



**Start-Up and Maintenance of
AdvanTex® AX100 & AX20 Commercial
Wastewater Treatment Systems**

**COMMERCIAL
O&M
MANUAL**

Orenco®

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Introduction

About Orenco

Since 1981, Orenco Systems®, Inc. has researched, designed, and manufactured leading-edge onsite and decentralized wastewater treatment technologies. We are one of the nation's leading manufacturers and suppliers of equipment for the collection and treatment of wastewater. At Orenco, we specialize in the manufacture of complete treatment systems for residential, commercial and community applications. Wastewater collection and treatment is our only job. When you purchase an Orenco system, you can be confident you have chosen the best equipment available.

Assistance

In addition to providing quality equipment, Orenco prides itself on its outstanding customer service and technical assistance. Should you have any questions regarding your system, components, instructions, or this O&M Manual, please contact us for assistance. Please include the name and location of your project or system with any correspondence, so we can quickly respond to your request.

When Your Equipment Arrives

Inspect your order for completeness and inspect each component for shipping damage. Check to be sure that the instructions and items supplied comply with your state and local regulations. Carefully read and follow all instructions. Be aware that improper system or component installation may void warranties.

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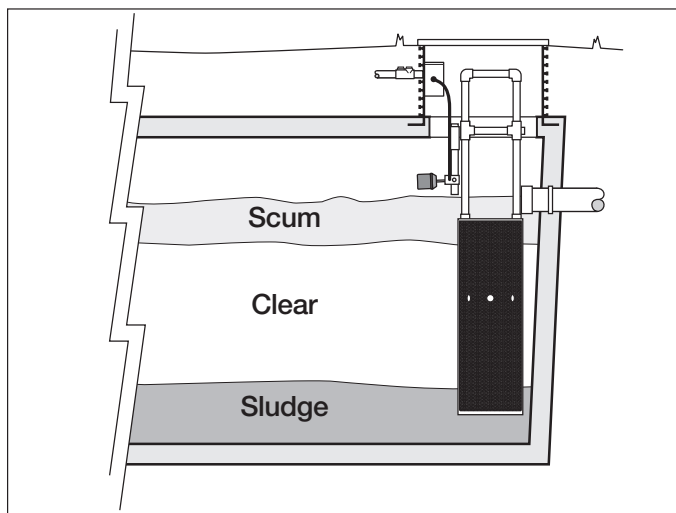
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About the AdvanTex Treatment System

Primary Tank

The primary tank provides passive primary wastewater treatment. There can be one or more primary tanks in parallel or series, depending on the size of the system. In certain applications, the primary tank may be preceded by a grease interceptor tank.



The primary tank is an enclosed, watertight receptacle designed to collect wastewater; segregate settleable and floatable solids (sludge and scum); accumulate, consolidate, and store solids; digest organic matter; and discharge treated effluent. BOD (biochemical oxygen demand) removals of greater than 65% and TSS (total suspended solids) removals of greater than 70% are easily accomplished. In the primary tank, wastewater separates into three distinct layers: a floating scum layer, a bottom sludge layer, and a clear zone in between, which is relatively free of large solids. An effluent filter or pump vault allows liquid effluent from the clear zone to be transported to the recirculation/blend or recirculation/blend and anoxic tank.

Anoxic Tank (if applicable)

The anoxic (low oxygen) tank enhances the denitrification of AdvanTex® filtrate. It is sized based on the design flow of the system. In systems that use an anoxic tank, it is generally located between the primary tank, flow splitter basin, and recirculation/blend tank in the treatment train.

The anoxic tank provides the ideal environment for carbonaceous microbes that reduce nitrates to nitrogen gas (denitrification) from AdvanTex filtrate returning from the flow splitter basin. The harmless nitrogen gas is released freely back into the atmosphere.

Recirculation/Blend Tank

The recirculation/blend tank reduces the strength of the effluent being applied to the AdvanTex filter. It is sized at 80 to 100% of the design flow. It is located after the primary treatment tank and before the AdvanTex textile filter.

The reduction in effluent strength is achieved by mixing treated filtrate from the AdvanTex filter with primary treated effluent at the recirc valve, located at the inlet of the recirculation/blend tank. A timer-controlled pump at the outlet end of the tank then sends the blended effluent to the AdvanTex filter.

AdvanTex® Textile Filter

The AdvanTex textile filter pod provides secondary wastewater treatment. There can be one or more AdvanTex pods, depending on the size of the system.



The filter is a sturdy, watertight fiberglass basin filled with an engineered textile material. The textile media has a very large surface area and void volume (for free flow of oxygen). Wastewater percolates both through and between the textile media. A visible biological film normally develops on the filter media within a few days of system start-up. Within the filter, aerobic conditions exist that are ideal for microbes that convert ammonia to nitrate (nitrification). BOD and TSS reductions occur almost immediately. Nitrification may take four to six weeks, depending on ambient temperature.

After percolating through the filter media, the effluent gravity-flows to the recirculating valve. On systems designed for enhanced nitrogen removal, the effluent first flows to a flow splitter basin where a percentage of the effluent is diverted to the inlet side of a primary tank or anoxic tank. The remainder flows to the recirc valve, where it is directed either into the recirculation/blend tank or discharged.

Start-up & Operation

Introduction

This section covers the start-up of an AdvanTex®-AX100 Treatment System in a commercial application. The formal start-up of an AdvanTex Treatment System should only be performed by trained personnel. As a trained member of the team performing the system start-up, you play a critical role in the operation of the system. The decisions made at the time of the start-up will determine the long-term maintenance needs of the system. Regulators, manufacturers, dealers, property owners, neighbors, and service providers all rely on a thorough start-up.

Before you start your system, please read this entire manual, as well as the engineering plans, and contact your Dealer if you have any questions. You'll save yourself time and money, and you'll reduce the potential for follow-up work. For information specific to your system, refer to your detailed engineering plans.

We recommend following the flow path through the treatment train, if possible, when performing the system start-up, beginning at the building outlets and ending at the final discharge point. By following this start-up sequence, the treatment train can be effectively inspected for proper operation and each step in the process can be given systematic attention.

Roles and Responsibilities

Prior to start-up, the Orenco Representative or AdvanTex Dealer will contact the Designer, Installer, and Service Provider to coordinate a start-up date. The date will be based on a status report provided by the Orenco Representative and the availability of all parties. The status report will include, but will not be limited to, verification of leak testing performed by the Installer, installation of all equipment, and the availability of power, phone line, and water at the site.

- The **AdvanTex Dealer** is expected to be on site and is either performing the start-up or acting as a coordinator and general resource during the installation and start-up of the system.
- The **Designer** is required at the site during start-up to answer questions concerning site-specific issues not covered in the plans, timer settings, and float settings.
- The **Installer** is required at the site during start-up to address any installation issues that arise.
- The **Service Provider** is required at the site during start-up to become familiar with the system, receive training on control panel and treatment system operation, and to learn correct sampling techniques for the system.

Safety Precautions

Before starting up, maintaining, or servicing any wastewater treatment system, observe the following precautions for the safety and health of all service personnel working with or around wastewater, effluent, and its associated equipment:

- Wear proper clothing that covers all parts of the body that will be exposed to wastewater or effluent.
- Wear personal protection equipment (PPE) such as rubber gloves and eye protection when handling or touching any equipment components that come in contact with wastewater or effluent.
- Turn off system power at the service entrance panel and set the circuit breakers in the panel to their "OFF" positions before removing any system components. If the control panel or service entrance panel is not within eyesight of the pumping system, use Lock Out/Tag Out tags to ensure safety.
- Avoid driving over any part of the wastewater treatment system unless it's been equipped to withstand vehicle traffic. If the system is subject to possible traffic, put a barricade up to protect the system.
- Do not enter any tank access. Any work performed on the tank should be done from the outside. Gases and/or oxygen depletion in the tank can be fatal.
- Secure all tank access lids properly to the riser after all work is complete.
- Practice proper personal hygiene at all times.

Start-up & Operation (continued)

Recommended Tools and Equipment – Start-up

The following items are recommended for a smooth and successful start-up:

- A tool kit containing common tools and these additional items:
 - A cordless power drill with 1/2" nut driver and 3/16" hex-head bit
 - Voltmeter
 - Small electronics screwdrivers
 - Wire strippers/cutters
 - Cable ties
 - Tape measure
 - Adjustable pliers
- A laptop computer with Hyperterminal (PC) or ZTERM (MAC), to interface with the control panel if the control panel doesn't have a touch screen.
- A copy of the layout and a start-up checklist for the person performing the system start-up.
- Appropriate personal protection equipment (PPE) for each person involved in the start-up.

Pre-start-up Inspection

- **Site drainage:** Verify that all riser lids, external splice box lids, and AX pod lids are level and above grade.



- **Serviceability:** Verify that there is a minimum of two feet of space between AX pods. Check for a useable water source within hose distance of the system.
- **System layout:** Verify that the component layout in the plans or the system diagram matches the installed system and note any differences between the plans and the installed system.

- **Landscaping:** Check for landscape features that may cause long-term maintenance issues:
 - Trees planted on top of tanks
 - Trees that could shed snow onto critical components, such as control panels
 - Risers, external splice boxes, and pods covered in bark or other landscaping materials

- **Circuit breakers:**

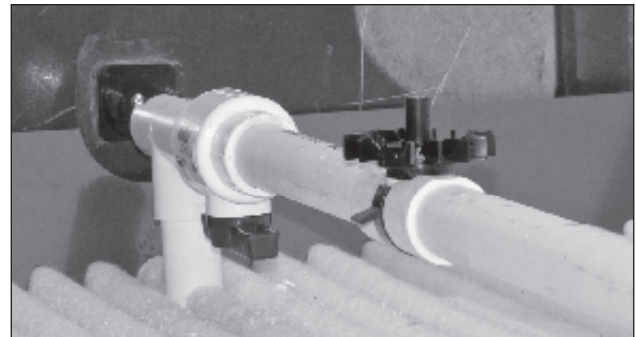
Open the control panel and verify that all of the circuit breakers are off.

- **System access:**

Remove lid bolts and open all lids.

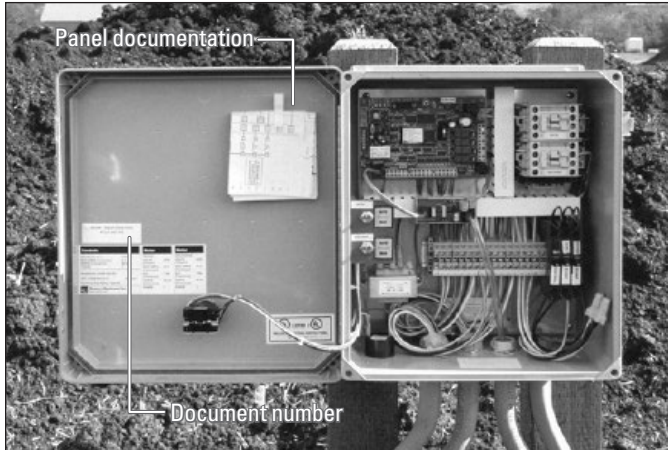
- **AX100:** Verify that the lid bolt boxes and pressure gauges have been removed from the AX pods.

If not, remove them at this time. Verify that the lateral inlet valves in the pods are open and the spray nozzle turbines are pointed up, as shown below.



Inspection Points

Inspection Points – Control Panels



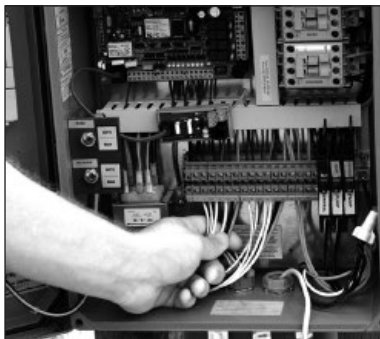
The system may have multiple control panels. Identify if there are control panels on the section of the system that you are about to start-up.

If the tank or basin has associated controls, perform the following start-up steps:

1. **Panel documentation:** Locate the panel-wiring diagram inside the panel and verify the document matches the document number found on the inside of the front panel door. If you can't find the wiring diagram, contact Orenco at (800) 348-9843 or (541) 459-4449 to have a copy e-mailed or faxed to you.

2. **Wiring installation:**

Verify all of the main breakers are in the "OFF" position. Inspect the wire terminations in the panel by giving a light tug to all of the float wires, pump wires, pump power lines, and main power lines in the panel. If a wire comes loose, reattach the wire correctly.



WARNING: Failure to identify a loose wire may cause intermittent failures, inconsistent panel operation and over-current conditions on the pumps.

3. **Conduit seal installation:** Check for conduit seals on all conduit connections to the control panel.

WARNING: Failing to seal the conduit may allow corrosive gasses to corrode major components. Orenco recommends conduit seals for all connections to the control panel to assure proper system operation and component longevity.

4. **Power supply voltage:** Make sure the panel breakers are switched off, and check the power supply voltage at the panel.

- On 120 V panels, measure voltage between L1 and ground. The voltage should be within ten percent of nominal.
- On 230 V panels, measure the voltage between L1 and ground, and between L2 and ground. The voltage of each leg should be approximately 115 volts. Measure the voltage between L1 and L2. The voltage should be within ten percent of nominal.
- On 208 V, 230 V, and 460 V 3-phase panels, measure the voltage between L1 & L2, L2 & L3, and L3 & L1. The voltage between each leg should be 208, 230 or 460 volts, respectively. If there is a voltage difference between line legs, it is an indication that the power source may be undersized. The voltage between each leg and ground on 208 volts should be approximately 120 volts. The voltage between each leg and ground on 460 volts should be approximately 277 volts. (Due to the variability in the ways 230 V, 3-phase power can be wired, there is not a standard test method.)

5. **Neutral and ground voltage:** Check for any voltage difference between each neutral (N) wire in the panel and ground. If there is a difference in voltage, use the wiring diagram to track down the source of the difference and correct it.

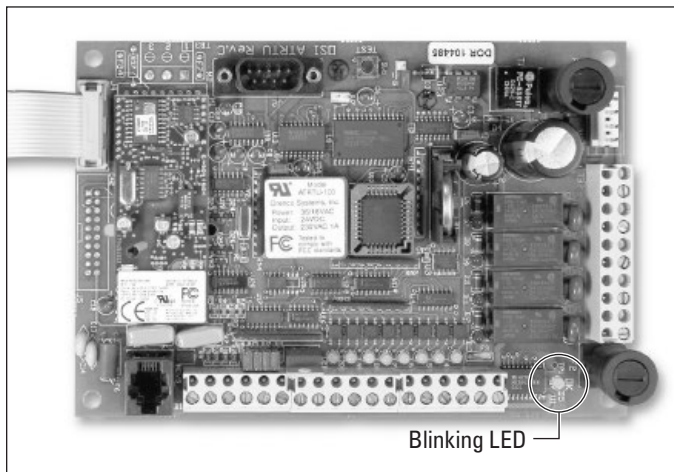
6. **Controls circuit:** Connect the controls circuit if it is not already connected. The controls circuit is now ready to be turned on. Do not turn on the pump circuit at this time.

WARNING: Turning the pump circuit on at this time can damage the panel or the pump if the pumps and floats are miswired or if there isn't sufficient liquid in the tank.

Inspection Points (continued)

7. **Panel operation:** Verify that the panel is powered up.

- On TCOM and VCOM panels, an LED will light up indicating the board is operational. If the blinking light does not turn on, refer to the wiring diagram and verify the connections on the control circuit were properly terminated.



- On MVP, Simplex, and Duplex panels, turn on the control circuit, then toggle the pump “AUTO-OFF-MAN” switch to “MAN.” The motor contactor will visibly and audibly engage at this point. If the motor contactor does not engage and there are no alarm conditions, refer to the wiring diagram and verify the connections on the control circuit were properly terminated.

NOTE: For VCOM-equipped systems, place VCOM in test mode at this point.

Inspection Points – Tanks and Basins

Not all tanks and basins have associated components as described below. Check the system plans to identify if there are associated components — such as splice boxes, floats, filters, or pump vaults — on each section of the system as you start it up.

1. **Tank:** Confirm with the installer that all tanks have passed watertightness testing. Verify the inlet and outlet of the tank and riser are properly installed.
2. **Basin:** Verify the inlet and outlet of the basin are properly installed and the effluent flows through in the correct direction.
3. **Riser:** Inspect the riser attachment and rubber grommets for a watertight seal.

4. **Splice box:** Inspect the splice box for correct wiring and the use of waterproof splice nuts. If there is water in the splice box, use a baster or sponge to remove the water.



WARNING: Failure to use waterproof wire nuts can cause intermittent or permanent float failure.

5. **Effluent filter and float:** Verify the effluent filter cartridge and float assembly are easy to remove for service and maintenance. The ability to easily remove these components is essential and depends upon careful installation in accordance with the instructions provided in Appendix B. Set components on a plastic tarp or plastic sheeting when they are out of the tank.
 - a. Detach the float assembly from the housing, remove it from the tank, and lay it aside. Verify there is enough slack in the cord for easy removal.
 - b. Pull the effluent filter cartridge out of the housing, and remove it from the tank. There should be ample clearance to allow unhindered removal of the cartridge from the housing and tank.
 - c. Slide the filter housing out of the slide rail and remove the housing from the tank. (Slide rail models only.)
 - d. Raise the high-level alarm float to simulate a high-level condition. Verify that the high-level signal is on by the audible alarm or the high-level alarm input LED on the circuit board in the panel.

NOTE: The audible alarm is delayed for 2 hours in TCOM control panels.
 - e. When the floats and filter cartridge are out of the tank, verify the handles are long enough for easy access. If they are not, adjust them to the necessary length.
 - f. Reinstall the cartridge into the effluent filter housing and install the float assembly.

Inspection Points (continued)

6. **Biotube® pump vault filter and floats:** Verify the pump vault filter cartridge and float assembly are easy to remove for service and maintenance. The ability to easily remove these components is essential and depends upon careful installation in accordance with the instructions provided in Appendix B. Set components on a plastic tarp or sheeting when they are out of the tank.

- Detach the float assembly from the housing, remove it from the tank, and lay it aside. Verify there is enough slack in the cord for easy removal.
- Pull the filter cartridge out of the pump vault and remove the filter cartridge from the tank. There should be ample clearance to allow unhindered removal of the cartridge.

c. Test the floats, starting with the lowest float on the assembly. Raise each float to the “up” position and verify that the signal is on for the correct float by the audible alarm and the alarm input LED on the circuit board in the panel. If your panel does not have alarm input LEDs, check voltage coming into the panel from the float you believe is activated.

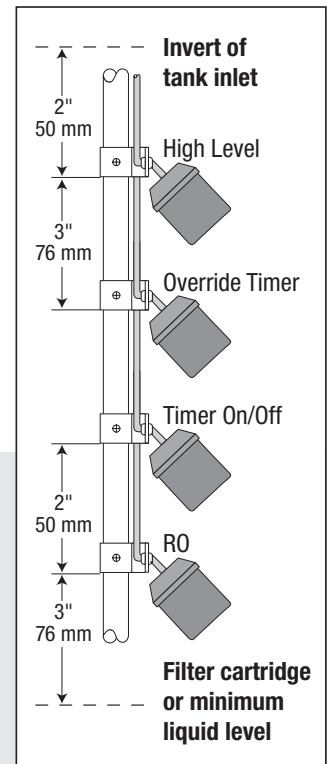


NOTE: The audible alarm is delayed for 2 hours in TCOM control panels.

d. Check the float settings provided in the plans against the actual float settings. If the plans don't provide float settings and the engineer or system designer is unable to provide settings, set the floats based on the following rules:



- Demand Dose:
 - “Redundant Off” (RO) float is set 3 inches (76 mm) above the filter cartridge or the minimum liquid level of the pump, whichever is higher.
 - “Pump Off” float is set 2 inches (50 mm) above the “RO” float.
 - To calculate the “Pump On” float distance from the “Pump Off” float, divide the desired dose volume by the gallons per in. or liters per mm of the tank. Place the “Pump On” float that many inches above the “Pump Off” float.
 - “High Level” or “High Level/Lag Pump Enable” float is set at 2 inches (50 mm) below the invert of the tank inlet.
- Timed Dose:
 - “RO” float is set 3 inches (76 mm) above the filter cartridge.
 - “Timer On/Off” float is set 2 inches (50 mm) above the “RO” float.
 - “Override Timer” float is set 3 inches (76 mm) below “High Level” float.
 - “High Level” or “High Level/Lag Pump Enable” float is set at 2 inches (50 mm) below the invert of the tank inlet.



WARNING: Pumps have a 30-second minimum run time. We recommend a drawdown differential of at least 30 seconds between the “Pump Off” float and “RO” float or the pumps may continue to run, resulting in a false low-level alarm.

NOTE: If you use the general float settings, you may need to return at a later time and adjust float settings after the system is in operation.

Inspection Points (continued)

- e. When the floats and filter cartridge are out of the tank, verify the handles are long enough for easy access. If they are not, adjust them to the necessary length.
- f. Reinstall the cartridge in the pump vault. Leave the float assembly out of the tank or basin for use during pump run testing.

7. Effluent pump: Verify the pump is easy to remove for service and maintenance and that the pump flow rate and voltage are correct. The ability to easily remove the pump is essential and depends upon careful installation in accordance with the instructions provided in Appendix B. Set components on a plastic tarp or plastic sheeting when they are out of the tank.

- a. Switch the pump breaker(s) in the control panel to the "OFF" position.
- b. Verify the ball valve and cam-lock fitting or union on the discharge assembly is within 24 inches (610 mm) of the top of the riser.



- c. Close the ball valve on the discharge assembly if there is one and disconnect the discharge assembly at the union or cam-lock fitting.
- d. Verify there is enough slack in the pump cord for easy removal.
- e. Pull the pump out of the vault by the discharge assembly and remove the pump from the tank.

WARNING: Lifting or lowering the pump by the cord can damage the pump and cord.

- f. Check the voltage and phase values on the pump nameplate. Write them down in the start-up report. If there are pump motor stickers on the inside of the control panel door, check to see if they match the pump nameplate.

WARNING: If the pump does not match the panel voltage and phase requirements, do not turn on the pump breakers.

- g. Reinstall the pump if the pump matches the panel voltage and phase requirements.
- h. Reconnect the discharge assembly at the union or cam-lock fitting and open the discharge assembly ball valve.
- i. Switch the pump breaker(s) in the control panel to the "ON" position when finished.

Inspection Points – Pumps

When the panel has been inspected and powered up, the float inputs have been tested, and all pump voltage and phase information has been verified, the pump(s) can be powered up and tested.

1. Manual pump operation:

- a. Switch the pump breaker(s) in the control panel to the "ON" position.
- b. Measure the static voltage of the pump(s) and enter the value(s) on the start-up checklist.
- c. Toggle the pump



"AUTO-OFF-MAN" switch to "MAN." The motor contactor will visibly and audibly engage at this point. If the motor contactor does not engage, check for an "RO" alarm condition. If there is no alarm condition, refer to the wiring diagram and verify the connections on the control circuit were properly terminated.

WARNING: There is no motor protection in TCOM panels and panels without "RO" alarms. Before running a pump, always verify that there is sufficient liquid in the tank or basin.

NOTE: Refer to the "General Operating Instructions" section of the VCOM control panel documents to perform the "Manual Test" if you are starting up a pump controlled by a VCOM panel.

- d. Verify pump motor operation by checking the discharge plumbing assembly for vibration.
 - No vibration in the discharge plumbing assembly indicates a pump wiring issue. Check the pump voltage and pump wiring terminations in the panel and in the splice box. Wires may be incorrectly terminated or wire insulation may be causing faulty contact between the wire and terminal lug.
 - Vibration in the discharge plumbing assembly with low or no flow from the pump indicates closed valves or line breakages. On duplex pumping systems with two discharge plumbing assemblies connected together to a single line, verify that there are check valves on both pumps and that they are operating correctly. On three-phase systems, verify L1, L2 and L3 are wired correctly. A quick way to identify if the pump is wired correctly is to watch for clockwise torsion in the discharge plumbing assembly when the pump is first turned on.

Inspection Points (continued)

- e. Measure and compare the dynamic (running) voltage of the pumps to the measured static (resting) voltage. Voltage drops indicate connection problems in the splice box or wiring that is too small for the pump.
- f. Use an ammeter to measure the pump amperage. Make sure the amperage is within the range specified in the table below or listed on the pump nameplate. For non-Orengo pumps, consult the manufacturer's literature.

NOTE: On TCOM panels with a current sensor option, pump amperage should match the value listed in the panel. If it does not match, inspect the three-position switch on the current sensor for the correct scaling factor.

- g. Set the high and low amperage ranges based on the reading.

Pump Amperage Chart

Pump Model	Low Amp Reading	High Amp Reading
PF100511	11.9	12.6
PF100512	6.0	6.4
PF10053200	3.5	3.9
PF100552	3.6	3.8
PF100712	7.8	8.4
PF10073200	4.9	5.2
PF100752	5.8	6.2
PF101012	9.0	9.8
PF10103200	5.1	5.6
PF101552	9.4	11.4
PF102012	10.0	12.2
PF102032	6.4	7.6
PF10203200	7.5	8.7
PF200511	11.0	12.5
PF200512	5.8	6.5
PF200532	2.5	2.9
PF20053200	3.3	3.8
PF201012	9.6	10.5
PF300511	10.7	11.8
PF20103200	5.0	5.9
PF20153200	6.0	7.2
PF201512	10.5	12.6
PF300512	5.6	6.2
PF30053200	3.3	3.7
PF300552	3.5	4.2
PF300712	7.4	8.6
PF300752	5.5	6.1
PF30073200	4.1	4.9
PF301012	9.3	10.4
PF301052	6.4	7.4
PF30103200	4.9	5.8
PF301512	10.1	12.6
PF30153200	5.5	6.9
PF301534	2.3	2.8
PF301552	8.1	9.3
PF302012	7.4	11.0
PF30203200	7.7	9.3
PF303012	12.6	16.8
PF303032	8.2	10.1
PF305012	20.1	25.8
PF305032	14.0	16.6

Pump Model	Low Amp Reading	High Amp Reading
PF30503200	15.4	18.6
PF500511	10.5	12.1
PF500512	5.4	6.2
PF500532	2.6	3.0
PF50053200	3.2	3.7
PF500534	1.3	1.5
PF500552	3.3	3.9
PF500712	7.3	8.5
PF500732	3.1	3.9
PF50073200	3.9	4.9
PF500734	1.4	1.8
PF501012	8.8	10.1
PF50103200	4.6	5.7
PF501034	1.8	2.2
PF501512	9.6	12.6
PF50153200	5.4	7.0
PF501552	8.0	9.1
PF503012	12.6	17.7
PF503032	8	10.4
PF50303200	10.1	13.1
PF503034	4.2	5.3
PF505012	17.3	26.4
PF505032	13.1	16.5
PF751512	11.4	12.3
P200511	12.6	13.8
P200512	6.1	7.1
P201512	11.2	12.2
P300512	5.8	6.5
P300712	7.4	8.3
P301012	9.1	10.3
P500511	11.2	12.7
P500512	5.8	6.5
P50053200	3.4	3.8
P500712	7.7	8.8
P50073200	3.8	4.8
P501012	9.4	11.2
P501512	10.6	13.1
P50153200	6.0	7.6
PEF3311	6.9	7.8

Inspection Points (continued)

2. **Drawdown test:** Perform a drawdown test to set the pump flow rate in the control panel.
 - a. Measure and record the distance from the top of the tank to the liquid level in the tank.
 - b. Toggle the pump "AUTO-OFF-MAN" switch to the "MAN" position for sixty seconds.
 - c. Toggle the pump "AUTO-OFF-MAN" switch to the "OFF" position; then measure and compare the difference in elevations. The difference in elevation in inches or millimeters, multiplied by the gallons per inch or liters per millimeter of the tank or basin will provide the correct flow rate in gallons per minute (gpm) or liters per minute (L/min). Follow the instructions provided with the control panel for entering the measured pump flow rate.

NOTE: *This method will not work on recirculation/blend tanks if the flow is returning to the tank through the recirc valve or for dose tanks with transport lines that drain back.*
3. **Automatic pump operation:** Test the system using the floats to drive pump operation.
 - Demand dose:
 - a. Toggle the "AUTO-OFF-MAN" switch to the "AUTO" position.
 - b. Unclip the float assembly and remove it from the tank if it is not out already.
 - c. Verify the automatic operation of the pumps by incrementally lifting the floats to simulate normal raising and lowering of the tank liquid level. The pumps should cycle on when you lift them and cycle off when you release them. On duplex systems, the pumps should alternate between lead and lag pumps and cycle off when the floats are dropped.

NOTE: *An "On/Off" float works differently than a pair of "On" and "Off" floats. Verify the type of floats in your system before testing.*

 - d. Lower the float assembly into the tank and clip the float assembly into the float bracket.
 - Timed dose:
 - a. Toggle the "AUTO-OFF-MAN" switch to the "AUTO" position.
 - b. Record the timer settings, then reduce the timer settings to 0.5 minutes "OFF," 0.5 minutes "ON," and 1.0 minutes "OVR OFF."
 - c. Let the pump run through several cycles to confirm that the timers are operating correctly.
 - d. Change the timer settings back to the settings specified by the engineer.

Inspection Points – System Timer Settings

1. **Recirc Timer Settings:** The method for calculating Recirculation/ Blend Tank timer settings is provided below. Newer AX100 panels have the ability to adjust the timer setting based on actual flow data. See the instructions included with the control panel for setting information.

- Pump On Time = 1.5 Minutes

NOTE: *The standard Pump On Time for AX100 units is 1.5 minutes. Your system's needs may differ. Consult your site plans, engineer/designer, or Orenco for more details.*

- Pump Off time = (1440 ÷ Cycles per Day) - Pump On Time
- Calculate Cycles per Day using the equation below:

$$\frac{(\text{Average Daily Flow}) \times (\text{Recirc Ratio})}{(\text{Pump Flow Rate}) \times (\text{Pumps per Dose}) \times (\text{Pump On Time})}$$

NOTES:

- 1440 is the number of available minutes in a 24-hour period.
- The standard Recirc Ratio for AX100 units is 4 but it can range from 2 to 6, depending on the needs of the system.
- The Pump Flow Rate is 48 gallons per minute (3 L/sec) when nozzle pressure measures 3.0 psi (20.6 kPa).

2. **Discharge Timer Settings (Timed Dose Systems) :** The timer settings for the system are calculated based on the actual and expected flow. Equations are provided below.
 - a. Identify Dose Volume
 - Dose Volume = Number of gallons desired per dose
or
 - Dose Volume = (Number of Orifices) × (Loading Rate per Orifice)
 - b. Identify Doses per Day
 - Number of doses per day = (Design Flow) ÷ (Dose Volume)
 - c. Identify Time Interval Between Starts, in hours
 - Time Interval Between Starts = (Hours per Day) ÷ (Doses per Day)
 - d. Identify Time On, in minutes
 - Time On = (Dose Volume) ÷ (Measured Pump gpm)

Inspection Points (continued)

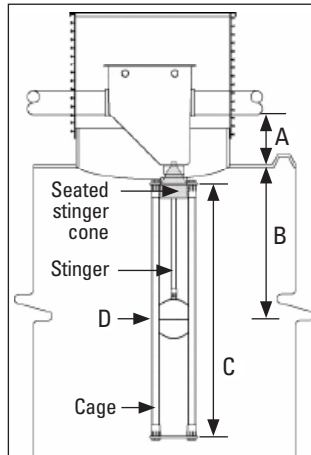
Inspection Points – Recirculation/ Blend Tank

Complete all of the inspections and checks described in the “Inspection Points – Tanks and Basins” section of this manual and then verify that the inspection points below are as follows:

1. **Recirc valve:** Verify the recirc valve is set so that the maximum water level in the tank matches the maximum liquid level as specified by the engineer. If the maximum liquid level is not on the plans, a general rule is to set it at 80% of the tank depth for straight-walled tanks or 80% of tank volume for curve-walled tanks.

2. **Stinger length:** Adjust the length of the recirc valve stinger based on installation instructions.

- a. Calculate the necessary stinger length adjustment using the equation $(A+B)-16"$ or $(A+B)-406$ mm, where A is the distance from the MM valve invert to the top of the tank and B is the distance from the top of the tank to the 100% discharge level. If the stinger needs to be lengthened to near or beyond the length of the cage, the cage will also need lengthening.



- b. Stinger Adjustment Dimensions:

- A = Distance from invert of MM valve to top of tank
- B = Distance from top of tank to the liquid level where 100% bypass is desired, typically 80% of the tank's volume
- C = Standard cage length: MM4 49 inches (1245 mm), fits stingers up to 36 inches (914 mm); MM6 57 inches (1448 mm), fits stingers up to 40 inches (1016 mm)
- D = Middle of ball (at the 100% discharge level)

NOTE: There should be a minimum of 9 inches (229 mm) from the normal liquid level to the “RO” float.

Inspection Points – AdvanTex® Filter Pods

Your system may include AX100 filter pods (shown) or AX20 filter pods. For AX20 inspection points, see the residential *Installation Manual* and residential *AdvanTex O&M Manual*, provided in Appendix B.

1. Installation

inspection: Verify the AX100 pod has been properly installed. Improper installation is usually indicated by the conditions listed below:



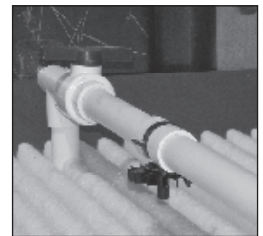
- **Sidewall bowing** — Check for any sidewall bowing in the pod. The bowing may cause excessive spacing between media sheets. If the spacing between the media sheets exceeds ½-inch (13 mm), cut the fiberglass rods for the correct media sheet spacing.
- **Lid misalignment** — Lid bolts will only go into the holes if the lid is lifted slightly and the bolts are partially inserted prior to closing the lid.

2. **Manifolds and Laterals:** Flush the manifolds and laterals. See the *AX100 Treatment Systems Installation Manual and Field Maintenance Report Form* in

Appendix B for more information.

For proper operation after flushing the manifolds and laterals, turn the ball valves to their correct positions and turn the spray nozzle turbines to point down.

3. **System Pressure:** Verify the pressure gauge is set to zero. If it is not, open the seal at the top and let the pressure equalize with atmosphere. Install the pressure gauge, turn on the recirc pumps, and set to 3.0 psi (20.6 kPa).



NOTE: On systems plumbed in parallel, adjust the pressure in all three pods at the same time to 3.0 psi (20.6 kPa) using the gate valve on the pod manifold.

4. **Pod drainage:** Verify that the pod drains easily. If the pod does not drain, check to see if the shipping plug has been removed from the pod outlet.
5. **Lid bolt installation:** When you have finished inspecting all pods, remove the pressure gauge and secure the lids on the pods with the included lid bolts.

Inspection Points (continued)

Inspection Points – Vent Fan Assembly

A current sensor monitors the vent fan operation. If the fan fails, this sensor will open and activate an alarm. Some vent fan assemblies are equipped with optional heater units for reliable performance in cold weather. Check your system plans to determine if your vent fan assembly includes a heater.



1. **Current sensor operation:** To test the current sensor, switch off the power to the fan and verify the visual alarm on the control panel is activated.

NOTE: TCOM control panels have a 12-hour delay in the audible alarm for the current sensor.

2. **Optional heater unit:** There are two types of heater unit controls available for vent fan assemblies: a single set-point style and a multiple set-point style. If your system is equipped with an optional heater unit, check your system plans to determine the type of heater included in the vent fan assembly.
 - Single set point — Locate the heater inside the vent fan assembly enclosure, remove the heater cover in the vent fan assembly, and set the thermostat to 43° F (6° C).
 - Multiple set points — In the control panel, set the “Heater On” point at 35° F (1.6 °C), “Heater Off” point to 45° F (7.2 °C), “Fan On” point to 35° F (1.6 °C), and “Fan Off” point to 25° F (-3.8 °C).

Inspection Points – Distribution Valve

To verify that the distribution valve is operational, the valve must be hydraulically loaded with the conditions under which it will operate. Use the system plans to find the location of all distribution valves in the system.

1. **Verify liquid level:** Make sure that the tank or basin that you are pumping from has sufficient liquid to perform the test.

WARNING: There is no motor protection in TCOM panels and panels without “RO” alarms. Before running a pump, always verify that there is sufficient liquid in the tank or basin.

2. **Turn on pump:** Toggle the “AUTO-OFF-MAN” switch for the pump that pressurizes the distribution valve to “MAN.”

3. **Leak inspection:** Once the distribution valve is pressurized, inspect the unions on the distribution valve for leaks. Tighten any unions that are leaking.

4. **Operation inspection:** Open and close the ball valve to test the operation of the distribution valve.
 - When the valve is closed and opened, the flow should transition from one leg of the valve to another. Observe the clear section of the leg to verify this transition. There may be flow in more than one leg, but there should only be full flow in one leg at any time.
 - When the ball valve is fully closed, the system will fully pressurize (deadhead condition). Incorrectly installed connections in the line may separate and require reinstallation before testing can be completed.
 - If the distribution valve does not rotate correctly, open the distribution valve and inspect for debris or breakage. If the problem is not a mechanical issue, review the plans for potential installation issues, including elevation.



Housekeeping

1. Verify that all control panels are turned on and all “AUTO-OFF-MAN” switches are toggled to “AUTO.”
2. Close all control panels.
3. Close and bolt down all tank access lids and riser lids.

WARNING: AN UNBOLTED RISER LID OR OPEN TANK IS A SAFETY HAZARD! Tank and riser access lids must be properly secured at all times. If bolts are lost or damaged, contact Orenco immediately for replacements.

4. Police the area for debris and tools.



Maintenance

Tools, Equipment, and Spare Parts List

Many of the recommended maintenance and troubleshooting procedures require specialized tools, equipment, and spare parts. Refer to the residential *AdvanTex O&M Manual*, provided in Appendix B, for a list of items to have on hand.

Record Keeping

Maintain a written log describing all activities relating to the AdvanTex system. This information is very valuable for analysis and trouble shooting if problems should occur. A *Field Service Report Form* and a *Field Maintenance Report Form* are provided in Appendix B for your convenience.



Maintenance Equipment

Safety and Hygiene

- Bleach/water solution
- Eye protection
- Hand cleanser
- Paper towels
- Plastic tarp
- Protective clothing
- Rags
- Rubber gloves
- Trash bags

Routine Inspection and Maintenance

- Biotube® filter cradle (OM-BIOTUBE CRADLE)
- Beakers or bottles
- Calculator
- Channel lock pliers
- Dissolved oxygen (DO) meter or colorimetric ampoules
- 3/16" hex head drill bit
- Drill
- Electrical tester (voltage and amperage)
- Extension cord
- Extra lid bolts
- Laptop with null modem cable (TCOM & VCOM only)

- Hook for raising floats to test them
- pH meter or pH test strips
- Pressure gauge
- Sample bottles
- Sludge and scum measuring device (e.g. Nasco Sludge Judge®) for sludge and Orenco SMUG for scum
- Tape measure
- Telephone for testing dial tone – (TCOM & VCOM only)
- Test strips for nitrate, ammonia, alkalinity
- Turbidity meter
- Watch or stopwatch

Repairs

- Adhesive
- Backflow prevention device
- Extension cord
- Flashlight with spare batteries/bulb
- Float switches
- Hacksaw with spare blades
- Hammer
- Hand tools
- Heat gun (torch)
- Hole saw (vari-bits: 3/4" and 1-3/8")
- Hose with nozzle
- Inspection mirror (e.g. Prototek™ "Mirror on a Stick")
- PVC cement and primer
- PVC fittings
- PVC pipe
- Screwdriver set
- Shovel Snake (building sewer)
- Spare parts for downstream components
- Waterproof wire nuts
- Wire stripping/crimping tool (10 to 22 AWG)
- Wrench (24" or 600 mm pipe wrench)
- Wrench (lid bolt)

Maintenance (continued)

Preventive Maintenance

As with any engineered system, such as a car or heat pump, your wastewater treatment system will work better and last longer if it is regularly maintained by a qualified service provider. The service provider should be present during installation, so he or she is familiar with the system, especially those service lines, conduits, and connections that get buried.

Your system will work better and last longer if you learn what not to put into the treatment system. There should be no disposal of toxics or chemicals into the system, such as restaurant degreasers, cleansers, wax strippers for linoleum, carpet shampoo and its waste products, and other toxics. As a general rule, nothing should go into any wastewater treatment system that hasn't been ingested, other than toilet tissue, mild detergents, and wash water. Every system user and qualified service provider should be familiar with the basic guidelines below:

- No septic additives
- No flammable or toxic products
- No excessive use of household cleaners or chlorine bleach
- No pool or spa products
- No disposing of pharmaceuticals
- No pesticides, herbicides, or agricultural chemicals or fertilizers
- No RV waste (unless the system is specifically designed and engineered to treat such waste)
- No surface runoff and storm water
- No excessive amounts of fats, oils and grease (FOG)
- No food byproducts
- No cigarette butts
- No paper towels, newspapers, sanitary napkins, diapers, disposable wipes, floss, gum or candy wrappers, etc.
- No chlorides or water softener backwash

Preventive maintenance should start with facility user and/or homeowner education. Orenco Systems®, Inc. can provide a manual of Do's and Don'ts to distribute upon request. To request multiple copies of this manual, contact Orenco Systems, Inc. at 1-800-348-9843.

With preventive maintenance and periodic inspections, the wastewater treatment system will function for decades.

Scheduled Maintenance

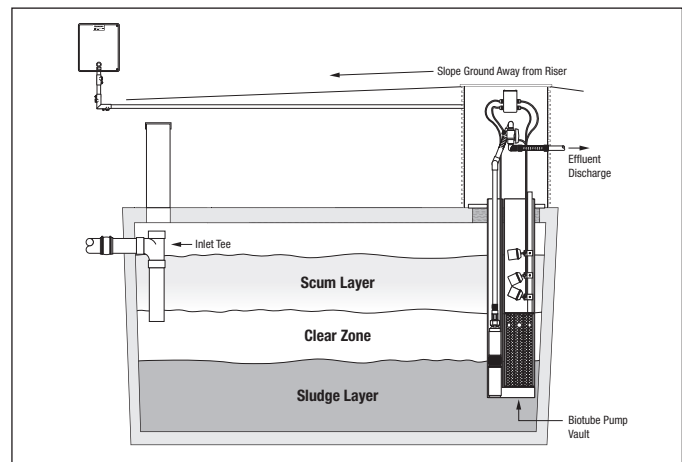
Scheduled maintenance should be performed in the time frames described in this section. A chart showing scheduled maintenance activities and times is included at the end of this section, for your convenience.

Monthly Maintenance

Once a month, during the first year of operation, make a visual inspection of the liquid levels in the septic, recirculation/blend, and dosing tanks. The liquid level should never be lower than the "Redundant Off" float. If liquid leaks out of the tank, the scum layer can drop to the level of the perimeter holes in the pump vaults and cause the screen to plug. A watertight tank is important and any leakage must be corrected.

During the first year of operation, check the Biotube® filter in the septic tank every month and clean when necessary. Follow the applicable instructions found in Appendix B for cleaning Biotube filters.

Once a month, during the first year of operation, the Biotube Pump



Vaults should be examined to determine if cleaning of the Biotube filter is necessary. If the liquid level inside the vault is discernibly different from the level outside the pump vault while the pump is running, cleaning is required. Remove the filter cartridge and clean it following the applicable instructions in Appendix B.

Once a month, read the hour meters and event counters for the recirculating/blend and dosing tank's pumps. Each pump should run approximately the same number of hours and turn on approximately the same number of times as their operating counterpart. If the run times or cycle times differ significantly between pumps, determine the cause of the discrepancy and take corrective measures.

If there is a distributing valve, manually cycle the valve through every outlet to confirm proper operation.

Maintenance (continued)

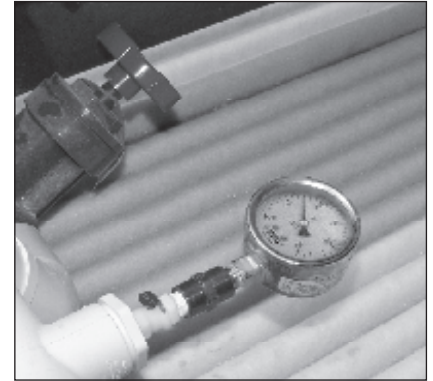
Quarterly Maintenance

Testing for Biochemical Oxygen Demand (BOD₅); Total Suspended Solids (TSS); Fats, Oils, and Grease (FOG); Ammonia (NH₃); Nitrate (NO₃); and pH should be done according to regulatory requirements. If testing is not required by the regulatory jurisdiction, samples should be taken quarterly for the first year to establish a baseline. Subsequent testing after the first year may be reduced based on the establishment of this baseline. Regular samples will provide valuable information for ongoing maintenance and troubleshooting. Effluent testing procedures may be found in the residential *AdvanTex O&M Manual* in Appendix B. All results obtained should be reported to the appropriate people, including Orenco's Engineered Systems Department.

For the first year only, check voltages and amperages of all pumps and record them on the *Field Maintenance Report Form* provided in Appendix B. Refer to the start-up voltages and amperages recorded in the "Start-up & Operation" section of this document. If the voltage drop or the amperage exceeds National Electric Code (NEC) requirements (see chart provided in "Inspection Points —Pumps" section of this document), have an electrician verify the service line and check the pump windings. If there is no discernible difference in voltage or amperage, this procedure may be performed annually.

Semi-Annual Maintenance

Inspect the spray of the nozzles in the AdvanTex pods. Look for reduced or uneven spray patterns as well as clogged spray nozzles or biological growth on the spray nozzles. Observe and measure the residual pressure. Refer back to the Start-up & Operation section for initial



measurements of residual pressure. If the observed residual pressure exceeds the initial residual pressure (3 psi) more than 15-20%, it can be assumed that some of the nozzles are plugged and the laterals require flushing. To flush the laterals, open the ball valves at the end of one lateral. At the control panel, toggle the "AUTO-OFF-MAN" switch to "MAN" and let the pump run to flush any material from the lateral. Repeat for each lateral until all of the laterals have been flushed. Recheck the residual pressure to ensure the laterals have been sufficiently cleared.

If there is still a significant difference in initial and current residual pressure, use an Orenco AX lateral cleaning brush or a high-pressure washer to clean the laterals.

To clean out the spray nozzles, turning the laterals so the spray nozzle turbines are pointed up and then hosing each turbine off. For excessive buildup in the spray nozzles, remove the nozzles and replace them with clean nozzles. Soak the plugged nozzle in TSP or any other approved cleaning agent for 30 minutes. When a spray nozzle is clear, you can see the spray nozzle turbine spin freely and the spray distribute evenly across the textile media. If the nozzles are substantially plugged after six months, then it may be prudent to inspect the residual pressure every three months and adjust scheduled testing and flushing of the laterals accordingly.

Visually inspect the recirculating valve and verify that the liquid level in the tank is within the normal range. Consult the design plans for proper operating level. If the liquid level is low, the ball mechanism could be jammed in the seated position. Remove, disassemble, and inspect. If the liquid level is high, the valve may require cleaning because it is not making a tight seal when seated. Remove, disassemble, and inspect.

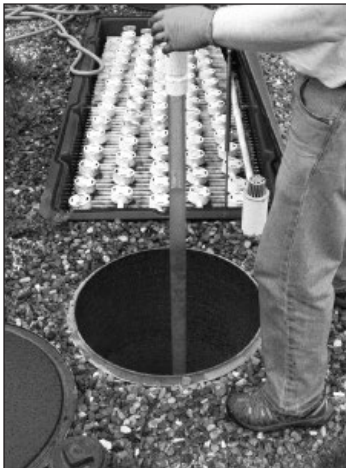
Maintenance (continued)

Annual Maintenance

Measure the scum and sludge accumulation in all tanks annually. Record scum and sludge measurements on a *Field Maintenance Report Form*.

1. Measuring the scum layer: Using a scum utility measuring gauge or similar tool, measure the thickness of the scum layer. With this measurement, determine if the distance from the bottom of the scum layer at the liquid's lowest normal level to the bottom of the outlet tee or to the top of the inlet holes for the pump vault is 3 inches (76 mm) or less. If so, it's time to pump out the contents from the tank (scum, sludge, and liquid) completely. After removing the septage contents from the tank, refill it with water to its normal operating level.

2. Measuring the sludge layer: Using a Sludge Judge® or similar tool, measure the thickness of the sludge layer. With this measurement, determine if the distance from the top surface of the sludge to the bottom of the outlet tee or inlet holes for the pump vault (PVU) is 6 inches (152 mm) or less. If so, again, it's time to pump out the contents from the tank (scum, sludge, and liquid) completely. If the tank is fitted with a pump vault or effluent filter discharge assembly, take the measurement from the top surface of the sludge layer to the bottom of the vault's inlet ports. After removing the septage from the tank, refill it with water to its normal operating level.



NOTE: Turn the laterals in the AdvanTex® treatment unit 180 degrees (so the spray nozzle turbines face up) prior to flushing to prevent nozzle clogging while material is being pushed along the lateral to the flushing valve.

Once a year, send copies of the complete activity log to the appropriate person. This information is very valuable for analysis and troubleshooting if problems should occur.

Check voltages and amperages of all pumps and record them on a *Field Maintenance Report Form*. Refer to the start-up voltages and amperages recorded in the "Start-up & Operation" section of this document. If the voltage drop or amperage exceeds NEC requirements, have an electrician verify the service line and check pump windings.

The pumping system should be inspected annually to ensure it is operating properly. Unscrew the stainless steel bolts that fasten the fiberglass lid over the pumping equipment. Remove the fiberglass lid for an inspection that includes these steps:

- Verify there are no obvious holes or leaks in the riser or around the perimeter of the riser connection to the tank. Wetness or watermarks may be an indication of weeping.
- Inspect the splice box to ensure it is free of water. Ensure the lid and connections are secure.
- Verify the floats are in good condition and properly secured to the float tree. Verify the float cords are neatly wrapped inside the riser so that they cannot interfere with the operation of the floats.
- Verify float operation. Refer to the float tests in the "Start-up & Operation" section of this document.

All TCOM control panels contain a lithium battery for backup. For good measure, we recommend you replace the battery every two years. Refer to "Battery Replacement" in the *Custom TCOM Control Panels and HyperTerminal Access Manual*, provided in Appendix F.

Maintenance (continued)

Scheduled Maintenance Reference Chart

NOTE: All designer specifications and local regulatory requirements should be followed. This table provides Orenco's minimum recommended guidelines.

Scheduled Maintenance Reference Chart		Recommended Activity Period				
		Monthly	Quarterly	Semi-annually	Annually	Biannually
Activity	Visual Inspection of Tank Liquid Levels	● ¹	●			
	Check Biotube® Effluent Filters; Clean as Required	● ¹	●			
	Check Biotube® Pump Vault Filters; Clean as Required	● ¹	●			
	Record Elapsed Time Meters and Event Counters for All Pumps	●				
	Confirm Proper Operation of Automatic Distributing Valve (if applicable)	●				
	Sample Influent and Effluent Quality Parameters ²		● ¹	●		
	Confirm and Record Pump Voltages and Amperages		● ¹		●	
	Inspect Distribution of Effluent in AdvanTex Pods; Clean as Required			●		
	Measure Inlet or Residual Pressures to AdvanTex Pods; Clean as Required			●		
	Inspect Recirculating Valve			●		
	Record Scum and Sludge Accumulation in Tanks				●	
	Flush Distribution Laterals in AdvanTex Pods				●	
	Inspect Pumping System Components; Clean as Required				●	
	Replace Lithium Battery in TCOM Control Panel (if applicable)					●

¹ This maintenance schedule is only required during the first year of system operation.

² Recommended guidelines only. Sampling should be scheduled according to regulatory requirements.

Maintenance (continued)

Corrective Maintenance

An alarm is triggered when the liquid in the tank reaches a level that is either higher or lower than it should be, under normal operating conditions.

When responding to an alarm, first discern the type of alarm being activated. If it is due to pump failure, test each pump manually and locate the failed pump. To replace the pump, see the “Removing & Replacing Inoperative Pumps” section of this document. Remove the access riser lid and visually inspect the liquid level. If a high liquid level or low liquid level has caused the alarm, follow the appropriate procedures below.

High Liquid Level Alarm

1. Determine if the high water alarm is from higher than expected usage (i.e., special event, etc.). If there is a long-term increase in flows, then timer settings need to be adjusted accordingly.
2. When a high liquid level condition exists, the source of the problem is likely to be one of the following:
 - a. Poor valve seal – Consult the design plans for proper operating level and visually inspect the recirculating valve to verify the liquid level in the tank is within the normal range. If the liquid level is high, the valve may require cleaning because it is not making a tight seal when seated. Remove, disassemble, and inspect.
 - b. Control panel breakers tripped – Check the circuit breakers, switches, and fuses in the system control panel. If separate breakers in the main panel were used for the pumps and controls, also check these breakers. If a breaker is found to be tripped, reset the breaker. If the breaker trips immediately, check the wiring for a short or bad breaker. If the breaker or breakers don't trip again, then the problem has probably been found or has corrected itself. Test the automatic function of the system as shown in the “Start-up & Operation” section of this manual to verify proper operation.
 - c. Faulty floats – If, after checking the circuit breakers, fuses, and switches, the pump still does not operate, toggle the “AUTO-OFF-MAN” switch to “MAN.” If the pump engages, the problem is likely to be in the float system. (If the motor contactor engages but the pump doesn't run, go to step g, “Water in splice box or loose wires.”) Pump the tank down to a level below the “Override Timer On/Off” float. Cycle the pump to simulate the timer on and off periods so the effluent is dosed to different zones of the AdvanTex® system. Toggle the “AUTO-OFF-MAN” switch to “AUTO.” Do not leave a pump in the “MAN” position unattended. If you do, the pump can continue to operate without liquid, possibly drawing solids into the filter and causing potential failures. Isolate the float switches and check to ensure all floats are operating properly. If a float is found to be faulty, refer to the “Removing & Replacing Inoperative Floats” section in this document.
 - d. Pump clogged or not clean – Check the pump for discharge flow. Close the ball valve, disconnect the union in the discharge plumbing assembly and turn the union so it is facing down. Engage the pump and visually inspect the approximate flow rate being discharged. If you are unsure of the discharge rate, measure the time it takes to fill a five-gallon bucket with the discharge. Check this value against the appropriate pump curve. If the flow rate is insufficient, the pump may need to be cleaned. Refer to the *Pump Repair Manual* provided in Appendix D.
 - e. Valves closed – If the pump operates in the proper flow range, check all downstream valves to ensure that they are in the open position. If the valves are all open, test the discharge pressure of the pump. For proper pump testing methods, refer to the *Pump Repair Manual* provided in Appendix D.

IMPORTANT! Before doing any work on either the wiring to the level control floats and pump or inside the pump control panel, switch off the power to the system at the service entrance panel and set the circuit breakers in the panel to their “OFF” positions.

Maintenance (continued)

- f. Pump failure or bad electrical connection – Check the panel to verify the motor contactor engages. If it engages but the pump doesn't operate, then it is either a pump failure or a bad electrical connection.
- g. Water in splice box or loose wires – Remove the access riser lid and the stainless steel screws from the splice box lid, being careful not to drop the screws into the tank. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove the water with a baster, sponge, or other appropriate method. Carefully check the splices to ensure they are intact and remain watertight. If all splices are found to be watertight, replace the splice box lid. In the control panel, carefully tug on each wire going to the splice box. Correct any wires that are loose. Reactivate and retest the system.
- h. Leaks in tank or system – If the system operates but can't keep up with the flow, check the system for watertightness. A leaking tank can infiltrate enough water to overcome the pump. Also check for leaking fixtures in the facility or home, though it is unlikely a leaky fixture could provide enough liquid to overcome the pump.
- c. Tank leaks – If the hydraulics of the system do not allow for siphoning, it is likely that the tank is leaking. Fill the tank to a normal operating level and return to inspect the tank at a later time. If the liquid level is below the normal operating level, the tank is leaking and needs to be repaired or replaced.
- d. Clogged pump vault cartridge – If the pump vault cartridge is clogged, the pump may be high cycling, causing the liquid level in the vault to drop faster than the liquid level in the tank. Remove the filter cartridge and clean it in accordance with the instructions provided in Appendix B.

Removing & Replacing Inoperative Floats

IMPORTANT! Before doing any work on either the wiring to the level control floats and pump or inside the control panel, switch off the power to the system at the service entrance panel and set the circuit breakers in the panel to their "OFF" positions.

Low Liquid Level Alarm

1. Determine the actual flows in the system. If the flows are considerably less than the timer is set for, then adjust the timer settings to match current flows. If a low level exists in the drainfield pump basin, then ensure the minimum run time is appropriately set.
2. When a low liquid level condition exists, the source of the problem is likely to be one of the following:
 - a. Ball valve mechanism jammed – Visually inspect the recirculating valve and verify the liquid level in the tank is within the normal range. Consult the design plans for proper operating level. If low, the ball mechanism could be jammed in the seated position. Remove, disassemble, and inspect.
 - b. Tank siphoning – Inspect the liquid level in the tank. If the liquid level is below the "Redundant Off/Low Level Alarm" float, then it is likely that the problem is either a leaky tank or siphoning. Siphoning typically occurs when the system is pumping downhill. A system will not necessarily siphon every time it operates. It is dependent on the system design. A siphoning system can be retrofitted with an anti-siphon valve. Most siphoning problems will manifest in the first months of operation.
1. Remove the float assembly from the vault. There is no need to move the settings of the floats to remove and replace a float. After noting the tether length, snap the inoperative float out of the holding collar.
2. Remove the stainless steel screws from the splice box lid, being careful not to drop the screws into the tank. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove water with a baster, sponge, or other appropriate method. Loosen the cord grip at the splice box and identify the appropriate splice for the float. Cut out the splice and, if using a watertight wire nut for the common wires, remove the appropriate common wire.
3. Remove the inoperative float and replace it with a new one. Push the float cable through the watertight cord grip into the electrical splice box. Leave an adequate length of electrical cord coiled inside the riser to allow for easy removal of the float assembly. Do not remove the colored markers or the paper tags from the float cords, and do not try to thread the markers and tag through the cord grip. Tighten the cord grip by hand, then test the tightness of the cord grip by tugging on the cord. A cord is secure when the cord grip is tight enough to prevent slippage. An adequate length of cord should be left within the splice box to allow for future disconnecting and re-splicing.

Maintenance (continued)

4. Splice the float wires to the wires from the control panel following the wiring schematics provided in Appendix F. Attach the common wire with the other commons using the waterproof wire nut. It may be necessary to replace this wire nut with a new watertight wire nut. Always use watertight wire nuts or heat shrink splice kits for all connections!
5. Replace the float in the collar, using the same tether length, and return the assembly to the pump vault.
6. Reconnect power and test the unit per the instructions provided in the "Start-up & Operation" section of this manual.
3. Remove the inoperative pump and replace it with a new one of the same type. Push the pump cable through the watertight cord grip into the electrical splice box. Leave an adequate length of electrical cord coiled inside the riser to allow for easy removal of the pump. Tighten the cord grip by hand, not by tool; then test the tightness of the cord grip by tugging on the cord. A cable is secure when the cord grip is tight enough to prevent slippage. An adequate length of cord should be left within the splice box to allow for easy removal for future disconnecting and re-splicing.

Removing & Replacing Inoperative Pumps

IMPORTANT! *Before doing any work on either the wiring to the level control floats and pump or inside the control panel, switch off the power to the system at the service entrance panel and set the circuit breakers in the panel to their "OFF" positions.*

1. Close the ball valve on the discharge plumbing assembly, disconnect the union, and carefully remove the pump and attached plumbing from the tank. Disconnect the pump from the discharge plumbing assembly.
2. Remove the stainless steel screws from the splice box lid, being careful not to drop the screws into the tank. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove the water with a baster, sponge, or other appropriate method. Loosen the cord grip at the splice box and identify the appropriate splice for the pump. Cut out the splices and label the wires.
4. Splice the pump wires to the appropriate wires from the control panel following the wiring schematics provided in Appendix F. Always use watertight wire nuts or heat shrink splice kits for all connections!
5. Reattach the discharge plumbing assembly and carefully lower the pump into the flow inducer alongside the Biotube® pump vault. Be careful not to lower the pump by the cable or to pinch the cable when lowering it into the flow inducer. Reconnect the union and open the ball valve.
6. Reconnect power and test the unit per the instructions provided in the "Start-up & Operation" section of this manual.

