

OPERATION & MAINTENANCE MANUAL

AdvanTex Treatment Systems



*For Service Providers of
Residential AdvanTex® Treatment Systems
and for Homeowner Reference*

*Another Carefully Engineered
Treatment System by:*



Orenco Systems®
Incorporated

*Changing the Way the
World Does Wastewater®*

**800-348-9843
www.orenco.com**



Your Expertise Matters

As the operator and service provider of an onsite wastewater treatment system, you play a crucial role. Property owners, neighbors, regulators, dealers, manufacturers ... all rely on your efficient and effective work.

All onsite systems require servicing, from the simplest of standard stone-trench systems to the most complex tertiary treatment systems. Regular servicing optimizes the treatment process and ensures that onsite systems are a sustainable technology.

To make servicing easier, Orenco has configured the AdvanTex® Treatment System and its components to be one of the most trouble-free and service-friendly residential treatment systems on the market. We've also provided this O&M Manual. In it, you'll find valuable information about . . .

- The AdvanTex System's configuration and treatment process
- Performance expectations (norms) at each stage in the treatment process
- System components
- Routine cleaning and maintenance procedures and frequencies
- Routine cleaning and maintenance checklist
- Testing procedures
- Troubleshooting tips
- Sample documentation
- Equipment and tools checklist

Operation and maintenance of an onsite treatment system requires an understanding of all the above information. So please read through this entire manual first, before providing any service. Then write in the Record of System Facts, on the back page. Reading the manual first and maintaining up-to-date records will save everyone time and money in the long run.

Also, at start-up and periodically thereafter, we recommend that you get together with the system user to review the *Homeowner's Manual* that comes with the system, especially the "Do's and Don'ts." This will educate the user on preventive maintenance and on the operating and maintenance responsibilities of system users and authorized personnel, as well as service-related obligations of the manufacturer. Meeting periodically with the user will also allow you to track any significant changes in the household (e.g., number of occupants, changes in water use, use of detergents, disposal of cleaning compounds, etc.).

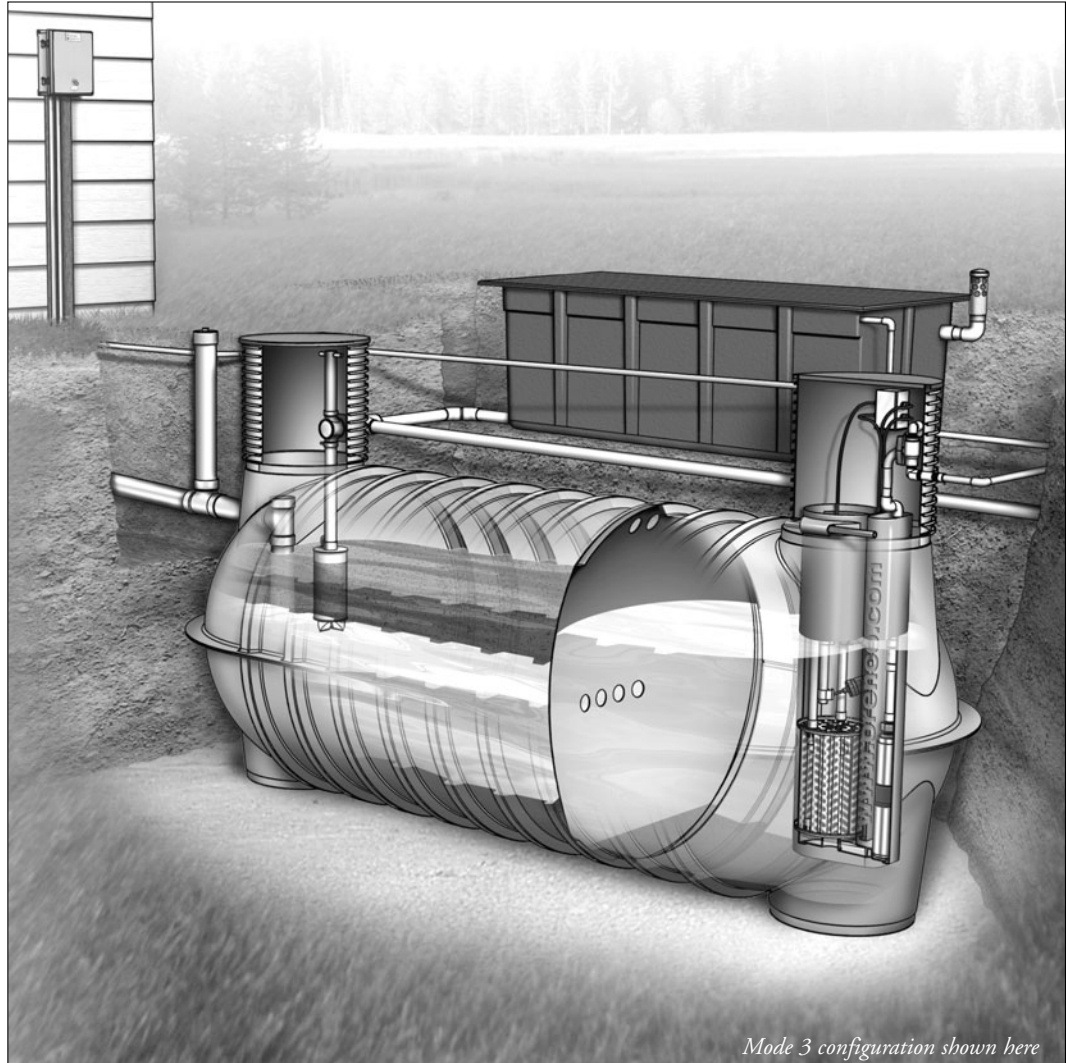
We're very proud of the AdvanTex Treatment System. Like all our products, it has gone through extensive research, development, and field-testing. Then each component is built to written specifications and subjected to quality review, before shipping. In addition, our AXN models meet the requirements of ANSI-NSF Standard 40 for Class I Systems. If any component of this System does not meet your expectations, please call your authorized AdvanTex Dealer.

AdvanTex® Treatment Systems

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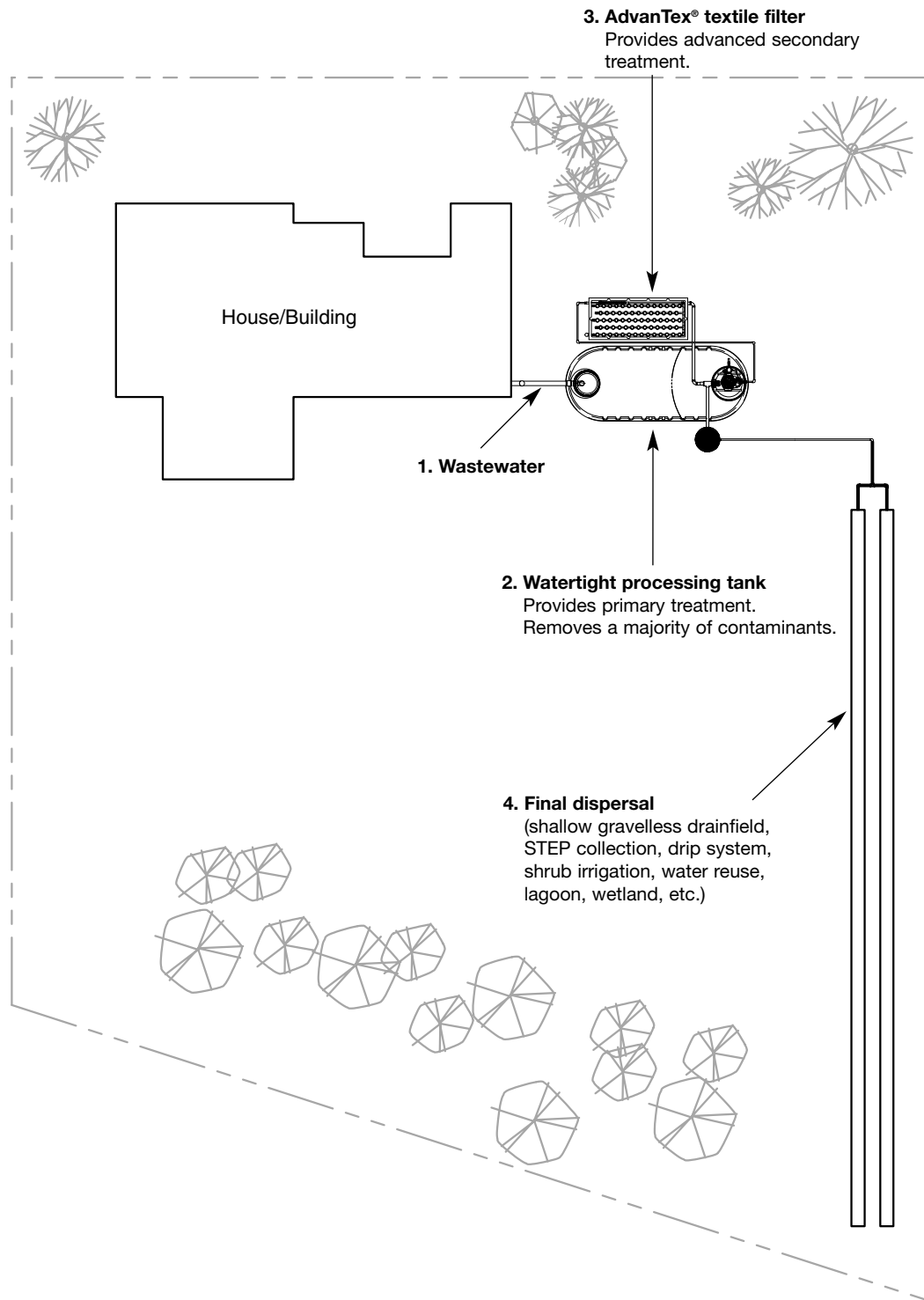
Typical System Configuration



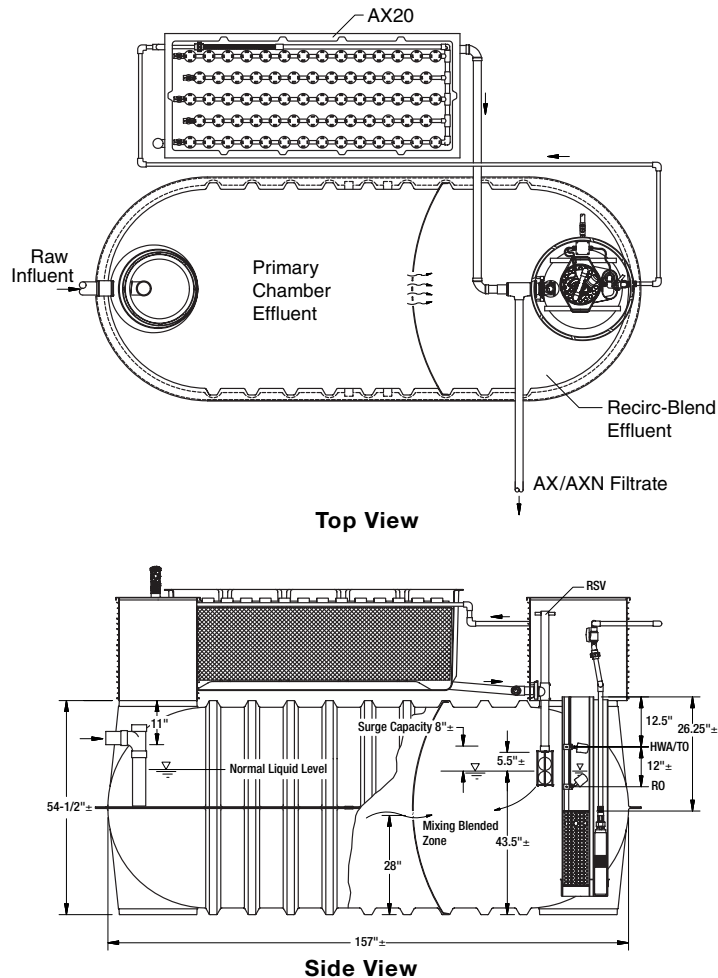
Mode 3 configuration shown here

This 3D illustration shows a typical backyard configuration for the key elements of an AdvanTex® Treatment System, using an AX20 textile filter, which can be neatly positioned on top of or adjacent to the processing tank.

Typical System Configuration: Plan View



Treatment Process/Performance Expectations



Processing Tank

The processing tank provides primary wastewater treatment. The 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.

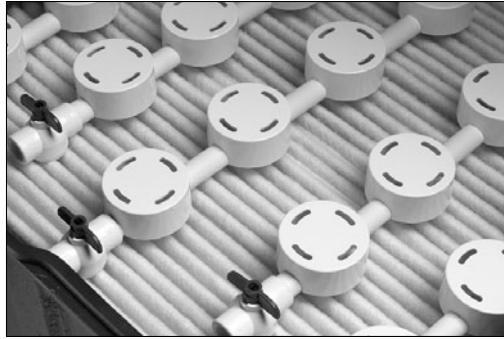
The tank operates as a plug-flow type of reactor (fluid and particles enter and exit the tank in progressive sequence). Wastewater separates into three distinct layers: a floating scum layer, a bottom sludge layer, and a clear zone in between, which is relatively free of large solids. A pump vault with effluent filter located at the outlet end of the tank draws liquid effluent from the clear zone, and the filtered effluent is dosed to the next step in the treatment process . . . the AdvanTex Textile Filter.

Because the AdvanTex Treatment System operates in the recirculating mode, the filtrate from the Textile Filter returns to the processing tank in one of two ways: to the back (outlet end) of the tank in Mode 1 and to the front (inlet end) of the tank in Mode 3. This plumbing configuration affects effluent quality. Effluent quality is also contingent upon a number of other conditions inside the tank:

- strength and characteristics of incoming waste (see "Raw Influent," page 7)
- average flows within design range (typically 40-60 gallons per person per day)
- adequate long-term solids retention for thorough digestion
- watertightness of tank (for proper stratification of incoming waste to prevent treatment short circuiting and hydraulic overloading)
- proper size of tank (for minimum 24-hour hydraulic retention time through the tank's clear zone, at average flow rates and when sludge and scum are developed fully)

If the above conditions are met, you can expect treatment performance per the table on page 7.

Treatment Process/Performance Expectations (continued)



AdvanTex Textile Filter

The AdvanTex textile filter provides secondary wastewater treatment. The filter is a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent textile material treats a tremendous amount of wastewater in a small space.

The AdvanTex filter operates in the recirculating mode, just like a recirculating sand or gravel filter, but loading rates are typically 5-20 times higher, for a number of reasons. For one thing, the textile media has a very large surface area—about 5 times greater than that of an equivalent volume of sand. Textile also has a greater void volume (for free flow of oxygen) and greater water-holding capacity.

Wastewater percolates both through and between the textile media. A visible biological film normally develops on the filter medium within a few days. BOD₅ and TSS reductions occur almost immediately.

Within the filter, aerobic conditions exist that are ideal for microbes that convert ammonia to nitrate (nitrification). Other conditions exist, too, that result in further nitrogen reduction within the media. Some AdvanTex filters are configured (Mode 3) so that the filtrate recirculates back to the high-carbon, low-oxygen environment at the inlet end of the processing tank, which is ideal for microbes that reduce nitrates to nitrogen gas (denitrification). Harmless nitrogen gas is then released freely back into the atmosphere. The

acclimation period for nitrification may range from four to eight weeks, or longer in colder climates.

AdvanTex filtrate effluent quality is dependent upon proper management of the recirc/blend effluent flowing into the filter (which, in turn, is dependent on the conditions described on the previous page). If proper conditions are met, and with typical average daily flows of 40-60 gallons per capita per day, you can expect the following treatment performance:

Performance Expectations

	BOD ₅ mg/L	TSS mg/L	TKN mg/L
Raw Influent¹	450	500	70
Primary Chamber Effluent	150	40	65
Processing Tank Recirc/Blend Effluent²	15-40	10-20	— ⁴
AXN Filtrate³	5	5	— ⁴

¹ Source: Crites & Tchobanoglous. *Small and Decentralized Wastewater Management Systems*, p. 180, 183, 1998. McGraw-Hill. Based on 50 gpcd.

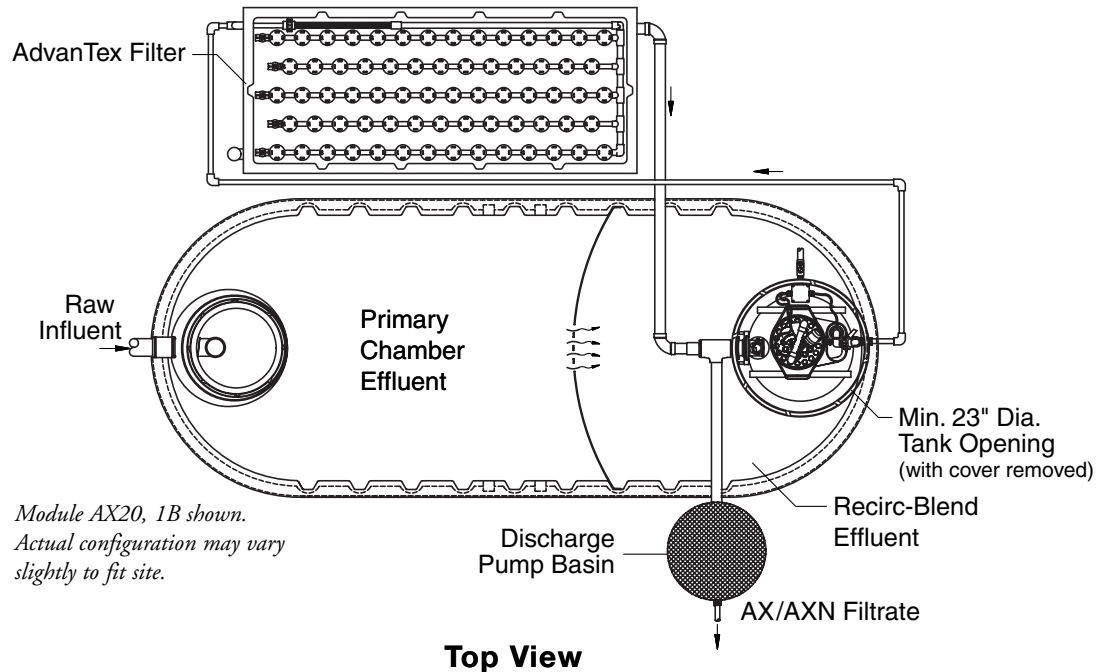
² Will vary with recirc ratios and mode configuration. The numbers here represent a recirc ratio between 2:1 and 4:1 and are derived from Orenco and third-party testing in Mode 1.

³ Actual performance results, based on a six-month accumulative average from NSF (National Sanitation Foundation) testing on the AX20N at 500 gpd, using composite sampling. See page 17 for additional information on treatment performance.

Performance and servicing frequencies will tend to vary relative to the mass load being treated. Procedures for treating excessively high loads will require engineering review. For more information, please review AdvanTex Design Criteria.

⁴ Dependent on treatment system configuration and recirc ratios.

Typical Materials List



Orenco's AdvanTex Treatment Systems come in multiple models and configurations. Following is a typical materials list (excluding the processing tank) for an AdvanTex AX20 system that requires a pump basin (some do not).

Processing Tank Access Equipment

Two Access Risers necessary:

One 24" dia., w/Lid

One 30" dia., w/Lid & necessary Grommets

Treatment System Equipment

PVC Splice Box

Universal Biotube® Pump Vault

Discharge Assembly

Float Switch Assembly

Orenco Pump, 115V

MVP or VCOM AdvanTex AXB Panel, 115V

Recirculating Splitter Valve Assembly

AdvanTex AX20 Filter (7.5' x 3' x 2.5')

w/Vent Assembly

Anti-Flotation Flanges

Pump Basin Equipment

PVC Pump Basin, 24" dia., w/Lid

PVC Splice Box

Discharge Assembly

Float Switch Assembly

Orenco Pump, 115V

Tools, Equipment, and Spare Parts List

Many of the recommended maintenance and troubleshooting procedures require specialized tools, equipment, and spare parts. At a minimum, we recommend you keep the following items on hand:

Tools and Equipment

anemometer (call for information)

beakers or bottles

camera (preferably digital)

calculator

channel lock pliers—6" and 12"

crimping tool—10 to 22 AWG

drill (cordless, with spare batteries, charger)

drill bit set—1/16" to 1/2"

electrical tester (voltage and amperage)

extension cord

flashlight with spare batteries/bulb

funnel

hacksaw with spare blades

hammer

heat gun (torch)

hole saw (vari-bits: 3/4" and 1-3/8")

hose with nozzle and backflow prevention device

pencil

Mirror on a Stick (available from Prototek)

pressure gauge (0 to 100 psi, 0 to 200 psi)

backpack pressure washer (portable)

screwdriver set (straight blade and Phillips)

shovel

SMUG device

snake (building sewer)

squirt-height gauge

stir sticks

tape measure

watch or stopwatch

wire strippers

wrench (24" pipe wrench)

wrench (lid bolt)

30 gal. garbage can

30 gal. garbage bags

Spare Parts

control panel parts:

— breakers

— contactors

fuses

epoxy

floats

heat shrink tubing

insulated butt connectors

king connectors

lid bolts

PVC fittings (3/4" to 2")

PVC glue/primer

PVC pipe (3/4" to 2")

Hygiene and Clean-Up

bleach/water solution

hand cleanser

paper towels

protective clothing

eye protection

rubber gloves

towels and rags

Miscellaneous

Patience and good humor!

Routine Cleaning & Maintenance Procedures

Orenco Systems requires regular inspection and maintenance of AdvanTex Treatment Systems as a condition of purchase. All activities are to be performed three-to-six months after system start-up; and an annual field-service inspection, including sampling, is to be scheduled in late spring or in early summer. For AXN systems, there is to be a minimum of four inspections during the first two years, and then annual inspections thereafter.

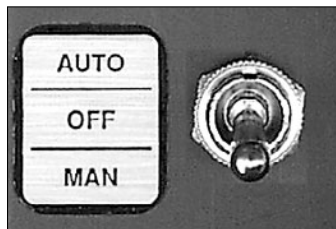
Following is a list of the routine cleaning and maintenance procedures we recommend or require. Failure to provide required maintenance will void the AdvanTex Treatment System warranty.

Copies of inspection and maintenance reports, along with any additional documentation, must be forwarded to and retained by the Authorized AdvanTex Treatment System Dealer who sold the system. If there is no Dealer, then the documentation must be forwarded to Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, OR 97479, ATTN: Systems Engineering.

Control Panel/Pumps/Alarms

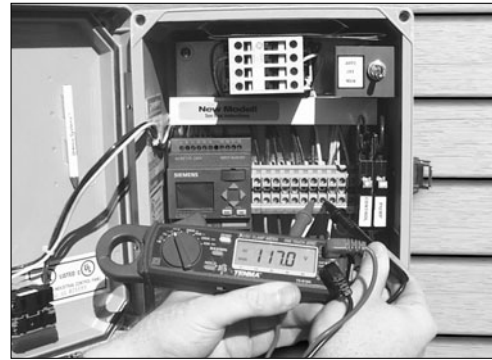
WARNING: Only qualified/certified electricians or service providers should perform maintenance on electrical equipment.

1 Check pump operations. Place the MOA switch (Manual, Off, Automatic) to Manual and make sure the pump runs. Then switch back to Automatic and continue to check the automatic operation of the alarm floats, the recirc timer on the floats, the discharge timer on/off, and timer overrides. Refer to the installation, operation, and setting instructions for the control panel that comes with the system. A set of instructions is stored in a plastic pocket on the inside of the panel door.*



NOTE:
Be sure to set the MOA switch back to Auto after testing.

2 Check voltages and motor run amps and record them on the Field Maintenance Report Form. If the voltage drop exceeds National Electric Code (NEC) requirements, have an electrician verify the service line and check pump windings.



3 Verify that the programmable timer settings for all pumps are correct. With MVP panels, you can check timer settings using the digital timer's function keys and large LCD display. With VeriComm® panels (shown here), you can check timer settings online or at the panel, using a laptop computer or PDA. If the timer settings have been changed, the current setting and date of change should be written on your Timer Setting Instructions and Record of System Facts, at the back of this Manual. Place the date and your initials by the recorded change. Appendix 3 gives typical timer settings for households of various sizes.



*If the instructions are missing, you can obtain another set from Orenco's online Document Library, at www.orenco.com, or by calling Orenco at 800-348-9843, or by calling your local AdvanTex Dealer.

4 Read and record the elapsed time meter (ETM) and cycle counter (CT) values (from the panel's logic controller or from the Web-based telemetry software) on the Field Maintenance Report Form.

ETMs and CTs are valuable troubleshooting tools if problems occur with the system. ETM and CT data signal high water usage, low water usage or tank leakage, and excessive pumping, among other operating situations.



5 Confirm operation of audible and visual alarms per the installation, operation, and setting instructions for the control panel that comes with the system.

Pumping System

Pump systems should be inspected annually to ensure that they are 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:

1 Verify that there are no obvious holes or leaks in the riser or around the perimeter of the riser connection to the tank. Wetness or water marks may be an indication of weeping.

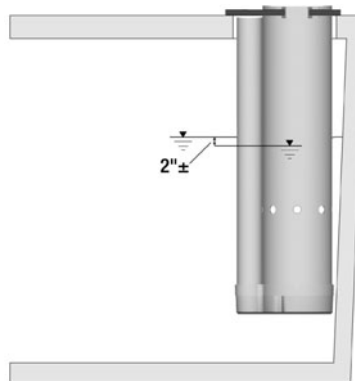
2 Inspect splice box to ensure lid and connections are secure.

3 Verify that floats are in good condition and properly secured to the float tree. Verify that float cords are neatly wrapped inside the riser so that they cannot interfere with the operation of the floats.



4 Verify float operation. With MOA switch in Automatic, simulate system operation by lifting the floats in the same order that the liquid would lift them (bottom first, top last).

5 Determine whether the Biotube effluent filter needs cleaning by testing the change in the tank's liquid level when the pump is on. Turn the recirc pump on by flipping the MOA switch in the control panel to Manual. **Watch the liquid level inside the screened vault as the pump is running for about 30 seconds to determine if there is any noticeable liquid level differential between it and the tank liquid level.** Return the MOA switch to Auto. When the liquid level difference between the inside and outside of the vault is about two inches or more, or if the low-level alarm is activated, the Biotube cartridge may need to be cleaned.

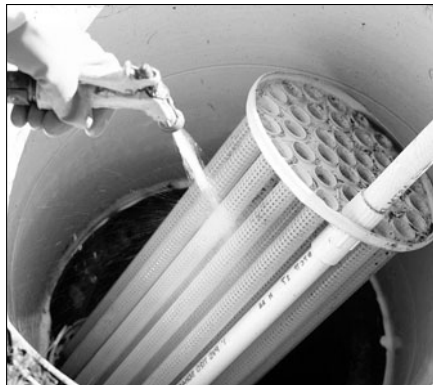


If the Biotube needs cleaning, do the following:

- Turn circuit breaker off at service panel
- Switch MOA and circuit breakers in control panel to “Off”
- Slide Biotube cartridge out of vault
- If necessary, the RSV valve may be removed to allow room in the riser for cleaning the Biotube
 - Pull RSV out of its Quick Disconnect holster (see photo next page) and place it in a plastic trash can
 - Hose off the trash can into the tank after replacing the RSV

NOTE: Refer to RSV installation instructions for details on how an RSV works.

- Hold Biotube cartridge over open inlet of tank or primary compartment
- Carefully spray build-up into tank
- If there are significant solids in vault, remove and clean it too

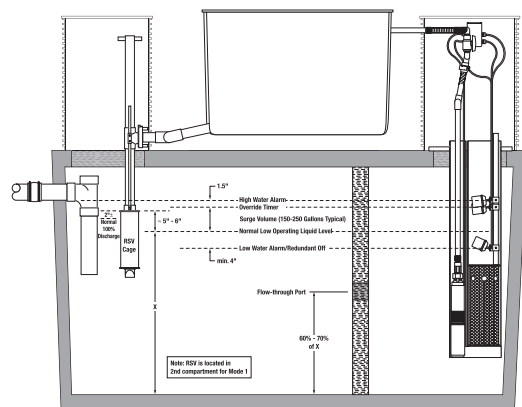


6 Pull the pump and place it on a cleanable surface, like the riser lid, or in a plastic trash can. Check the intake screen; wash off particles as necessary. Record the kinds of particles (cigarette butts, hair, lint, gum, kitty litter, cloth wipes, grease build-up, etc.) on the Field Maintenance Report form. Report findings to user (for education).



7 Visually inspect the Recirculating Splitter Valve and verify that the liquid level in the tank is within the normal range. If low, the ball mechanism could be jammed in the seated position. Remove, disassemble, and inspect. If high, the RSV may require cleaning because it is not making a tight seal when seated. Remove, disassemble, and inspect.

NOTE: The figure below shows the RSV adjacent to the inlet of the processing tank, which is typical for Mode 3 systems (Mode 1 systems have the RSV in the second compartment of the tank — the Recirc Chamber). To read dimensional specifications, see full-sized drawing in Installation Guide, Appendix 2.



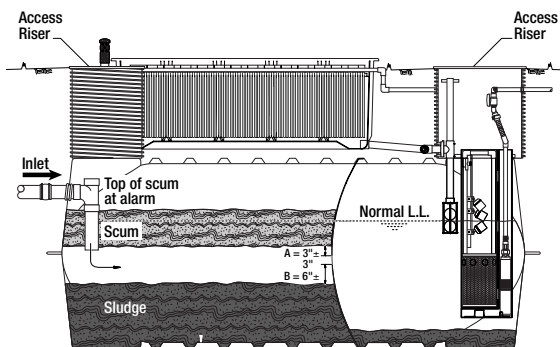
Processing Tank

1 If possible, verify no inlet flow when all household appliances are turned off. Access the inlet inspection port for visual verification of lack of flow. If the inlet inspection port is not readily accessible, then listen for trickling water at the access port. This could indicate faulty fixtures or leaky plumbing. Check building sewer cleanout for flow. If faulty plumbing isn't the problem, the

sound of trickling water could indicate I & I (infiltration and inflow) from ground or surface water. In that case, further investigation is necessary.

2 Inspect the processing tank for the following:

- Liquid depth (should be about 60-70% of the total inside depth of the tank)
- Odor (should be musty, not pungent)
- Color/consistency of scum (should be dark brown with a consistency that varies from dense and crusty to soft and amorphous)
- Effluent characteristics (should be no oily sheen or foam)
- Sludge and scum thickness (records should indicate typical growth accumulation of 1" of scum and 2" of sludge per year for 3-4 occupants)

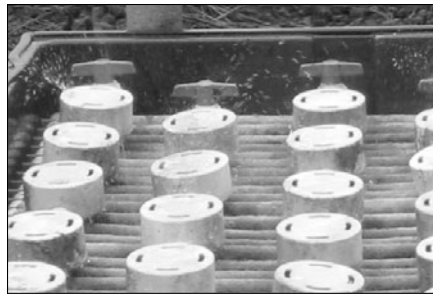


Measurements of solids accumulation help to determine when the septic tank needs pumping. A recommendation for pumping should be made when the bottom of the scum layer is within 3" of the flow-through port of the baffle or when there is an accumulation of sludge to a depth within 6" below the flow-through port. After the first year's measurement of septic tank sludge and scum thickness, measurements need to be taken only about every three years, until the thicknesses approach their maximum depths.

Textile Filter

1 Inspect for ponding.* The filter should not be saturated. Effluent should move freely through the media.

2 While manifold is pressurized, check for proper positioning of orifice shields over each orifice. (See photo, step 3, page 14.)



** If there is ponding in the textile filter because of a build-up of oil and grease, scrape a sample of the biomat and have it analyzed by an environmental lab to determine its characteristic. If there is ponding of indeterminate cause, coupled with a pungent odor, it may be necessary to clean the textile media. (Excessive cleaning will retard nitrification. Only clean as often as necessary.) The textile media hangs in individual sheets, and these sheets can be pulled out for cleaning (if necessary). First, remove the Recirculating Splitter Valve.*

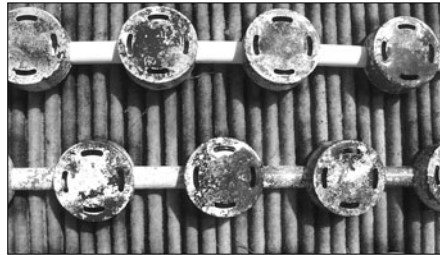


Use a hose with spray nozzle or "low-pressure" pressure-washer, connected to the nearest spigot. Wash the biomat into the underdrain and it will flow back to the tank, as long as the Recirculating Splitter Valve has been removed. When done, replace RSV.



Remember: clean filter only if ponding and odor occur.

3 Verify that there is equal spray on and under all orifice shields. (Each orifice shield should show signs of organic biomat build-up on and underneath it. In this case, a clean orifice shield top is not better!)



4 Check for clogged orifices (orifice shields without spray or biomat build-up underneath). You should be able to observe uniform water droplets dancing around orifice shields while dosing.



5 Assess the character and color of the biomat. If it seems appropriate, take a photo and comment on the growth and characteristics of the biological mat under and around the orifice shields. Biomats are natural and normally appear light-brown to dark-brown and gelatinous in texture. If the mat appears too light (yellowish with the texture of lard, wax, or margarine), the grease and oil concentrations should be checked.

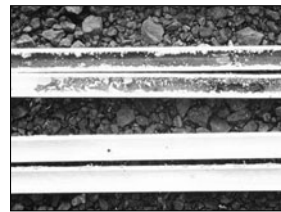
If routine DO measurements show a decrease in DO, the biomat may be retarding oxygen transfer. Make sure there is no ponding or ventilation problem, then clean the sheets if necessary.

6 Check the odor emitting from the filter. If a strong or offensive odor (e.g., smell of rotten eggs, rotten cabbage, etc.) is emitted, measure the DO level in the filtrate and recirculation chamber and adjust the recirc time, if necessary. (Normally, systems will smell musty, earthy, or moldy but not pungent).



7 Check squirt height and compare residual pressure against the start-up value. This may take longer than just cleaning and flushing the manifold, but will help establish frequency of cleaning.

If the squirt height is 40-50% higher than the start-up value, clean and flush the manifold. (A 50% increase in squirt height signals approximately 18% orifice blockage.) To flush laterals you can run the pump or use a bottle brush or



Flushing with pump

Flushing with pressure washer or bottle brush

pressure washer. Brushing or pressure washing is best. (When you flush the laterals, biosolids slough into the bottom of the filter, flushing the underdrain at the same time, then return to the tank.) Verify again that all orifices are clear. Re-check squirt height.

8 Regardless of squirt height, be sure to open the flush valves and run the pump for two-to-three minutes to flush solids and biomass from the pod's underdrain back into the tank. This only takes a couple of minutes and can be done while accomplishing other tasks.

9 Verify passive ventilation and air flow. Use an anemometer (available through Orenco) to measure the air flowing through the system. 1-3 cubic feet per minute (cfm) is typical. The following chart shows how much airflow is needed* to handle the indicated strength of BOD₅ and ammonia:

Unit	Flow (gpd)	BOD ₅ (mg/L)	Ammonia (mg/L)	Req. Air Flow (cfm)
AX20	500	150	65	0.8

**Ultimately, treatment is accomplished and final effluent quality provides the effective measure of treatment performance and capacity. Typical dissolved oxygen levels in the filtrate effluent will range from 3.5 to 5 mg/L DO.*



In the above photo, the measurement on the meter shows air velocity of 124 feet/minute, which, after mathematical conversion, means that 2.7 cfm (cubic feet/minute) is being drawn through the vent line. Slight atmospheric conditions are more than sufficient to cause two or more air changes to occur every hour.

Record inlet air flow and outlet air flow, where applicable, to ensure there isn't a large difference between them. A large difference means that leaking or bypassing is occurring. Clean vent pipe as necessary.

Miscellaneous

1 Exercise all mechanical valves. Fully open and close valves to ensure they have not failed or become stuck in one position.

2 Before leaving the site ...

a) Review the Maintenance Checklist to ensure all activities have been performed.



b) Be particularly careful to ensure the following:

— **Valves are back in their recommended positions**



— **Control panel has been set back to automatic and circuit breakers have all been switched back on**



— **Household water lines have been turned back on (if they were turned off earlier in the visit for I & I evaluation)**

— **Lids and lid bolts are properly in place and tightened**

Documentation

1 Complete all documentation and submit any required reports to the appropriate parties/agencies. Be sure to send a copy to the AdvanTex Dealer.

CAUTION! While providing O&M services, be sure to use proper personal protection equipment, such as rubber gloves and eye protection, as well as protective clothing, to cover parts of the body that will be exposed to wastewater or effluent. When finished, use proper personal hygiene.



Effluent Testing Procedures

Orenco Systems recommends regular testing of effluent from AdvanTex Treatment Systems as part of system maintenance. Copies of test results and additional comments/documentation must be forwarded to and retained by the Authorized AdvanTex Treatment System Dealer who sold the system. If no Dealer was involved in the sale, then documentation must be forwarded to Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, OR 97479, ATTN: Systems Engineering.

Protocol for Sampling, Testing, and Analysis

Sampling Locations — For residential systems, sample the discharge filtrate at the filtrate splitter valve. This location is illustrated on your system drawings. Pull the RSV out of its Quick Disconnect holster and lay it on a flat surface. Take the sample at the RSV inlet.

To take a sample that accurately represents the system's effluent quality, do two things:

1. Wash down, brush, or wipe the RSV inlet before taking the sample so that dislodged solids will not contaminate the sample.
2. Don't run the pump manually to force a quick sample. Take the sample during normal system operation.

Sampling Schedule — Typically schedule full-scale annual sampling events for spring.

Sampling and Storage Methods — Sampling equipment, minimum sample size, and storage procedures should conform to those recommended in the most current edition of *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association (APHA), available from the Water Environment Federation, 703-684-2400.

Analytical Methods — Analytical methods should conform to *Standard Methods*, cited above.

Routine Tests, Frequencies, and Typical Values

While regional requirements vary, Orenco recommends that the following effluent tests be performed three to six months after system start-up. An annual field-service inspection, including sampling, is to be scheduled in late spring or in early summer. For AXN systems, there must be at least four inspections during the first two years, with sampling once a year as described on the Field Sampling Report Form, and then annual inspections with sampling thereafter.

These tests can be performed in the field; they cost very little and do not require lab work. However, they are very useful in assessing system performance and maintenance.

Parameter	Methodology	Typical Values*
Clarity	Visual ¹	Clear (15± NTUs)
Odor	Sniff ²	Non-offensive (musty is OK; rotten egg or cabbage is not OK)
Biotube®	Visual	No liquid level differential inside/outside vault Norm: 1-2 year cleaning interval for recirculating systems
Oily film	Visual; inside the pump vault	None; no red, blue, green, or orange sheen
Foam	Visual; inside tank	None
pH	Field ³	6-9

*Source: These typical values are recommended by various sources. Biotube parameters are based on Orenco research and development.

¹ To check for clarity, service providers can carry a sample bottle of typical effluent, to compare against, or can use a portable turbidity meter.



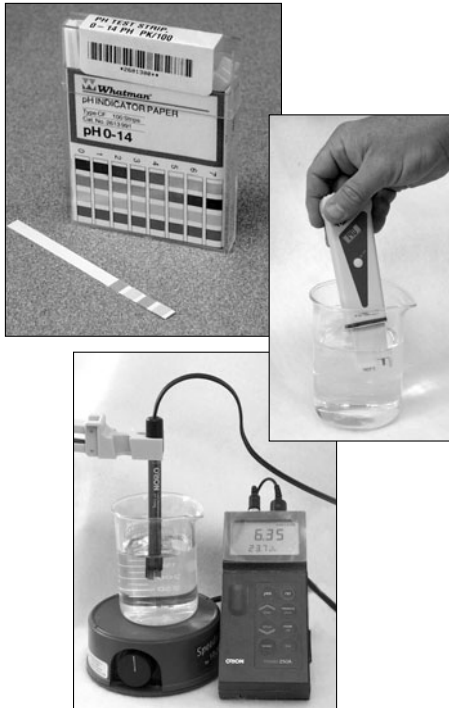
Always put effluent sample in a clear glass container or beaker to evaluate clarity. Using a small, removable sticker, write the date and place it low on the beaker.



² To check for odor, service providers can simply sniff the effluent sample or can use a sulfide measuring packet or an olfactory snifter device for detection of odors.



³ To check for pH, service providers can use litmus paper, a pocket pH meter, or a benchtop pH meter.



Supplemental Testing and Typical Values

If effluent is cloudy or smells pungent or if the biomat on the textile filter appears greasy, waxy, or oily, further tests and troubleshooting of the filtrate should be performed. The following filtrate tests provide invaluable information for troubleshooting and diagnosing problems and causes:

Parameter	Methodology	Typical Values (mg/L)	
		AX ¹	
BOD ₅	Grab	Mode 1 10±	Mode 3 10±
TSS	Grab	10±	10±
TN	Grab	25±	5-15±
G&O	Grab	<1	
DO	Field ²	2.5-6±	
pH	Field	6-8±	

¹ AX values are based on Orenco and third-party testing.

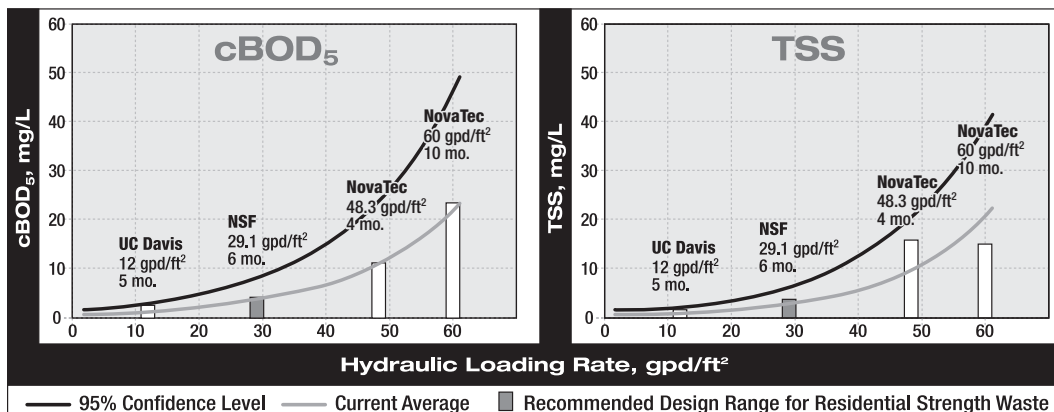
² To check for Dissolved Oxygen, use a DO meter, available from VWR Scientific, Cole-Parmer, or Hach.

³ Typical nitrogen reduction ranges from 60-80%±, with sufficient carbon source and alkalinity.

Relationship Between Test Results and Loading Rates

As noted on pages 6-7, filtrate quality is dependent on a number of factors, including influent characteristics and loading rates. The following charts show how low-to-moderate loading rates produce BOD and TSS of <5mg/L, while higher loading rates produce BOD and TSS in the range of 15-25 mg/L.

Effluent Quality vs. Hydraulic Loading Rates
ANSI/NSF Standard 40 and Other Third Party Testing Results

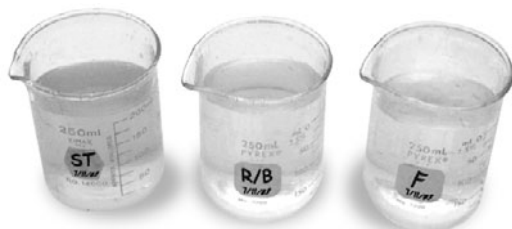


Troubleshooting Tips for Operators: Process Treatment

Once you know the typical values for wastewater treatment system performance (see pages 6, 7, 16, and 17), you can be proactive and troubleshoot nontypical process indicators, before system performance is affected.

Troubleshooting Effluent Quality

If your effluent samples are cloudy and color/turbidity is significantly higher than expected (15 to 30 NTUs), do the following:



Septic Tank Recirc/Blend Filtrate

- Perform cBOD₅ and TSS tests
- Check the Biotube® filter for clogging
- Check to see if the textile filter smells of chemicals (medication, chlorine, etc.) or has a granular or crusty appearance. (For example, a white crystalline crust could signal that water softener discharge or industrial strength detergents have been flushed into the system.)
- Check to see if the recirc ratio is too high or the pump dose time is too long

If the effluent cBOD is high and TSS low, a large amount of soluble cBOD has not yet been consumed. That would likely be because the recirc ratio is too low for the influent strength or insufficient start-up time has elapsed. Typical organic reduction within the first 24 hours in residential systems is about 75% or greater. As the biomat begins to develop, greater reductions in the soluble cBOD will occur (typically within the first 7-10 days). With a higher influent strength, the soluble cBOD would not be readily removed until the biomat on the media is established.

If none of these troubleshooting steps made a difference, interview the user about system abuse, especially in the area of harmful chemicals, solvents, or strong cleaning agents. **Be sure to**

check that no water softener backwash is discharging into the processing tank! Water softener backwash can be extremely high in salts, which can disrupt system performance, especially nitrogen reduction processes!

If no system abuse is uncovered, call Orenco to explore the following design remedies, in this order:

1. Expanded tankage (e.g., additional grease/oil tank)
2. Pretreatment (e.g., additional aeration)
3. Larger filter area (e.g., additional module)

Troubleshooting Odor

If the tank or textile filter smells like rotten eggs or cabbage:

- Check Dissolved Oxygen levels
- Use a DO meter or Colorimetric Kit
- Note filtrate DO levels that are <2.5 or >6 mg/L



Filtrate DO that's <2.5 mg/L indicates insufficient oxygen. If the filtrate DO is <2.5 mg/L:

- Check filter surface for evidence of clogging
- Check to ensure the pump is working
- Check to ensure ventilation is occurring
- Check to ensure the recirc ratio isn't too low; increase if too low
- Check to ensure influent strength isn't too high (see AdvanTex Design Criteria)
- Check to ensure hydraulic retention time isn't too high

Filtrate DO that's >6 mg/L indicates excessive aeration. If the filtrate DO is >6 mg/L:

- Check to ensure recirc ratio isn't too high
- Check to see if influent flows are below normal
- If influent flows are below normal or recirc ratio is too high, reduce recirc ratio

Troubleshooting Biotube Filter Clogging

If a visual inspection of the Biotube filter for bio-mass build-up shows the need for cleaning more often than once every 1-2 years (which is typical for recirculating systems), try the following:

- Verify the pump isn't running too long (typically 3 cycles/hour)
- Ensure the recirc ratio isn't too high
- Verify normal DO levels; if high, reduce recirc ratio
- Check for below normal influent flows
- Check influent Grease & Oil and TSS; if excessive, a review of component sizes may be required



Troubleshooting Oily Film

All signs of oil or grease anywhere in the system (in the tank, in the vault, on the effluent or textile filter) must be investigated. Ask the system user to identify the probable source:

- Recent change of car oil?
- Canning meat or poultry?
- Excessive use of garbage disposal?
- Excessive use of bath or mineral oils? (Jacuzzi® tub?)
- Excessive use of detergents?



If the system user can't identify the probable source, try the following:

- Sample/test effluent for BOD₅ and Grease & Oil
- Sample/test at all process steps, including influent (if possible)
- Label, date, and photograph all samples
- Use standard glass beakers and set samples in front of a common, uniform background, when photographing
- Check biomat accumulation at AdvanTex Filter
- Note if biomat is yellowish and wax-like or lard-like. If so, scrape biomat sample for analysis:
 - Photograph/document biomat sample
 - Send to lab with effluent samples

Note: Excessive Grease & Oil (>25 mg/L) is typically a design and management concern with commercial applications.

Troubleshooting Foam

Foam indicates that microbes are producing excessive gas byproducts. Foam rarely occurs in packed bed filters (and AdvanTex is a packed bed filter). If foam is present:

- Verify the pump isn't running too long
- Ensure the recirc ratio isn't too high
- Ask residents about detergent use

As an aid to troubleshooting, Appendix 3 gives typical timer settings for households of various sizes.

O&M For Nitrogen Reduction

AdvanTex Treatment Systems do an excellent job of reducing nitrogen, especially in the Mode 3 configuration, where Total Nitrogen* is typically reduced to 10 mg/L ±, with influent TKN of 55-65 mg/L. Because many people purchase AdvanTex for its nitrogen reducing capabilities, and because nitrogen reduction is a complex, many-staged process, it's important to understand the process, its related factors, the signs of effective nitrogen reduction, and how to keep the process optimized.

It's also important to know the Total Nitrogen limits required by the system user's permit. Some regulatory agencies have no requirement; some require a specific percentage reduction of a certain kind of nitrogen (90-95% nitrification of ammonia nitrogen, for example); and some require that Total Nitrogen be reduced to levels at or near drinking water quality at the point of final dispersal.

Finally, because influent characteristics greatly affect the amount of nitrogen reduction possible from any given system, it's vital to know the alkalinity of your waste source and the local/regional norms for organic and ammonia nitrogen.

The Process

In nitrogen reduction, ammonia is converted to nitrate and then reduced through bacterial action to nitrogen gas, which can be released harmlessly to the atmosphere. Optimum nitrogen reduction requires the following:

- Adequate alkalinity of approximately 250± mg/L or higher (lab test shows levels)
- pH of 6-8. Fixed film microbial processes generally thrive between pH 5.5 and 9. Treatment problems typically result from rapid changes in pH rather than extreme long-term mean values, although long-term levels can result in less efficient process activity

- Filtrate DO level of 2.5-8 mg/L, process tank DO level of <1 mg/L
- Adequate time for the nitrifying bacteria to develop (one to three months)
- Adequate temperature (below 40° F retards the process)
- Good organic removal

For a thorough description of the nitrogen reduction process, see Appendix 1. In residential wastewater, the ammonia level is typically about 60 mg/L and the Total Nitrogen level is typically about 65 mg/L.

Signs of Effective Nitrogen Reduction

Service providers frequently ask us, "How do I know if my wastewater treatment system is reducing nitrogen?" A thorough description of key indicators is included in the Appendix. Following is a brief summary:

- Clear, odorless filtrate effluent (a "see and sniff" test is generally considered sufficient)
- Normal-looking biomat on the textile filter (light-brown to dark-brown and gelatinous in texture)

Additional Filtrate Tests Will Show ...

- Typically, low BOD₅ and high clarity
- DO of 2.5-6 mg/L and odorless or odor that is not a nuisance
- Relatively low ammonia and high nitrate levels, since nitrification converts ammonia to nitrate

* Total Nitrogen is the sum of organic and ammonia nitrogen, nitrate nitrogen, and nitrite nitrogen.
(TN=ON + NH₃-n + NO₃-n + NO₂-n ... or ... TN=TKN-n + NO₃-n + NO₂-n)

Troubleshooting Nitrogen Reduction

If you suspect that the System is not meeting expectations for nitrogen reduction, troubleshoot each of the critical factors that contribute to optimum nitrogen reduction, to determine a cause.

Filtrate Alkalinity Too Low — Available alkalinity determines the degree of nitrification possible for any wastewater treatment system, because it takes 7.14 parts alkalinity to nitrify 1 part ammonia.

If filtrate alkalinity is too low:

- Check the recirc ratio; a high recirc ratio increases alkalinity consumption*
- Check influent TKN or ammonia levels and source alkalinity

If a large quantity of nitrification is required, it may be necessary to add a buffering compound to the system, to raise alkalinity levels.

Filtrate pH Too Low — Nitrification is particularly sensitive to pH but tends to thrive at levels between pH 7.2 and 9. The nitrification process releases hydrogen that consumes alkalinity and causes pH levels to drop.

A pH level of <6 retards microbial activity of all kinds, including denitrification. Maintaining an alkalinity of 50 to 80 in the effluent is typically sufficient to maintain pH levels above 5.5. If the filtrate pH level is too low:

- Check influent alkalinity level (pH drops when too much available alkalinity is consumed)
- Check recirc ratios; reduce if too high*
- Ask system user about chemical discharges into the system, including carpet cleaners, chlorine, and photo developing agents

Filtrate DO Levels Outside Range of 2.5-6 mg/L

— If your filtrate DO is too low (indicating insufficient oxygen), you may experience periodic sulfide odors during dosing events, or perhaps a more lasting smell within the filter pod. Try the following:

- Check for surface clogging/ponding and clean as necessary
- Check air flow through the vent assembly
- Check the recirc ratio; if it's too low (<2:1±) increase as necessary*

If your filtrate DO is too high (indicating excessive aeration), it's likely that excessive recirculation or insufficient hydraulic retention time are factors. Try the following:

- Decrease the recirc ratio*

High Filtrate Ammonia Levels — Because ammonia is consumed during nitrification, high ammonia levels are a sign that something is amiss. Try the following:

- Check for surface clogging/ponding and clean as necessary
- Check for sufficient aeration (measure DO)
- Ensure no blockage of air flow into textile filter (indicated by thick biomat development or a build-up of grease and oils)
- Ensure no blockage in the manifold, causing ...
 - Localized hydraulic overloading, saturation
 - Short circuiting
- Check for sufficient alkalinity; if insufficient, consider supplemental buffering. Call Orenco Engineering for assistance, if necessary.

**Keep in mind that a recirc ratio that's too high can generate a highly aerobic biomat growth on the pump filter; and a recirc ratio that's too low can tend to liberate periodic odors during dosing events. So search for the optimum ratio (typically between 2 and 4:1)*

Low Filtrate Nitrate Levels — Residential packed bed filters normally yield 98+ percent nitrification (ammonia to nitrate). Therefore the ammonia levels in the filtrate should be low and the nitrate levels higher. Some denitrification typically is experienced through the packed bed filter. So the normal nitrate level may vary. Be sure you are familiar with the mode of operation, as some AdvanTex modes are configured to produce lower nitrate levels. If it appears that nitrification is dropping off:

- Check the recirc ratio; adjust as necessary* (high recirc ratios may drive pH too low for effective nitrification/denitrification and low recirc ratios may not provide sufficient aeration)
- Verify incoming ammonia levels
- Check recirc/blend for sufficient organic food source (high BOD — see Table, page 7 — may cause greater oxygen demand through the filter, reducing nitrification)

Adequate Time and Temperature —

Nitrifying bacteria require one to two months to develop, and extremely cold temperatures (below 40° F) retard that process. If the AdvanTex Treatment System has been installed in a very cold climate, nitrification may not “kick in” for several months until warmer temperatures are reached. Typically, a June-September installation provides the necessary temperatures for a 30-60 day nitrification start-up time. Once nitrifiers colonize, they typically continue to nitrify through normal winter conditions. Only in severely cold regions should additional insulation be necessary.

**Keep in mind that a recirc ratio that's too high can generate a highly aerobic biomat growth on the pump filter; and a recirc ratio that's too low can tend to liberate periodic odors during dosing events. So search for the optimum ratio (typically between 2 and 4:1)*

AdvanTex Treatment Systems

While regional regulations may vary, Orenco Systems requires that the following inspection and maintenance activities be performed, by a qualified provider, on all AdvanTex Treatment Systems sold. All activities are to be performed three-to-six months after system start-up; and an annual field-service inspection, including sampling, is to be scheduled in late spring or in early summer. For AXN systems, there is to be a minimum of four inspections during the first two years, and then annual inspections thereafter. Copies of inspection and maintenance reports and additional comments/documentation are to be forwarded to the AdvanTex Dealer, or if no Dealer, to Orenco Systems, 814 Airway Avenue, Sutherlin, OR 97479.

Date: _____ Site: _____ Operator: _____

Maintenance Activity

Activity Check-Off/Notes

A) Inspect Control/Alarm Panel

- 1) Check pump operations in manual mode ☐ _____
- 2) Check/record pump amperage and voltage ☐ _____
Voltage at rest: _____ Amps at rest: _____ Amps while pumping: _____
- 3) Check timer settings ☐ _____
- 4) Record elapsed time meter and counter readings (if applicable) ☐ _____
- 5) Confirm operation of audible and visual alarms ☐ _____

B) Inspect/Test Pumping System

- 1) Verify no leaks in riser ☐ _____
- 2) Inspect splice box for moisture and secure connections ☐ _____
- 3) Verify condition of and correct operation of all floats ☐ _____
- 4) Verify neat wrap of float cords ☐ _____
- 5) Pull pump and clean intake screen if necessary ☐ _____
- 6) Visually inspect recirculating splitter valve and liquid level ☐ _____

C) Inspect Effluent Filters/Pump Screens

- 1) Clean as needed ☐ _____
- 2) Visually inspect and comment on biomat growth ☐ _____

D) Inspect Processing Tank

- 1) Verify no inlet flow ☐ _____
- 2) Inspect liquid depth, odor, scum color, effluent characteristics ☐ _____
- 3) Measure sludge and scum; recommend tank pumping, if necessary ☐ _____

E) Inspect AdvanTex Filter

- 1) Inspect for ponding; assess character and color of biomat ☐ _____
- 2) Check squirt height ☐ _____
- 3) Verify proper orifice position, equal spray under orifices, no clogged orifices ☐ _____
- 4) Check for odors; adjust recirculating time if necessary ☐ _____
Normal: ☐ Musty ☐ Earthy ☐ Moldy
Pungent: ☐ Sulfide ☐ Cabbage ☐ Decay
- 5) Clean and flush manifold (if necessary) ☐ _____
- 6) Re-check squirt height ☐ _____
- 7) Flush underdrain ☐ _____
- 8) Inspect intake vent and clean as necessary ☐ _____

F) Miscellaneous

- 1) Exercise all valves ☐ _____
- 2) Return valves, control panel to proper settings ☐ _____
- 3) Submit required documentation ☐ _____

Field Alarm Report Form

Operator Responding: _____

Alarm call by: _____

Date/Time Responded: _____

Alarm call Date/Time: _____

Total Field Time: _____

Total Travel Time: _____

Alarm Call Addendum

Conditions Leading to Call

- | | |
|---------------------------------------|---|
| <input type="checkbox"/> Alarm | <input type="checkbox"/> Tank Overflow |
| <input type="checkbox"/> Odor | <input type="checkbox"/> Surface Runoff |
| <input type="checkbox"/> Noise | <input type="checkbox"/> Sewage Backup |
| <input type="checkbox"/> Other: _____ | |

Odor

- | | | | |
|----------|----------------------------------|----------------------------------|--------------------------------|
| Normal: | <input type="checkbox"/> Musty | <input type="checkbox"/> Earthy | <input type="checkbox"/> Moldy |
| Pungent: | <input type="checkbox"/> Sulfide | <input type="checkbox"/> Cabbage | <input type="checkbox"/> Decay |

Date/Time Discovered: _____ / _____

Method of Detection: _____

Alarm

- ☐ High Liquid Level
- ☐ Low Liquid Level
- ☐ Off

Pump

- ☐ On
- ☐ Off

Tank Liquid Level

- ☐ Normal
- ☐ High
- ☐ Low

Circuit Breaker

- ☐ On
- ☐ Off
- ☐ Tripped
- ☐ Switched

Cause of Malfunction

Mechanical

- ☐ Control Panel
- ☐ Pump
- ☐ Float Switch
- ☐ Screened Vault
- ☐ Hose & Valve
- ☐ Check Valve
- ☐ Building Sewer
- ☐ Service Line
- ☐ Other: _____

Physical or Process-Related

- ☐ Power
- ☐ Back Pressure
- ☐ Air Bound
- ☐ Sludge & Scum
- ☐ Clog
- ☐ Infiltration/Inflow
- ☐ Exfiltration
- ☐ Siphoning
- ☐ Other: _____

Repair: _____

Replace: _____

Notes: _____

Field Sampling Report Form

25

Date: _____

Inspector: _____

Address: _____

System Type: _____

The following effluent tests can be easily and routinely performed in the field. Perform annually, or as frequently as necessary per the methodology indicated. For AXN systems, there is to be a minimum of four sampling events the first two years and then annual sampling thereafter. Record your results/observations in the space provided:

Parameter	Methodology	Typical	Field Observations	Pre-Test Lab Concurrence
Clarity	Visual ¹	Clear (15 ± NTUs)	_____ _____	_____
Odor	Sniff ²	Non-offensive (no smell of rotten eggs or cabbage; a musty, earthy, or moldy odor is normal)	_____ _____ _____ _____	_____ _____ _____ _____
Oily film	Visual; inside tank	None (no red, blue, green, or orange sheen)	_____ _____ _____	
Foam	Visual; inside tank	None	_____	
pH	Field	6-9	_____	

Date _____ Date: _____

Signature
Field Sampler

Signature
Lab Technician

¹ To check for clarity, service providers can carry a lab-prepared sample bottle or bottles with known turbidities of 15 NTUs and 30 NTUs, to compare against, or can use a portable turbidity meter. Always put effluent sample in a clear glass container or beaker to evaluate clarity. Using a small, removable sticker, write the date, place it low on the beaker, and photograph for documentation.

² To check for odor, service providers can simply sniff the effluent sample with the assistance of an olfactory snifter device and/or sulfide odor measuring packet. Whenever possible, interview system users about odor occurrences and request user's assistance in verifying or detecting odors.

ETM/CT Log & Worksheet

Electronic Time Meter Log

Date	ETM Reading	ETM Differential (Current - Prev.)	Number of Intervening Days	Duration: Minutes/Cycle (ETM Diff. / Interv. Days)

Comments: _____

Cycle Log

Date	Cycle Reading	CT Differential (Current - Prev.)	Number of Intervening Days	Frequency: Cycles/Day (CT Diff. / Interv. Days)

Comments: _____

Two-Compartment Tank

Operator Responding: _____

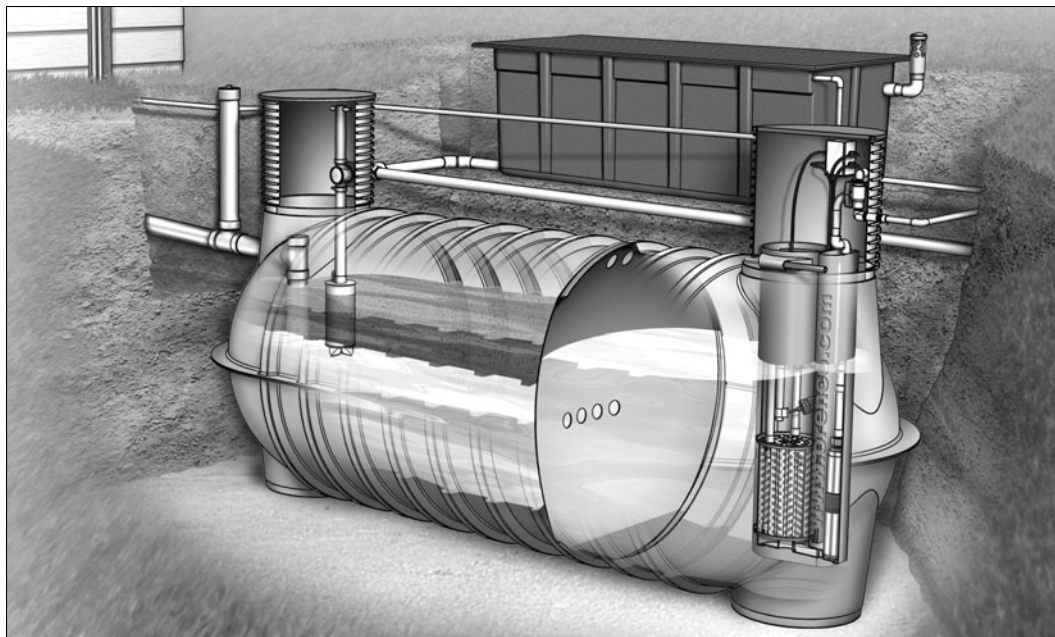
Date/Time Responded: _____

Address: _____

Date of Installation: _____

Phone: _____

Date of Last Pumping: _____



First Compartment Scum

Date	Depth (Inches)	Rate of Accumulation

First Compartment Sludge

Date	Depth (Inches)	Rate of Accumulation

Second Compartment Scum

Date	Depth (Inches)	Rate of Accumulation

Second Compartment Sludge

Date	Depth (Inches)	Rate of Accumulation

Comments: _____

Appendix 1: The Nitrogen Reduction Process and Key Indicators

The Process

Nitrogen removal (or “nitrification/denitrification”) is a biochemical process in which ammonia is converted to nitrate (nitrification) (2NH_3 converts to $2\text{NO}_3 + 3\text{H}_2\text{O}$) and then reduced through bacterial action (denitrification) to nitrogen gas, which can be released harmlessly to the atmosphere.

During the nitrification process, about 9 parts oxygen are consumed in converting 2 parts ammonia to nitrate. Therefore, depending on the concentration of ammonia, a considerable amount of air may be needed. Other processes, like biological (BOD) reduction, may occur simultaneously and further elevate the demand for aeration, especially if the organic level is high.

In an abundance of air, all the aerobic or facultative microbes compete for their share of oxygen. When the organic concentration is high, the microbes that oxidize organic matter, primarily the heterotrophic bacteria, are aggressive and tend to outcompete other microbes for the available free oxygen in solution. The oxidation of ammonia is accomplished by autotrophic bacteria, which do not have as aggressive of a growth rate, so if there isn't an abundance of oxygen, nitrification suffers. Consequently, the nitrification process usually lags until the organic concentration is depleted or until sufficient oxygen is present. At a 2.5:1 BOD/TKN ratio, the nitrifiers may only make up about 10 percent of the microbial population. At 0.5:1 BOD/TKN, the nitrifiers make up about 35 percent of the population.

In a filtering process, the filter column must be deep enough, or the filter media must be efficient enough at filtering organic particles, to deplete organic concentrations to a level in which a sufficient population of nitrifiers will be sustained. The physical (dimensional) features of the filter will vary depending on the media's characteristics — void ratio, moisture holding capacity, and effective surface area per unit volume ratio. Tankage, surge capacity, application rates, and loading characteristics are other design considera-

tions that play a role in the sizing of the filter unit.

Performance Indicators

To judge the nitrogen-reducing performance (or potential) of any wastewater treatment system, be sure to check the following performance indicators:

Clear, Odorless Effluent — Simple, “see and sniff” tests can be performed easily in the field. Effluent from packed bed filters (recirculating textile filters, recirculating sand filters, intermittent sand filters) that are performing well should be clear (with turbidity ≤ 20 NTUs \pm) and odorless.

Tests for Ammonia and Nitrate Nitrogen —

If your system is oxidizing ammonia to nitrate (nitrifying), lab tests should measure relatively low ammonia levels and relatively high nitrate levels in the filtrate. Because nitrification responds to many and varying conditions within the aerobic treatment processes, ammonia and nitrate nitrogen levels in the filtrate are the most ideal constituents to watch for any changes in performance. Start-up times can be plotted, optimum recirc ratios can be gauged, cleaning frequencies can be predicted, and nonvisible clogging or saturation detected by watching either of these constituents.

Typical nitrification in single-family residential systems is expected to be in the 98-99% range. You'll want to investigate if the process appears to degrade by 5 percentage points or more.

BOD — The nitrification process requires oxygen, which is why nitrification is enhanced when BOD is extremely low. Measures of filtrate BOD should be <15 mg/L, although higher BOD may not necessarily correlate with low levels of nitrification.

Typical influent characteristics are shown on page 7. When BOD₅ is high, there is a greater organic demand for oxygen, which may hamper the nitrogenous demand for oxygen. Increasing the recirc ratio should help establish oxygen balance.

Dissolved Oxygen — Dissolved oxygen also provides critical information with which to diagnose how well a system is performing. Measures of Dissolved Oxygen should be in the range of 2.5 to 6 mg/L. If the DO level drops, the degree of nitrification will normally drop as well, which could be a sign of blinding or saturated flow conditions — anything that might inhibit free air from flowing into the system. (Though it's quite possible to have low filtrate DOs and still have high effluent quality, as measured by BOD and TSS levels.)

Biological Growth on Filter — With “fixed film” treatment systems, biological growth on the filter media is natural. The biomat should appear light-brown to dark-brown in color and gelatinous in texture.

Influent Characteristics — Influent characteristics (see page 7) will greatly affect the amount of nitrogen reduction that is possible from any wastewater treatment system. High solids and/or fats and cooking oils increase the oxygen demand and accumulation of material on and within the media, affecting the available oxygen for nitrification.

pH — For normal residential nitrogen loads, pH is typically maintained between 6 and 8.

Alkalinity — The nitrification process releases hydrogen ions into solution, which tends to lower the pH level. Alkalinity is essential for nitrification. For each part ammonia that is nitrified, 7.14 parts alkalinity are consumed (buffering the acidity caused by the release of hydrogen ions). Consequently, if the degree of nitrification is less than expected, it could simply be a lack of sufficient alkalinity to support more. Typical residential nitrification requires alkalinity above 250± mg/L for recirculating processes and double that for single pass processes. *Many wastewater streams do not have sufficient alkalinity to support complete nitrification.*

Wastewater streams without sufficient alkalinity to support complete nitrification may, depending on the type of process, cause a depletion in the alkalinity to the point where its ability to buffer stops. The pH correspondingly drops to a level that retards the microbial activity (<6±). Recirculating the effluent helps, since half the

alkalinity can be restored in the recirc or process tank, wherever denitrification occurs (and adjusting the recirc ratios may also bring the pH back to preferred operating levels). But wastewater streams that are alkalinity-starved can't provide for 100% nitrification.

The use of low flush fixtures requires special consideration. Low flush fixtures tend to reduce hydraulic loads, which causes elevation of wastewater constituents (i.e., higher concentrations of BOD, TSS, TKN, etc.). In this case, the available alkalinity in the water supply may not be adequate to accomplish the full level of nitrification desired.

These constraints exist for all wastewater treatment operations, regardless of whether the operation involves a suspended growth contact stabilization process or an attached growth packed bed filter. Packed bed systems will perform better, especially if they have a large attached growth surface area per unit volume ratio, because the micro-sites near the attached side of the biomat, where denitrification typically occurs, return some of the alkalinity. Textile packed bed filters, because of their large surface area per unit volume ratio, tend to perform even better. Nevertheless, additional buffering may be necessary to accomplish the level of nitrification desired. In low alkalinity conditions, pH adjustment can be made with the addition of Quick or Hydrated lime, soda ash, or caustic. (Note: at process points preceding sedimentation zones, lime adjustment — buffering — would be preferred. Soda ash and caustic both contain sodium, which is a dispersant.)

Appendix 2: Abbreviations & Definitions

3D	Three dimensional (typically refers to a drawing)			collected over a period of time not to exceed 15 minutes
amps	Amperage	min.		Minute(s)
alkalinity	Alkalinity is not a specific polluting substance, but a combination of factors. It is the ability of water to neutralize an acid, and is due primarily to the presence of carbonate (see pH). Alkalinity is also essential for nitrification (for each part ammonia nitrified, 7.14 parts alkalinity are used.) Insufficient alkalinity will result in incomplete nitrification.	mg/L		Milligrams per liter
		Mode 1		AdvanTex Treatment System configuration in which the textile filter's filtrate returns to the outlet end of the processing tank
		Mode 3		AdvanTex Treatment System configuration in which the textile filter's filtrate returns to the inlet end of the processing tank
AX	AX stands for Aligned Textile (hanging style) treatment media.	MOA		Manual/On/Off switch in control panel
AWG	American Wire Gauge	NEC		National Electric Code
BOD₅	Five-day biochemical oxygen demand	NH₃		Ammonia gas
CB	Circuit breakers	NH₄		Free ammonia
cfm	Cubic feet per minute	NO₂		Nitrite
CT	Counter (a device that counts)	NO₃		Nitrate
dia.	Diameter	NTU		Nephelometric turbidity unit (see turbidity unit)
diff.	Differential	O&M		Operation and maintenance
DO	Dissolved oxygen	pH		pH is a measure of the activity of hydrogen ions. A pH of 7.0 indicates neutrality, greater than 7.0 indicates alkalinity, lower than 7.0 indicates acidity. Overall pH ranges from 0.0 to 14.0.
EC	E. Coli (<i>Escherichia coli</i>)	prev.		Previous
ETM	Elapsed time meter	psi		Pounds per square inch
F	Fahrenheit	PVC		Polyvinyl chloride
FC	Fecal coliform bacteria	recirc		Recirculating
ft.	Feet	RSV		Recirculating Splitter Valve
H₂O	Water	SMUG		Scum Measuring Utility Gauge
hp	Horsepower	STEP		Septic Tank Effluent Pump
I & I	Infiltration and inflow	STEP System		Used to refer to an effluent (pressure) sewer
interv.	Intervening	TDS		Total dissolved solids
gal.	Gallon	TKN		Total Kjeldahl nitrogen (organic and ammonia nitrogen)
G&O	Fats, oils, and grease (aka FOG). Fats and oils are the third major component of foodstuffs. The term "grease" as commonly used includes the fats, oils, waxes, and other related constituents found in wastewater. Fats and oils are contributed to domestic wastewater in butter, lard, margarine, and vegetable fats and oils. Fats are also commonly found in meats, in the germinal area of cereals, in seeds, in nuts, and in certain fruits. Fats are among the more stable of organic compounds and are not easily decomposed by bacteria.	TP		Total phosphorus
		TN		Total nitrogen (organic and ammonia nitrogen, plus nitrite and nitrate nitrogen)
		TSS		Total suspended solids
		turbidity unit		A measure of particulate and color in water and wastewater streams
gpd	Gallons per day	V		Volts
gpm	Gallons per minute			
grab sample	An individual discrete sample			

Appendix 3: Timer Settings

Start with these typical timer settings for households of various sizes. Calculations assume water usage of 50 gallons per person per day and a return recirculation ratio of 3 : 1. For more detailed instructions about timer settings, consult the *AX20 Timer Settings Worksheet*, NDA-ATX-SET-2, available from the Document Library at www.orenco.com.

Number of People	Time ON (seconds)	Time OFF (minutes)
2	15	29.75
3	15	19.75
4	30	29.75
5	30	23.75
6	30	19.75

Notes

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page or a sheet of stationery designed for writing.

Record of System Facts

(Record in Pencil)

Property Address

Dealer Name

Property Owner Name(s)

Dealer Phone

Property Owner Phone

Engineer Name

Property Owner E-Mail

Engineer Phone

Start-Up Date

Installer Name

AdvanTex Model #

Installer Phone

AdvanTex Serial Number (on filter pod)

Service Provider Name

Control Panel Model #

Service Provider Phone

Float Model #(s)

Pump(s) Model #(s)

Regulatory Authority

Pump(s) Design Specifications:

Permit # (if applicable)

_____ gpm _____ gpm

Contact Name

Design Flow

Contact Phone

Tank(s) Size(s)

Recirc Ratio (start-up)

Recirc Timer Settings

Discharge Timer Settings (when applicable)

Initial Squirt Height

Dispersal Method

Distributed by:



AdvanTex®
Treatment System
AXN Models meet
the requirements
of NSF-ANSI
Standard 40 for
Class I Systems.



Orenco Systems®
Incorporated

*Changing the Way the
World Does Wastewater®*

800-348-9843
www.orencosystems.com