SeptiTech®
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# System Startup Manual

## SeptiTech Wastewater Pretreatment System Models:

**STAAR 0.5 / STAAR 0.5D**
**STAAR 0.75 / STAAR 0.75D**
**STAAR 1.0 / STAAR 1.0D**
**STAAR 1.2 / STAAR 1.2D**
**STAAR 1.5 / STAAR 1.5D**
**STAAR 3.0 / STAAR 3.0D**
**STAAR 4.5 / STAAR 4.5D**

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**Startup Manual**
**SeptiTech Residential Wastewater Treatment Systems**
**Conventional and Denitrification Units**

## 1. Introduction

This document provides detailed instruction for startup of a SeptiTech Residential Treatment Unit. It is intended for use by certified SeptiTech treatment system operators and others SeptiTech representatives that have experience with operation and maintenance of on-site wastewater treatment systems.

## 2. System Startup Procedures

Proper startup of a SeptiTech residential treatment system is a straight forward process, yet very important process that:

1. Verifies the system and all electrical and mechanical components have been properly installed and connected
2. Calibrates the system to account for site-specific conditions.
3. Provides baseline-operating information that can be compared to future readings to verify proper operation and/or diagnose specific operating issues.

Startup consists of a series of system checks that proceeds in a step-wise fashion to inspect and adjust the following:

- **Electrical Connections** –ensure that the electrical service to the control panel and between the control panel and processor are properly wired.
- **Physical Installation** –ensure that components have been properly placed and connected
- **Mechanical Operation** –ensure that all pumps, valves, float switches and airways are properly connected and function properly.
- **System Tuning** –calibrate pumps flow and set process control variables for site-specific operating conditions in particular discharge pump flow and anticipated daily flows
- **Final Startup** –putting the system in fully automatic operation and verifying that all system settings have been stored by the PLC and recorded for future reference and observing physical operation of the unit in auto mode.

**IMPORTANT NOTE PRIOR TO STARTUP!!**

The following actions must be completed prior to startup of a SeptiTech treatment unit:

1. Septic tank must be filled.
2. Processor must be filled with clean water so that the water level is at the bottom of the media support pipes.
3. All electrical and mechanical connections have been completed.
4. System has been backfilled and properly graded.
5. The control panel and service panel are accessible and control panel is energized.
6. All hatches are accessible and finished at or slightly above grade with maximum 24 inches from processor tank top to finished grade.
7. Septic tank inlet and outlet hatches are open/accessible for inspection
8. Where required by SeptiTech, all tanks and pump lines are properly insulated.

A **Startup Inspection Checklist** is included in the documentation packet upon delivery of every SeptiTech unit (**see Appendix A**). This checklist must be completely filled out and signed by the startup technician. ***As a condition of activating the system warranty, a copy of the checklist must be provided to SeptiTech within 30 days of startup.***

**Recommended Tools & Equipment**

The following is a list of recommended tools and equipment that all certified SeptiTech representatives that will be performing startup procedures should have on hand.

- Digital Multi-meter
- Ammeter
- Pressure Gauge (4-inch dia –0-30 psi) w/ ¼-inch tubing and threaded insert fitting
- Tape Measure
- Water Level Gauge (see Appendix D)
- Float Hook
- Hatch Opening Tool
- Shovel
- Garden Hose (100-ft min)
- Camera (digital)
- Misc Screwdrivers, Wrenches
- Anemometer
- Stopwatch

## 2.1. Electrical Inspection

Prior to energizing the control panel, all electrical connections within the control panel and in the processor must be checked as follows:

**Control Panel**

- Panel supplied by two separate circuits of appropriate voltage and current rating in accordance with system requirements, which vary depending on size of unit, discharge pump and, if required, UV disinfection unit.
- All terminal screws and push-on connections are tight, including point to point wiring, as some may become loose during transport and installation.
- All wires are properly labeled in accordance with the supplied drawings and connected to the correspondingly numbered terminal block.
- All circuit breakers and fuses are in working order.
- If supplied, heater block is connected to power supply and temperature set to 40-50 F.
- Electrical conduit feeding processor is sealed with appropriate putty/sealant to block airflow/venting of processor into panel.

**Processor Junction Box (J-box)**

- J-box may be mounted inside or outside of access hatch in a manner that will not impair servicing processor in the future.
- All wires are numbered in accordance with the supplied drawings and connected to the corresponding pump/float or other component wires using appropriately sized wire nuts.
- All outgoing wires run through watertight fittings
- Electrical conduit feeding J-box is sealed with appropriate putty/sealant to block airflow/venting of processor into panel.
- Wiring is run from the control panel to the processor in appropriately sized and sealed electrical conduit. ***Warning: Presence of water in J-box is presumed to indicate unsealed conduit and will result in termination of startup until corrected.***
- Sufficient slack wire is available to facilitate removal of pumps and other electrical components for servicing.

## 2.2. Physical Inspection of Installation

Physical inspection of the system includes the following:

**Septic Tank Installation**

- Septic tank is level
- Water level is at outlet invert elevation
- Inlet pipe invert is 3 inches above water level
- Clearance between top of septic tank baffle and tank cover allows air passage
- No visible evidence of settlement around tank
- ***Conventional Units Only*** - Effluent filter is installed and does not obstruct airflow from processor to septic tank inlet

**Processor Installation**

- Processor is level
- Verify connections to septic tank and discharge system (e.g., leach field or surface discharge outlet) are complete
- Processor has been filled with clean water up to the bottom of the media support pipes
- Inlet tee has no standing water and has positive pitch into processor
- Processor is less than 24-inches below grade
- Processor tank has been insulated using rigid 2-inch foam insulation (where applicable)
- All exterior piping of the processor has been insulated using rigid 2-inch foam insulation (where applicable).
- No visible evidence of settlement around tank
- Media support racks are standing straight and all clamps are attached to the support frames and rack pipes.
- At low float, the water level is a minimum of 1 inch above the recirculation pump handle
- All pumps are completely submerged
- Verify that there is no dirt or debris visible on the media or in the recirculation basket. If present, remove all debris and remove the recirculation pump and inspect the bottom of the basket for debris, wood chips, small stones etc that could be drawn into the recirculation pump and clog the venturi nozzles or damage the pump.
- Discharge pump is adequately supported
- Make sure airline has positive pitch to the processor. On level ground, the inlet silencer should extend fully above ground level

**Control Panel**

- Location is safely accessible at ground level for service, viewing of information on display screen, and resetting alarm.

## 2.3. Mechanical Inspection and Testing

Upon completion of the physical and electrical inspections of the system, the unit is ready for mechanical testing of all pumps and float systems. Mechanical testing includes the following:

- Checking integrity of internal plumbing and return pump line.
- Checking recirculation pump for proper spray and air draw.
- Checking operating pressure and drainback/vacuum breaks for pump-back and discharge pumps, where required.
- Proper operation of float switches.

Procedures for checking these important operating functions follow:

**<u>Checking integrity of internal plumbing and return pump line</u>**

- All internal piping should be free from leaks at all joints and pump and through-wall connections. ***It is recommended that the recirculation and pumpback pump lines be checked first and that the discharge pump check be completed during the discharge pump calibration step (i.e., running the discharge pump will pump down the processor) to avoid lowering the water level in the tank before all other system checks are complete.*** Check by sequentially operating recirculation pump and pumpback pump and checking internal lines and connections for leaks. All lines that exit the processor are equipped with anti-siphon orifices that will spray a small stream of water indicating that the pump is operating and orifice is functioning.
- **Check Pumpback Pump operation as follows:**
    - Inside the processor inlet hatch, remove pressure port plug on pumpback return line and attach pressure fitting, tubing and pressure gauge.
    - Measure and record the distance from the processor water surface to a fixed point near the top rim of the outlet riser. Record the initial level on the Startup Checklist.
    - Using touchscreen operator interface terminal (OIT), navigate to the Pump Toggle screen, touch the Auto button (Manual will then be displayed) to operate individual pumps.
    - Turn on the Pumpback Pump
    - Measure and record pump current draw by attaching ammeter around Wire #35. (Normal operating range 2.4 –2.8A)
    - Note that input X5 lights up on the PLC.

- With pump continuing to operate, check pumpback pump operation in the processor by:
    - Record operating pressure on the Startup Checklist. Normal pressure reading should be less than 2.5 psi. Gauge readings can be made at the ground surface as long as air is present in the majority of the tubing. If the tubing is nearly full of water, the measurement should be made at the pressure port elevation to minimize and pressure loss due to the additional height of the water column in the tubing.
    - Observing return flow into the septic tank and processor. It is normal for the water level in the septic tank to rise 1 ½ to 2 inches before full flow into the processor is established. Once the water level in the septic tank has stabilized, record the water level in the processor (effective drawdown).
    - Verify that there is a small stream coming out of the anti-siphon hole drilled near the top of the pumpback pump piping assembly
- Run pump for approximately 10 minutes
- Record running current draw
- Shut pump down
- Wait several minutes for water flow from the septic tank into the processor to stop
- Measure and record the distance to the water surface.
- Calculate the water level change. Changes greater than 1/8-inch may indicate a leak in the return line and should be investigated.

- **<u>Checking recirculation pump for proper spray and air draw</u>**
    - Using touchscreen operator interface terminal (OIT), navigate to the Pump Toggle screen, touch the Auto button (Manual will then be displayed) to operate individual pumps. More detailed instructions can be found in the OIT operating instructions provided as Appendix 3 to this Startup Manual
    - Turn on the Recirculation Pump
    - Measure and record pump current draw by attaching ammeter around Wire #33. (Normal operating range 2.4 –2.8A)
    - Note that input X4 lights up on the PLC.
    - With pump continuing to operate check Recirculation Pump operation in the processor by:
        - Observe spray pattern emanating for all spray heads. They should be similar and exhibit a pulsing spray, which indicates that air entering the distribution chamber is being cyclically pressurized and depressurized to enhance/expand the spray distribution over the media.

    - Note any differences in spray patterns between the two header pipes as significant differences may indicate partial blockage of the venturi nozzle in the header exhibiting weaker spray.
    - Verify that water flow into the recirculation pump basket is not being restricted or lowering the water level within the basked below the plastic motor cover. ***Low water levels in the basket can lead to overheating and in some cases tripping the thermal protection switch inside the pump, resulting in a recirculation pump alarm.***
    - Measure intake velocity at the airline silencer inlet using an anemometer. Normal range for STAAR 0.5 is 80-140 ft/min (fpm) and for STAAR 0.75 and STAAR 1.0 is 175-250 fpm.
    - **Note: Using your hand to *"feel"* air draw is not adequate and may give the impression of more air flow than is actually occurring.**
  - Run pump for approximately 10 minutes.
  - Measure and record running current draw.
  - Shut pump down.

- <u>**Checking Discharge Pump**</u>

The type of discharge pump used in a SeptiTech residential processor varies from system to system depending on the location and type of leach field (or surface water outfall) that it must feed. ***The discharge pump should first be checked for proper operation as described below prior to tuning it to the site-specific discharge conditions (e.g., throttling the discharge ball valve to restrict the flow rate).*** SeptiTech recommends testing this pump last because testing results in discharge of water from the processor and the attendant lowering of the water level. If the water level is dropped below the low float, the technician cannot observe the system going into automatic operation unless additional water is added to the processor to bring the water level above the low float elevation.

To check discharge pump operation:

  - Turn the discharge valve to the fully open position.
  - Remove the pressure port plug on discharge line and attach pressure fitting, tubing and pressure gauge (recommend 4-inch diameter 0-30psi water pressure gauge).
  - Using touchscreen operator interface terminal (OIT), navigate to the Pump Toggle screen, touch the Auto button (Manual will then be displayed) to operate individual pumps.
  - Turn on the Discharge Pump
  - Measure and record pump current draw by attaching ammeter around Wire #31 and #47 if pump is 230V. (Normal operating range 2.4-2.8A)

- Note that input X3 lights up on the PLC.
- With pump continuing to operate check discharge pump operation in the processor by:
  - Measure and record discharge pump operating pressure on the Startup Checklist. Gauge readings can be made at the ground surface as long as air is present in the majority of the tubing. If the tubing is nearly full of water, the measurement should be made at the pressure port elevation to minimize and pressure loss due to the additional height of the water column in the tubing.
  - Verify that there is a small stream coming out of the anti-siphon hole drilled near the top of the discharge pump riser
- For standard discharge pump (Goulds LSP03) feeding a gravity flow D-box, if the discharge pressure is less than 3.5 psi, throttle the discharge valve until the pressure gauge reads 3.5 psi. This provides a working head for the pump and an approximate flow rate of 24 gpm.
- For all other pump/leach field configurations, the pump must be throttled to provide the appropriate flow conditions (i.e., pressure and/or flow rate) to the leachfield. Once the pump is set up for the site-specific discharge conditions, it will need to be rechecked for flow rate and pressure.
- Run pump for approximately 1 minute.
- Measure and record running current draw
- Shut pump down

**<u>Proper operation of float switches</u>**

The float switches are positioned in the decant chamber to minimize turbulence and accumulation of growth that could change their performance characteristics. Their positions are set to:

1) Maintain adequate water over all operating pumps;
2) Provide surge capacity to spread dosing to the leach field out over the entire day and increase the treatment residence time in the processor; and
3) Maintain the water level below the treatment media so that it remains free-draining

Float switches are pre-mounted on the discharge pump riser pipe, but can come loose or shift position in transit and during assembly. The float switch position must be checked in the field to ensure that they will maintain the water level within a range that meets the three criteria listed above.

To check float switch operation:

- When possible, fill processor to level where high float switch is activated. High float is active when the light above the X0 is glowing on the PLC.

- Manually run the discharge pump using the hand-off-auto switch on the front of the panel until the high float light goes out. The switch is now within ¼-inch of the high float activation elevation. ***Note: If the adjacent X1 light goes out instead, the float switches have been wired backwards and the float wires need to be reversed in the J-box in the processor.***
- Measure and record the distance from the top of the media support rack to the water surface. This should be minimum 2 inches.
- Manually run the discharge pump until the low float light on the PLC (i.e., X1) goes out. The switch is now within ¼-inch of the low float activation elevation. **NOTE: This step should not be completed until all other pump testing and calibrations are completed to ensure that all pump testing is done with the water level in the normal operating range.**
- Measure and record the water level above/below the recirculation pump basket. The water level should be no less than 1 inch below the top of the basket. If it is lower, consult a SeptiTech technical representative to discuss proper adjustment.
- Measure and record the water depth to the bottom of the tank (to the bottom of a rib in a FRALO tank). Water depth must be a minimum 17 inches in all processors.

## 2.4. System Tuning

The SeptiTech treatment process relies on a PLC to integrate and control all system processes. The key to achieving optimal performance lies in accurate measurement of discharge and recycle pump flow rates and matching discharge pump cycles with the anticipated daily flows. This section presents simple procedures for estimating flow rates and for setting discharge and recycle variables.

### 2.4.1. Pump Calibration

With the exception of the recirculation pump, the PLC program is set up with default pump flow rates that are based on a standard system configuration (i.e., septic tank and processor set in close proximity to each other with less than one-foot elevation between them and the processor discharging to a gravity discharge leach field that is within a five-foot elevation of the processor.)

Pump flow rates have been measured under these conditions and are used as the “default” variables in the PLC program that is loaded at the factory. Because individual pump performance varies, the flow rate of the pumps may vary by as much as 25% from the factory values provided on pump curves or performance tables. The cumulative effect of these variations may impact overall performance. The effect is generally more pronounced in a denitrification system than in a conventional treatment unit by virtue of the more intense internal hydraulic processes employed to achieve denitrification.

**<u>Pump flow rates can be measured in two ways:</u>**

1) <u>Indirectly</u> - by measuring the total head against which the pump is working at and extrapolating the flow rate from the pump performance curve. In general, this method is adequate for calibrating the recycle pumps (i.e., pumpback and denitrification pumps). However, as discussed above, this method does not take into account variations in pump performance in the field and cannot account for any drain back of fluid from the discharge lines. Drain back can be a significant factor, especially on discharge pumps that have long pipe runs between the processor and the disposal field. SeptiTech therefore recommends using indirect measurement on conventional treatment units where drain back is minimal.

2) <u>Directly</u> – by measuring the volume of water discharged by a pump over a specific time interval. This is by far the more accurate method and is recommended for calibration on conventional treatment units where drain back volume could amount to more than 20% of the discharge volume that will be pumped in a single discharge cycle. This method, hereinafter referred to as a ***dropdown test***, is accomplished by measuring the water level in the processor, running the discharge pump for a prescribed period of time (generally the discharge run time), allowing the water level to re-equilibrate after all drain back has ceased and then measuring the drop in the water level. The water level drop can be converted to gallons pumped using tank-specific conversion factors (SeptiTech representative performing the startup procedure must know what the gallons per inch measurement of the particular tank being used.)

***<u>Indirect Flow Rate Determination</u>***

Flow rate can be estimated using the pump pressure readings obtained during the startup procedure and recorded on the **Startup Checklist** or if recalibration is needed:

- Note the pump model number on the **Startup Checklist** or field notebook.
- Remove pressure port plug on pump line and attach pressure fitting, tubing and pressure gauge.
- Using touchscreen operator interface terminal (OIT), navigate to the Pump Toggle screen, touch the Auto button (Manual will then be displayed) to operate individual pumps.
- Turn on the discharge pump
- Measure and record operating pressure on the **Startup Checklist** or field notebook. Gauge readings can be made at the ground surface as long as air is present in the majority of the tubing. If the tubing is nearly full of water, the measurement should be made at the pressure port elevation to minimize and pressure loss due to the additional height of the water column in the tubing.
- Shut pump down
- Find the appropriate Flow Conversion Table for the pump being calibrated (See Appendix 5) and find the flow rate that corresponds to the closest pressure

reading that is less than the measured pressure. ***Note: These flow conversion tables have been adjusted for the additional static head between the pressure port and the water surface (approximately 1 psi).***

- Record this flow rate on the **Startup Checklist** or field notebook as appropriate.

***Direct Flow Rate Determination***

This ***drawdown test*** method is used to measure the volume of water pumped from the processor during a specific time interval (for discharge pumps it is generally the discharge pump run time). Determining pump flow rate by measuring water level changes in a tank requires that the volume or water per inch of depth be known and that the water level and pump run time can be accurately measured. Prior to running a drawdown test, it is useful to know the approximate flow rate of the pump being tested. Typically, the flow rate can be estimated from the discharge pump pressure measurement as described in the previous section. With the exception of discharge pumps, it is desirable to drop the water level between 1 and 2 inches (generally resulting in 30 to 50 gallons pumped) to reduce the significance of small variations in measurements and tank dimensions in subsequent calculations. To run a drawdown test:

- At processor, remove pressure port plug on pump discharge line and attach pressure fitting, tubing and pressure gauge (recommend 4-inch diameter 0-30 psi water pressure gauge).
- If testing a pumpback or denitrification pump, the line feeding the processor must be plugged either at the septic tank outlet or in the processor inlet.
- If the discharge pump is being calibrated, the test should be conducted at the target discharge run time and back pressure, which must be computed during the startup process.
- Measure and record the distance from the processor water surface to a fixed point near the top rim of the outlet riser. Alternatively, set up a tripod mounted water level gauge to measure water level changes, adjust the ruler to line up the 0 or 1-inch mark with a fixed position reference point and record the initial position of the ruler on the Startup Checklist.
- Using touchscreen operator interface terminal (OIT), navigate to the Pump Toggle screen, touch the Auto button (Manual will then be displayed) to operate individual pumps.
- Turn on the Pump that is being tested.
- Run pump for the appropriate interval using a stopwatch or sweep-second hand to record the actual run time in seconds.
- Shut pump off and observe the pump for signs of drainback and note how long it continues for future reference.
- Wait at least one minute after drainback stops for water level in processor to equilibrate

- Measure and record the distance to the water surface or the final position of the water level gauge.
- Calculate the water level change.
- Using the tank-specific capacity, measured in gallons per inch, calculate the total gallons pumped.
- Calculate the pump flow rate by dividing the total gallons pumped by the run time (in minutes).
- Record the flow rate on the Startup Checklist or Field Notebook as required.

***Discharge Pump Interval/Run Time Settings***

Several factors must be considered in the process of selecting the discharge interval and run time settings for a specific system:

1. Equalize (i.e., hold back) flow so that discharge occurs at regular intervals throughout the day and night;
2. Deliver sufficient flow to flood/pressurize the disposal field during each discharge cycle; and
3. Optimize flow through the processor to anticipate higher and lower flow days without compromising overall system performance.

SeptiTech inputs baseline or "default" settings in PLC programs that are installed on every residential treatment unit. The default settings are as follows:

| | **STAAR 0.5** | **STAAR 0.75** | **STAAR 1.0** |
|---|---|---|---|
| **Average Daily Flow** | 220 gpd | 365 gpd | 500 gpd |
| **Discharge Pump** | LSP03 | LSP03 | LSP03 |
| **Discharge Flow Rate** | 24 gpm | 24 gpm | 24 gpm |
| **Discharge Interval** | 3600 sec (1 hour) | 3600 sec (1 hour) | 3600 sec (1 hour) |
| **Discharge Pump Run Time** | 23 sec | 38 sec | 52 sec |

Leach field dosing specifications may require that more water is delivered to the field every discharge. In these circumstances, the discharge interval is increased in whole hour increments, but in no case should it be increased to more than 3 hours without first discussing the situation with a SeptiTech Technical representative.

Many systems use significantly less water than the factory defaults. A very few systems, most often seasonal or vacation use systems, use more. The following is a general guide to calculate discharge pump settings when average daily flows differ from the factory default values by more than 20-25 percent based on most recent download data from the PLC and the operator's knowledge of seasonal usage patterns beyond the 90-day recording period.

There are a few rules of thumb that apply to all systems:

1. Minimum discharge pump run time = 20 seconds

2. Maximum discharge interval = 10,800 seconds (3 hours)
3. Use 120% of average flow for prior 90 days as basis for calculating pump run times. ***Note: If system is used intermittently (e.g., weekend use) the average flow should be calculated based on only days where normal flow occurred.***
4. Drainback of water in the discharge pipe may occur if the elevation of the discharge pipe outlet is ***higher than the water level in the processor.*** This may have a significant impact of the net flow rate of the discharge pump where a small volume of water is being discharged to the field and there is a long distance between the processor and the field.

The following table lists the minimum flow required for a range of pump flow rates, and discharge intervals at the minimum 20 second run time:

| **Pump Flow Rate (gpm)** | **Minimum Flow for Discharge Interval (gpd) (20 sec run time)** | | |
|---|---|---|---|
| | **3600 sec** | **7200 sec** | **10,800 sec** |
| **5** | 33 | 16 | |
| **10** | 66 | 33 | |
| **15** | 100 | 50 | 33 |
| **20** | 267 | 133 | 89 |
| **25** | 333 | 167 | 111 |
| **30** | 400 | 200 | 133 |
| **35** | 466 | 233 | 156 |
| **40** | 533 | 267 | 177 |
| **45** | 600 | 300 | 200 |

To compute the discharge on time:

$$\frac{\textbf{Average flow (gal) X 120\% X 60 sec/min}}{\textbf{Flow rate (gpm) X 24/discharge interval (hrs)}} = \textbf{Discharge Run Time in Seconds}$$

If the calculated run time is less than 20 seconds, increase the discharge interval (e.g. from 3600 to 7200 sec) and recalculate. ***Note: If a run time >20 seconds cannot be achieved at 7200 sec discharge interval, it may be necessary to throttle the discharge pump in order to increase the pump run time.***

***<u>Example:</u>*** *For an anticipated daily flow is 125 gpd, discharge pump flow rate is 28 gpm and discharge interval is 2 hrs.*

$$\frac{125 \text{ gpd X } 120\% \text{ X } 60 \text{ sec/min}}{28 \text{ gpm X } 24/2} =$$

$$\frac{9000}{336} =$$

*<u>Discharge Pump Run Time = 27 seconds</u>*

To enter the discharge flow rate, discharge interval and run time into the PLC:

- Touch the OIT Screen to open the menu screen
- Touch the "Automatic" button to put the system in Manual/Maintenance Mode
- Touch the password-protected "Variables" button, enter the password, and hit the "Enter" button. Entering the correct password will open the process variables menu.
- Use the "Next" button to scroll down to the Discharge Pump GPM. Use the touch screen to change the flow rate to 28 gpm.
- Continue scrolling down the menu to the "Discharge Interval" screen. Use the touch screen to change the discharge interval to 7200 seconds (i.e., 2 hours).
- Continue scrolling down the menu to the "Discharge Pump Run Time" screen. Use the touch screen to change the discharge pump run time to 27 seconds.
- Touch the Manual/Maintenance Mode button to return the system to "Automatic" operation.

*Factoring in Drainback*

**Note: SeptiTech systems are equipped with check valves on discharge pump outlet to prevent backflow from the discharge line and potentially the leach field from flowing back into the processor. Drainback is not allowed without prior written approval from SeptiTech. Where allowed, drainback volume must be factored into the discharge pump run time and the discharge pump flow rate that is entered in the PLC.** Two-inch diameter plastic pipe is generally used to deliver water from the processor to the leach field disposal area. One-hundred feet of two-inch pipe contains approximately 16 gallons of water. Typical systems may have between 30 and 50 feet of pipe between the SeptiTech processor and the leachfield disposal area. At 16 gal/100feet this translates to between 5 and 8 gallons of water. While some discharge lines may be more than 250-feet-long and contain more than 30 gallons of water. Where a system is programmed to discharge 10 to 20 gallons/discharge cycle, the presence of drainback can have a measurable impact on the net volume of water delivered to the disposal field and must be taken into account.

Where drainback occurs, the most accurate way to compensate its impact on flow rate and discharge volume, is to use the **dropdown test** to measure the discharge flow for the actual discharge pump run time. The water level drop in the processor, when allowed to re-equilibrate after drainback has ceased, provides a **net flow rate** that, when input to the PLC, eliminates flow/volume calculation errors that might otherwise affect flow dependent unit processes that are paced off of the discharge volume calculated by the PLC.

If a **dropdown test** cannot be run, the estimated flow rate can be approximated using the indirect flow rate determination and adjusting the flow rate for anticipated drainback volume based on the diameter and length of discharge pipe and the discharge pump run time that will be input into the PLC. SeptiTech can provide and Excel spreadsheet to facilitate this calculation or it can be computed manually for a standard 2-inch discharge pipe as follows:

**Drainback volume (Vd) = Length of discharge pipe (in feet) X 0.16 gallons/ft**

$$\text{Adjusted Float Rate (gpm)} = \frac{[\text{Measured Flow Rate (Qm) X Run time (sec)/60}] - \text{Vd}}{\text{Run Time (sec)/60}}$$

This calculation simply subtracts the drainback volume from the total gallons pumped during a discharge cycle and dividing it by the run time in minutes. Use the touchscreen OIT to input the Adjusted Flow Rate as described above. ***NOTE: The Adjusted Flow Rate must be recalculated whenever the discharge pump run time is changed.***

***Recycle Pump Settings***

All SeptiTech treatment units are equipped with a pumpback pump whose primary function is to collect solids that accumulate on the bottom of the processor and return them to the head of the septic tank. SeptiTech denitrification treatment units also utilize the pumpback pump to recycle the nitrified wastewater produced in the processor back to the septic tank where the nitrates and nitrites are converted to harmless nitrogen gas.

The recycle rates (expressed as a percentage of daily discharge flow) of the pumpback pump for standard systems and for the pumpback pump for denitrification systems are set at the factory and rarely require adjustment. However, there are circumstances where the flow rate of the pumps requires calibration and adjustment, generally when the elevation of the septic tank is substantially higher than the processor. In these circumstances, the flow rate(s) can be determined using the indirect flow rate determination method described in Section 2.4.1. If the measured flow rate differs from the factory setting of 24 gpm by more than 2 gpm, the pumpback/denite flow rate should be reset on the PLC.

To enter the pumpback/denitrification pump flow rate into the PLC:

- Touch the OIT Screen to open the menu screen
- Touch the “Automatic” button to put the system in Manual/Maintenance Mode
- Touch “Variables” button and hit the “Enter” button.
- Use the “Next” button to scroll down to the Pumpback/Denite Pump GPM. Use the touch screen to change the flow rate to the new value.
- Touch the “Exit” button to return to the main menu screen
- Touch the Manual/Maintenance Mode button to return the system to “Automatic” operation.

## 2.5. Final Startup

After all checks and tuning procedures have been completed as outlined, the system is ready to be finalized and placed into “Auto” mode. Ensure all switches are in “Auto” position and that the PLC has been placed into “Auto” mode using the OIT touchscreen. The processor is now being controlled by the PLC and running in accordance with the programmed software and variable settings. System startup is complete.

# Discharge Pump Pressure/Flow Conversion Tables for SeptiTech Residential Treatment Units

| 50PU2.15S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 3 | 33 |
| 3.5 | 30 |
| 4 | 26 |
| 4.5 | 23 |
| 5 | 19 |
| 5.5 | 15 |
| 6 | 11 |
| 6.5 | 7 |
| 7 | 0 |

| 50PN2.25S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 3 | 55 |
| 3.5 | 53 |
| 4 | 50 |
| 4.5 | 48 |
| 5 | 45 |
| 5.5 | 43 |
| 6 | 40 |
| 6.5 | 37 |
| 7 | 34 |
| 7.5 | 30 |
| 8 | 26 |
| 8.5 | 23 |
| 9 | 20 |
| 9.5 | 16 |
| 10 | 12 |
| 10.5 | 9 |
| 11 | 6 |
| 11.5 | 3 |
| 12 | 0 |

| 50PN2.4S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 3 | 74 |
| 3.5 | 72 |
| 4 | 70 |
| 4.5 | 67 |
| 5 | 65 |
| 5.5 | 63 |
| 6 | 61 |
| 6.5 | 58 |
| 7 | 55 |
| 7.5 | 53 |
| 8 | 50 |
| 8.5 | 47 |
| 9 | 45 |
| 9.5 | 41 |
| 10 | 38 |
| 10.5 | 35 |
| 11 | 32 |
| 11.5 | 30 |
| 12 | 27 |
| 12.5 | 25 |
| 13 | 22 |
| 13.5 | 19 |
| 14 | 16 |
| 14.5 | 14 |
| 15 | 12 |
| 15.5 | 10 |
| 16 | 7 |
| 16.5 | 5 |
| 17 | 3 |
| 17.5 | 1 |
| 18 | 0 |

| 50PN2.75S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 5 | 89 |
| 5.5 | 87 |
| 6 | 86 |
| 6.5 | 84 |
| 7 | 82 |
| 7.5 | 80 |
| 8 | 78 |
| 8.5 | 76 |
| 9 | 74 |
| 9.5 | 72 |
| 10 | 70 |
| 10.5 | 68 |
| 11 | 65 |
| 11.5 | 62 |
| 12 | 60 |
| 12.5 | 58 |
| 13 | 54 |
| 13.5 | 52 |
| 14 | 48 |
| 14.5 | 45 |
| 15 | 42 |
| 15.5 | 38 |
| 16 | 35 |
| 16.5 | 32 |
| 17 | 28 |
| 17.5 | 25 |
| 18 | 22 |
| 18.5 | 20 |
| 19 | 18 |
| 19.5 | 14 |
| 20 | 13 |
| 20.5 | 10 |
| 21 | 8 |
| 21.5 | 6 |
| 22 | 4 |
| 22.5 | 2 |
| 23 | 0 |

| 50PSF2.25S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 7.5 | 24 |
| 8 | 23 |
| 8.5 | 23 |
| 9 | 22 |
| 9.5 | 21 |
| 10 | 20 |
| 10.5 | 19 |
| 11 | 18 |
| 11.5 | 17 |
| 12 | 16 |
| 12.5 | 15 |
| 13 | 14 |
| 13.5 | 13 |
| 14 | 11 |
| 14.5 | 10 |
| 15 | 9 |
| 15.5 | 8 |
| 16 | 6 |
| 16.5 | 5 |
| 17 | 3 |
| 17.5 | 2 |
| 18 | 0 |

| 50PSF2.4S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 9.5 | 28 |
| 10 | 28 |
| 10.5 | 27 |
| 11 | 27 |
| 11.5 | 26 |
| 12 | 26 |
| 12.5 | 25 |
| 13 | 24 |
| 13.5 | 24 |
| 14 | 23 |
| 14.5 | 22 |
| 15 | 21 |
| 15.5 | 20 |
| 16 | 19 |
| 16.5 | 18 |
| 17 | 18 |
| 17.5 | 16 |
| 18 | 15 |
| 18.5 | 14 |
| 19 | 12 |
| 19.5 | 11 |
| 20 | 9 |
| 20.5 | 8 |
| 21 | 6 |
| 21.5 | 4 |
| 22 | 2 |
| 22.5 | 0 |

| 50PSF2.75S | |
|---|---|
| ADJUSTED | |
| PSI | GPM |
| 8 | 61 |
| 8.5 | 60 |
| 9 | 60 |
| 9.5 | 59 |
| 10 | 58 |
| 10.5 | 57 |
| 11 | 56 |
| 11.5 | 55 |
| 12 | 54 |
| 12.5 | 53 |
| 13 | 52 |
| 13.5 | 51 |
| 14 | 49 |
| 14.5 | 48 |
| 15 | 46 |
| 15.5 | 45 |
| 16 | 43 |
| 16.5 | 42 |
| 17 | 40 |
| 17.5 | 38 |
| 18 | 36 |
| 18.5 | 34 |
| 19 | 32 |
| 19.5 | 30 |
| 20 | 27 |
| 20.5 | 25 |
| 21 | 21 |
| 21.5 | 20 |
| 22 | 16 |
| 22.5 | 14 |
| 23 | 11 |
| 23.5 | 7 |
| 24 | 3 |
| 24.5 | 0 |

| GOULDS LSP03 | |
| --- | --- |
| ADJUSTED | |
| PSI | GPM |
| 2.5 | 31 |
| 3 | 30 |
| 3.5 | 29 |
| 4 | 27 |
| 4.5 | 24 |
| 5 | 21 |
| 5.5 | 20 |
| 6 | 18 |
| 6.5 | 16 |
| 7 | 11 |
| 7.5 | 4 |
| 8 | 0 |

| BRUISER 7SB | |
| --- | --- |
| PSI | GPM |
| 60 | 10 |
| 65 | 9.5 |
| 70 | 9.5 |
| 75 | 9 |
| 80 | 8.5 |
| 85 | 4 |
| 90 | 7.5 |
| 95 | 7 |
| 100 | 6.5 |
| 105 | 6 |
| 110 | 5.5 |
| 115 | 5 |
| 120 | 4 |
| 125 | 2 |
| 130 | 0 |

| BRUISER 10SB | |
| --- | --- |
| PSI | GPM |
| 35 | 16 |
| 40 | 15.5 |
| 45 | 15 |
| 50 | 14.5 |
| 55 | 13.5 |
| 60 | 12.5 |
| 65 | 12 |
| 70 | 11 |
| 75 | 10 |
| 80 | 9 |
| 85 | 7 |
| 90 | 6 |
| 95 | 4 |
| 100 | 3 |