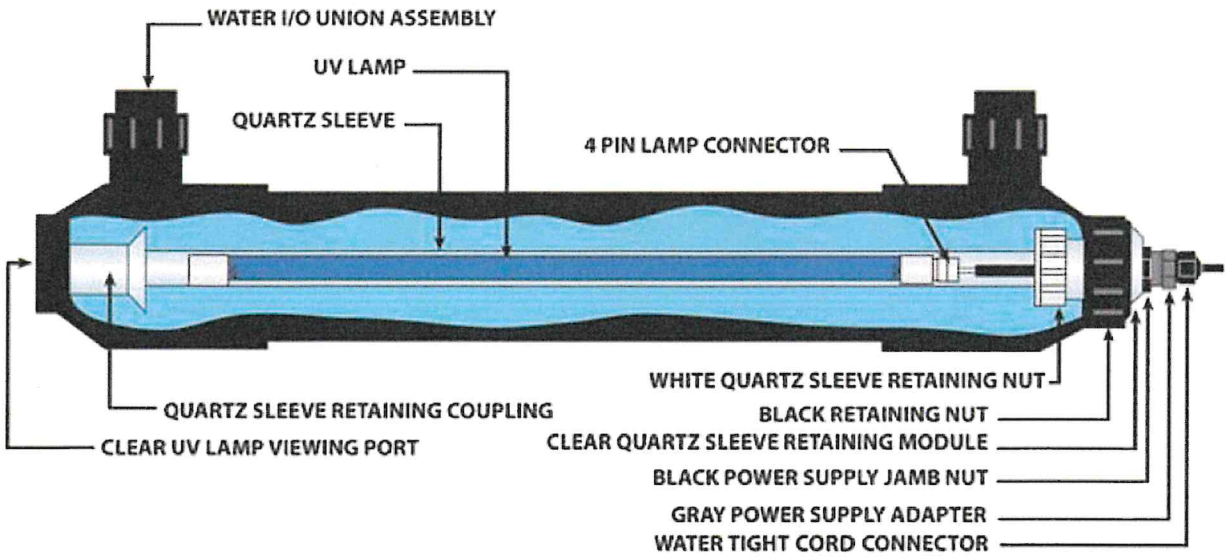


Figure 5: Emperor Aquatics UV Disinfection Unit

6.6. Pumps

SeptiTech has several pumps within the processors each with a specific function in order to provide the treatment performance required. 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
- **Discharge** – Submersible pump that discharges treated water from the processor to the disposal system.

The pump manufacturers that SeptiTech uses are Tsurumi America, Inc. and ITT Goulds/Xylem. 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.

Figure 6: Tsurumi VANCS Series Submersible Pump (Typical)
Picture courtesy of www.tsurumiamerica.com

Figure 7: GOULDS Series Submersible Pump
Picture courtesy of www.goulds.com

Table 4 lists the model numbers of the ***standard*** pumps that SeptiTech uses for each of the above processes for each SeptiTech model.

Table 4: SeptiTech Standard Pumps (Rev. 8/23/13)

Processor	SeptiTech Standard Pump Models			
	Recirculation Pump	**Pump-Back Pump**	**Discharge Pump**	
M400	Tsurumi OM3	Goulds LSP03	Goulds LSP03	
M550	Tsurumi 50PN2.25S	Goulds LSP03	Goulds LSP03	
M750	Tsurumi 50PN2.40S	Goulds LSP03	Goulds LSP03	

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 120/230 volt arrangements.

6.7. 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 Industries (www.alderonind.com).

Figure 8: Typical Mechanical Float

7. Alarms and Troubleshooting

The following table outlines SeptiTech alarm conditions and the associated reasons that could have caused the alarm to be generated.

Table 5: Alarm Descriptions and Troubleshooting

Alarm	Description	Problem	Solution
High Float Alarm	High Float stayed on for 7200 seconds (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
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
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 doesn't 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 (3-5 Years) and the effluent filter cleaned yearly (if installed), the SeptiTech processor is not to be pumped as the Sludge return loop eliminates the need for pumping. An annual inspection of the SeptiTech Processor is suggested.

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 Gould 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. Access Lids.

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

7.1.7. Can I drive over my system?

- No! Not unless you specifically specify and install an H-20 rated system. This is a special order from SeptiTech.

7.1.8. 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 and have the effluent filter (if installed) cleaned yearly. 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 don't 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 don't 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. Press the re-set button to silence the alarm and call your local SeptiTech distributor for service.

7.1.9. System Operation Information

a. 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

Some States and regions require an advanced treatment system owner to enter into an O&M agreement with a certified maintenance provider. Inspection frequency and coverage detail will vary according to State or regional regulation. The following represents an example of a typical SeptiTech O&M Agreement between a customer and a SeptiTech authorized service provider.

Agreement for Operating and Maintenance (O&M) Services For SeptiTech On-Site Wastewater Treatment System

Agreement is made on *(date)* _____ between:

(Client) *and (Authorized Service Provider)*

Name _____ **Name of Service Provider**

Address _____ **Address of Service Provider**

City, State, Zip _____ **Address of Service Provider**

1. For the duration of this contract beginning (date) _____ and concluding *(date)* _____(1 year), the Service Provider shall operate and maintain the SeptiTech wastewater treatment system installed at (site) _____, in accordance with conditions imposed by

SeptiTech and _____ *(name of regulatory agency with system oversight).*

2. Sample of discharge effluent if required as a result of visual inspection and field measurements as follows: *(examples):*

    a. Carbonaceous Biochemical Oxygen Demand ($CBOD_5$):
    b. Total Suspended Solids (TSS):
    c. Nitrogen/Ammonia:
    d. Fecal Coliform:
    e. Dissolved Oxygen:

3. Service Provider agrees to submit annually to the Owner, a report including an operation and maintenance summary and analysis of water quality sampling, if required.

4. Service Provider shall perform on a regularly scheduled quarterly service inspection the following maintenance procedures:

SeptiTech Service Check Sheet

Date: _____ Time: _____ Rep: _____

Remove lids & covers on processor. Visually inspect media & spray pattern. _____ (Initial)

Exercise entire system in maintenance mode. _____ (Initial)
- a. Recirculation pump(s)
- b. Pumpback pump(s)
- c. Discharge pump(s)

Perform maintenance/cleaning tasks, as necessary, based on visual inspection. _____ (Initial)
- a. Spray headers
- b. Media
- c. Screen

Take effluent sample from decant chamber _____ (Initial)

Record following values from controller read-out (Discharge Pump) _____ (Initial)
Days Runtime: _____
Hours Runtime: _____
Seconds Runtime: _____

Record controller program version: _____ _____ (Initial)

Record: pH_____Units DO_____mg/l Turbidity_____NTU _____ (Initial)

List parts and supplies used: _____

_____ _____ (Initial)

Return system to "run" mode _____ (Initial)

Re-install covers and lids on processor. _____ (Initial)

Check air intake muffler for obstruction and proper draw. _____ (Initial)

General Notes and Remarks: _____

_____

_____

_____ (over)

5. Owner agrees to immediately notify SeptiTech in the event of a system failure, alarm event or malfunction. SeptiTech agrees to take immediate corrective action to remedy the situation.

9. Sampling Protocol

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

9.1. 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:

9.1.1. 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 analytes 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.

9.1.2. 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 analytes as shown in the Sample and Preservation Holding Time Table on Page 24.

9.1.3. 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.

9.2. UV Systems

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

a. Pre-UV sampling will follow the sampling protocol listed 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 shall 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.

9.2.1. 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 analytes 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

9.2.2. 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 analytes as shown in the Sample and Preservation Holding Time Table.

9.2.3. 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.

10. 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.

SeptiTech®

a subsidiary of Bio-Microbics, Inc.

Operation and Maintenance Manual

SeptiTech Wastewater Pretreatment System

Commercial Processor Units

M1200 / M1500 / M2500 / M3000

Updated: 9-8-14

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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
M1200	2,000 gal	1,200 gpd
M1500	4,000 gal	1,500 gpd
M2500	6,000 gal	3000 gpd
M3000	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.

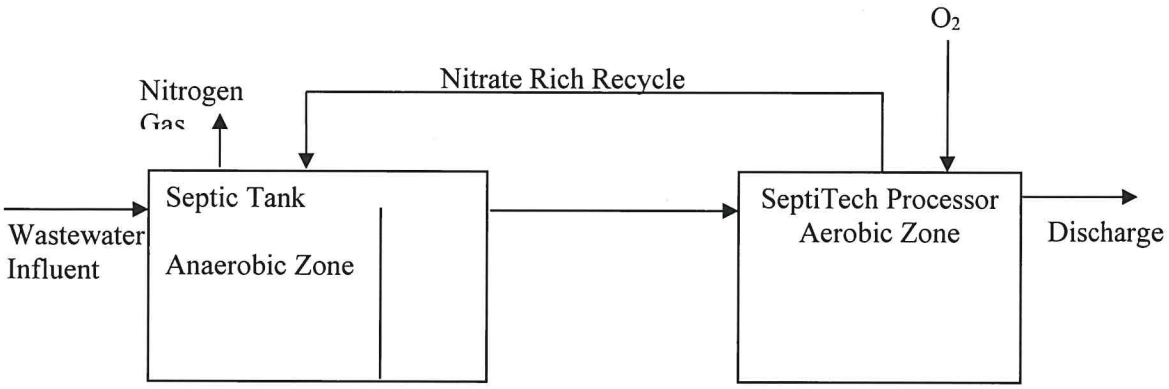
3.2. Denite Mix Loop (Optional Configuration)

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*
M1200	2,000 Gallons
M1500	4,000 Gallons
M2500	6,000 Gallons
M3000	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.

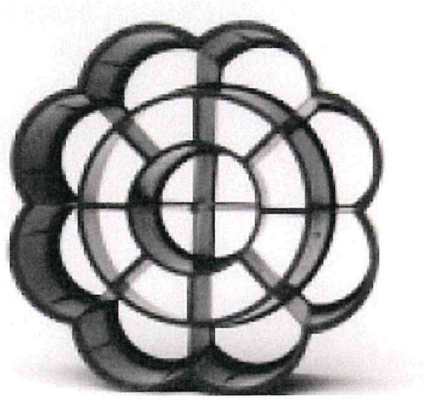


Figure 2: SeptiTech Plastic Media
Picture courtesy of www.jaeger.com

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.

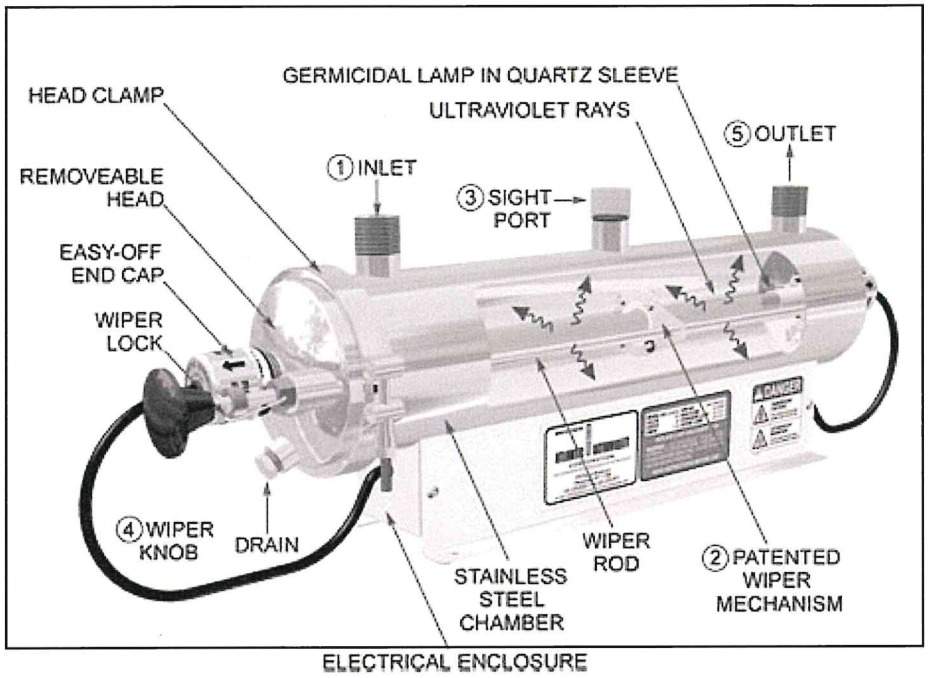


Figure 4: Sanitron Ultraviolet Water Purifier
Picture courtesy of www.ultraviolet.com

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**
M1200	50PN2.4S	OM3		OM3
M1500	50PN2.75S	OM3		OM3
M2500	(2)50PN2.4S	OM3		OM3

M3000	(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).

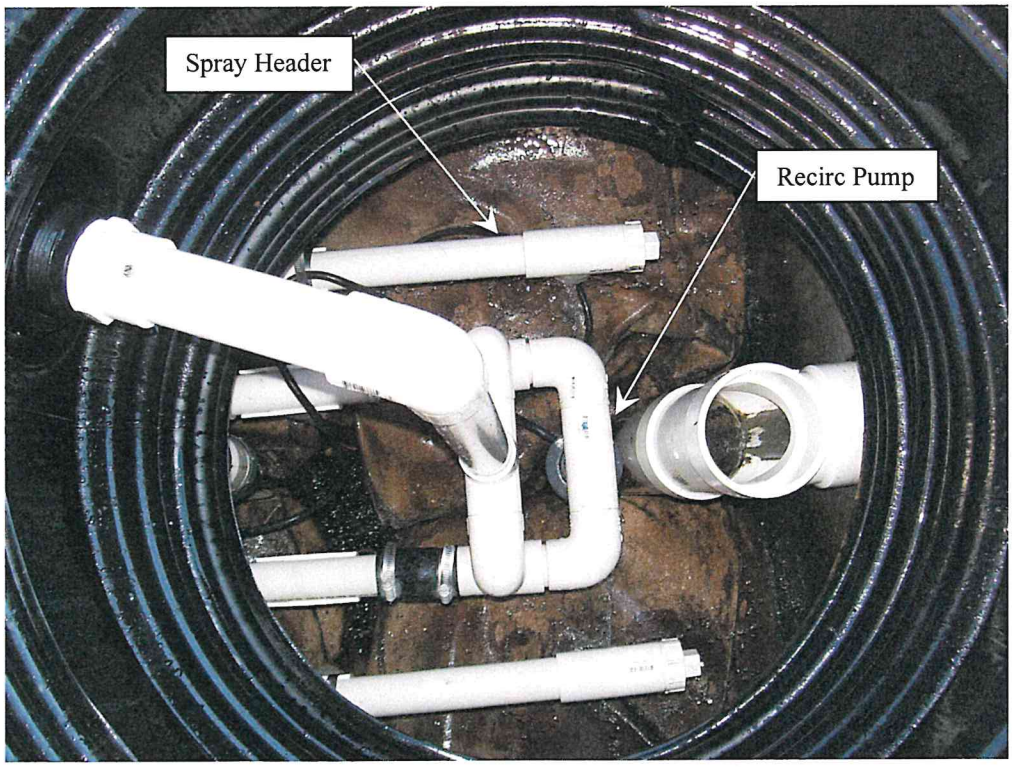


Figure 7: Recirculation Pump & Spray Header

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.

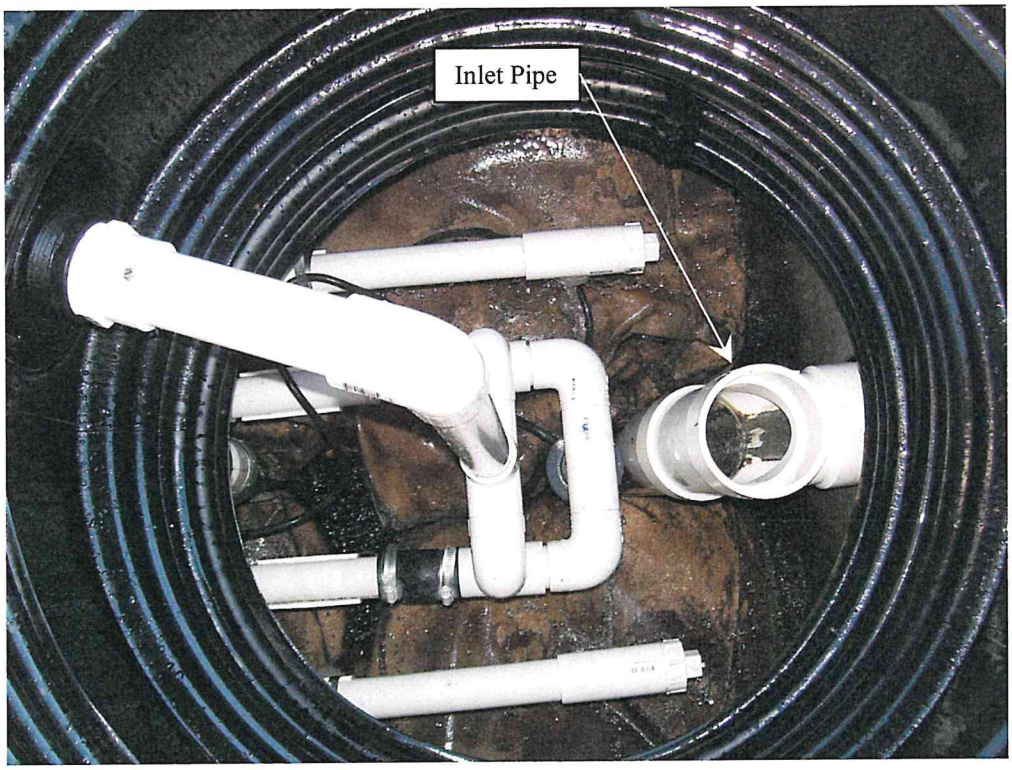


Figure 10: Processor Inlet Pipe

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.

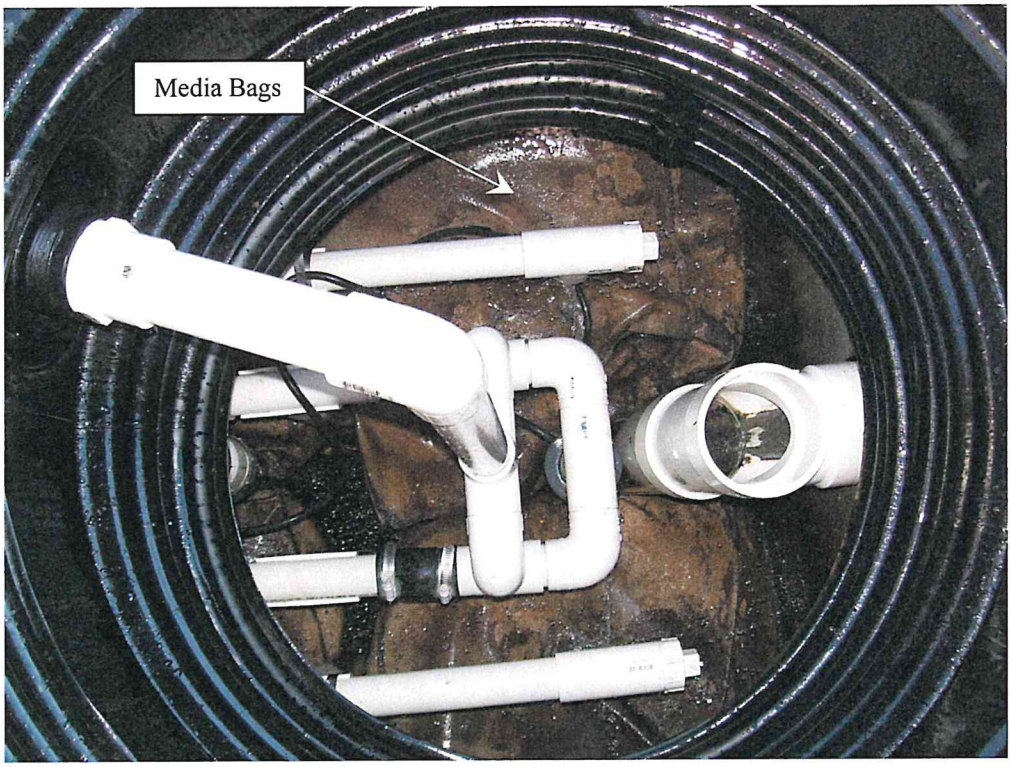


Figure 12: Media Bags

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.

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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.