AdvanTex® System Troubleshooting

Orenco Systems

Outline

- System basics and components
- Tools and Charts for Troubleshooting
- Identifying Common Issues
  - Electromechanical
  - Process

Goal = Clean Water

Definition of Troubleshooting

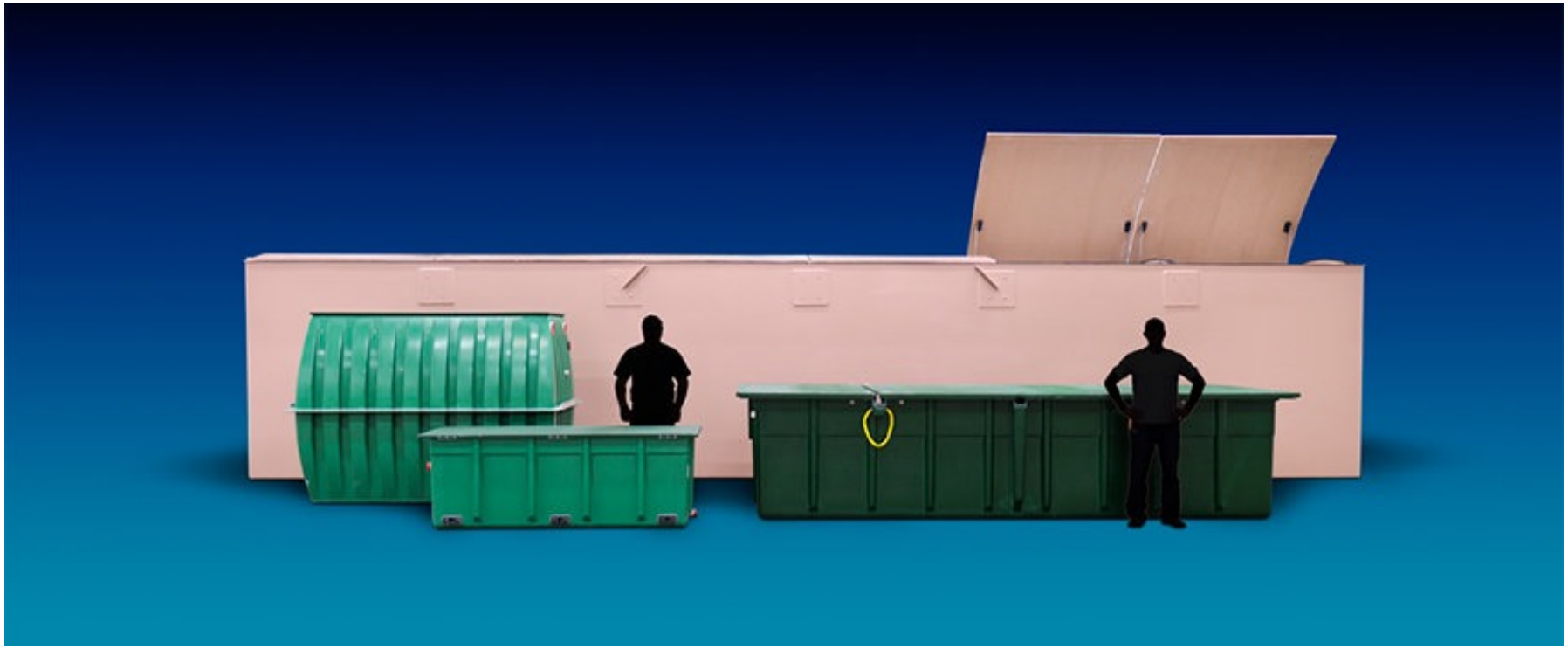
- Form of problem solving
- Logical – based on reason and sound ideas
- Systematic – has order, has a plan, methodical
- Requires identifying or isolating the malfunction or symptoms

Identifying the Problem

- Isolate the specific cause of symptoms
  - Basic principle – start with the most simple and easily tested
  - Use a checklist, chart, or table
- Intermittent symptoms
  - Difficult to troubleshoot due to difficulty to reproduce symptoms
- Multiple failures
  - May require adjustments rather than replacements

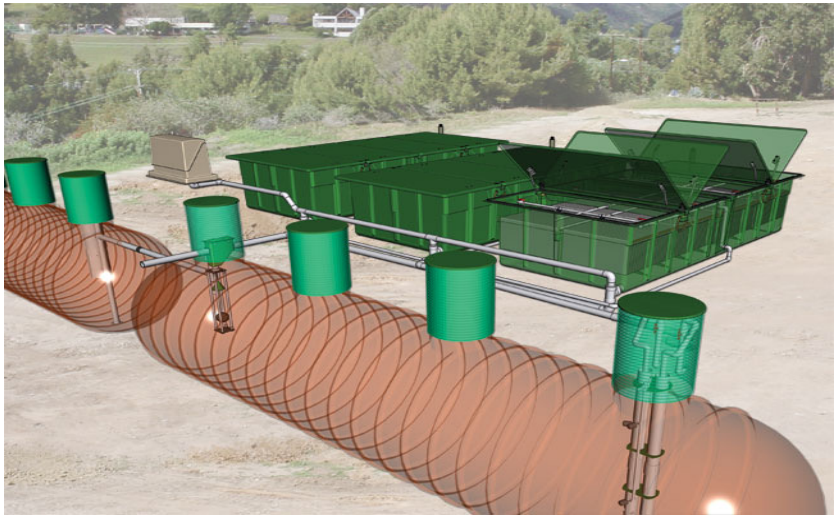
AdvanTex® Treatment Systems

- AX20
- AX-RT
- AX100
- AX-Max



You Need to Know:

- Systems configuration and components
- How the system operates for peak performance
- Knowing the systems capabilities and capacities
- Knowing the proper troubleshooting process
- Permit requirements

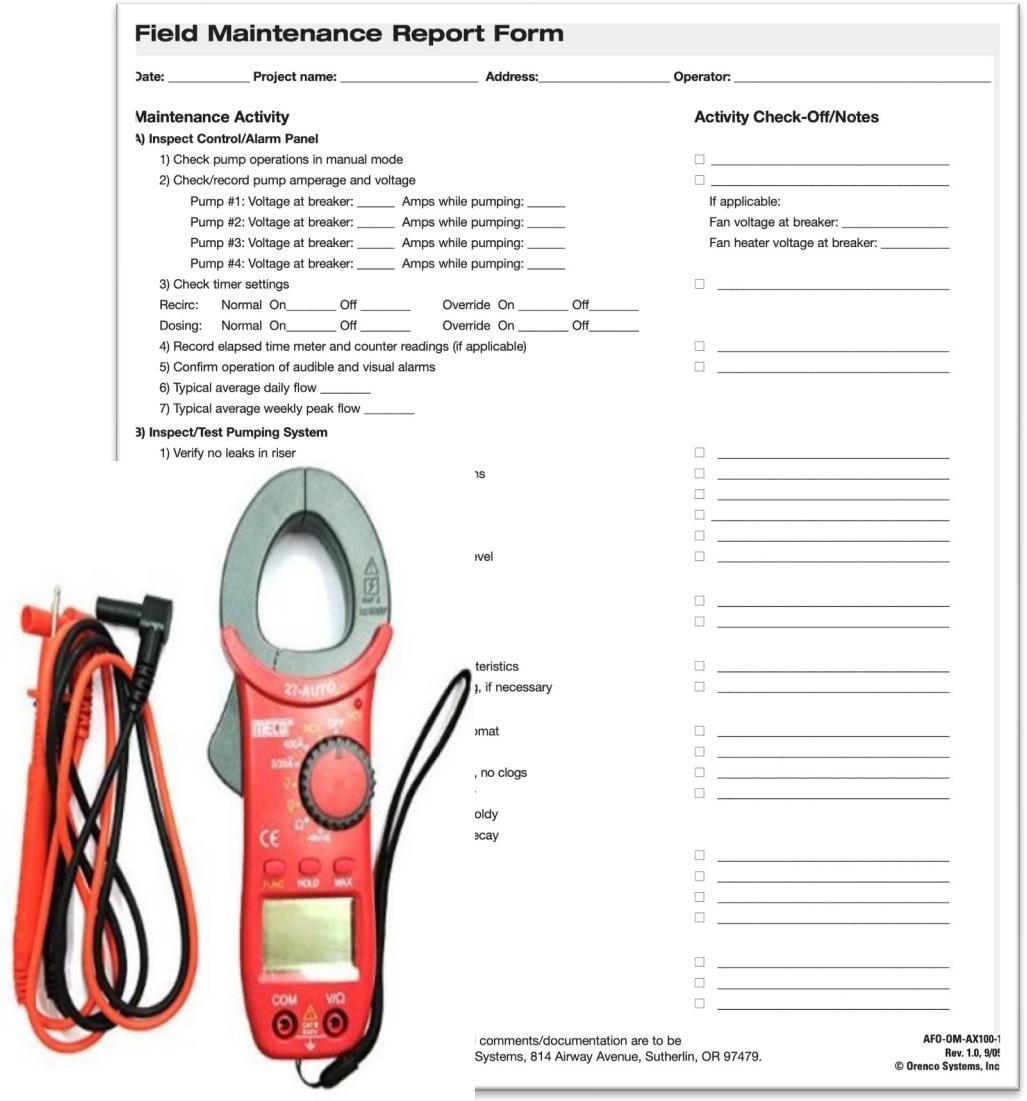


AX100

- Hydraulic loading capabilities up to ...
  - Actual: 25 gpd/sqft (2,500gpd)
  - Peak: 50 gpd/sqft (5,000gpd)

Tools for Troubleshooting

- Drill
- Multi-meter
- Screwdrivers
- Channel locks
- Sludge judge
- Spare parts
- Water supply-hose
- Biotube cradle
- PPEs
- Field Maintenance Report



Field Maintenance Report Form

Date: _____ Project name: _____ Address: _____ Operator: _____

Maintenance Activity | **Activity Check-Off/Notes**

4) Inspect Control/Alarm Panel

1) Check pump operations in manual mode
2) Check/record pump amperage and voltage
   Pump #1: Voltage at breaker: _____ Amps while pumping: _____
   Pump #2: Voltage at breaker: _____ Amps while pumping: _____
   Pump #3: Voltage at breaker: _____ Amps while pumping: _____
   Pump #4: Voltage at breaker: _____ Amps while pumping: _____
3) Check timer settings
   Recirc: Normal On_____ Off _____ Override On _____ Off_____
   Dosing: Normal On_____ Off _____ Override On _____ Off_____
4) Record elapsed time meter and counter readings (if applicable)
5) Confirm operation of audible and visual alarms
6) Typical average daily flow _____
7) Typical average weekly peak flow _____

If applicable:
Fan voltage at breaker: _____
Fan heater voltage at breaker: _____

3) Inspect/Test Pumping System

1) Verify no leaks in riser

comments/documentation are to be
Systems, 814 Airway Avenue, Sutherlin, OR 97479.

AFO-OM-AX100-1
Rev. 1.0, 9/0
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Troubleshooting Chart

Orenco® Chart

Orenco Control Panel Troubleshooting

Symptom	Check For
Pump does not operate with control panel toggle switch in "MANUAL" or "AUTO" position	• Pump circuit breaker off/fuse blown • Low-level alarm condition in tank • High-level alarm condition at discharge pump (residential ASF or SSF control panels only) • Inadequate power supply to control panel • Incorrect float switch wiring • Incorrect pump wiring • Incorrect model of "Redundant Off" float switch • Failed "Redundant Off" float switch • Failed connection in the pump wiring circuit • Failed motor contactor
Pump operates with control panel toggle switch in "MANUAL" position, but does not operate with switch in "AUTO" position	**Demand-Dose or Timed-Dose Panels:** • Low-level alarm condition in tank (VCOM and TCOM panels only) • High-level alarm condition at discharge pump (MVP and TCOM panels only) • Incorrect float switch wiring • Incorrect float switch model(s) • Failed "On" float switch **Timed-Dose Panels Only:** • "Off" time has not elapsed (the pump will start when the "Off" cycle is complete) • Failed float switch
Audible alarm activated	**Low-Level Alarm** • Control panel toggle switch in "Manual," position, pump left running • Tank pumped out with no refill • Siphoning condition in tank • Leaking tank (exfiltration) • Clogged filter • Incorrect float switch wiring • Incorrect float switch settings • Incorrect model of "Redundant Off" float switch • Failed "Off" or "Redundant Off" float switch • Water in splice box (low-decibel alarm) **High-Level Alarm** • Control panel toggle switch in "Off" position • Pump circuit breaker in "Off" position • Closed discharge ball valve • Failed pump • Clogged pump • Incorrect float switch settings • Incorrect float switch wiring • Incorrect model of "High-Level Alarm" float switch • Failed "On" or "High-Level Alarm" float switch • Power outage • Leaking tank or fixures (infiltration) • Water in splice box (low-decibel alarm)
Circuit breaker trips repeatedly or fuse blows repeatedly	• Water in splice box • Inadequate power supply to circuit breaker • Loose wiring connections • Corroded wires or wiring connections • Bound pump • Incorrect pump wiring • Incorrect capacitor pack wiring • Incorrect float switch wiring
Motor contactor "chatters"	• Corroded contacts • Inadequate voltage supply to motor contactor • Failed "On" or "Off" float switch • Incorrect float switch model(s)

Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

NCH-CP-1
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Influent Characteristics

- What's coming into your system?
  - Verify flows
  - Verify waste strength
  - Establish a baseline

Wastewater Characteristic	Raw Influent	Primary Tank Effluent	Recirc/ Blend Effluent	Treated Effluent (Filtrate)
$cBOD_5$ (mg/L)	250-400	150	40-60	10
TSS (mg/L)	250-400	30	30	10
TKN (mg/L)	40-80	40-80	40-80	<2
NO_3 (mg/L)	0	0	2-8	20-30
FOG (mg/L)	50-150	10-20	10-20	<5
DO (mg/L)	0	0	2-6	2.5-6
Alkalinity (mg/L)	200-500	200-500	100-200	100-150
pH[1]	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5

[1] *pH can be tested with litmus paper, a pocket pH meter, or a bench top pH meter.*

Most Problems Are Result Of:

- Hydraulic overloading
- Mass overloading
- Lack of maintenance
- Inadequate recirculation ratio
- Equipment malfunction
- Toxic event

AdvanTex Filtrate

Typical Values for AdvanTex Effluent (Filtrate)

Parameter	Sampling Method	Typical Values or Properties
Clarity	Visual[1]	Clear (≤15 NTUs)
Odor	Sniff[2]	Non-offensive (musty is OK; rotten egg or cabbage is not OK)
Biotube® filter	Visual	No liquid level differential inside/outside vault, one-year cleaning interval
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
DO	Field[3]	≈2.5-6

Effluent Lab Tests

Typical Values for Supplemental Lab Tests

Sampling Parameter	Sampling Method	Typical values[1] (mg/L)	
		Mode 1	Mode 3
BOD_5	Grab	≈10	≈10
TSS	Grab	≈10	≈10
TN	Grab	≈25	≈10-20[2]
G&O	Grab	<1	<1

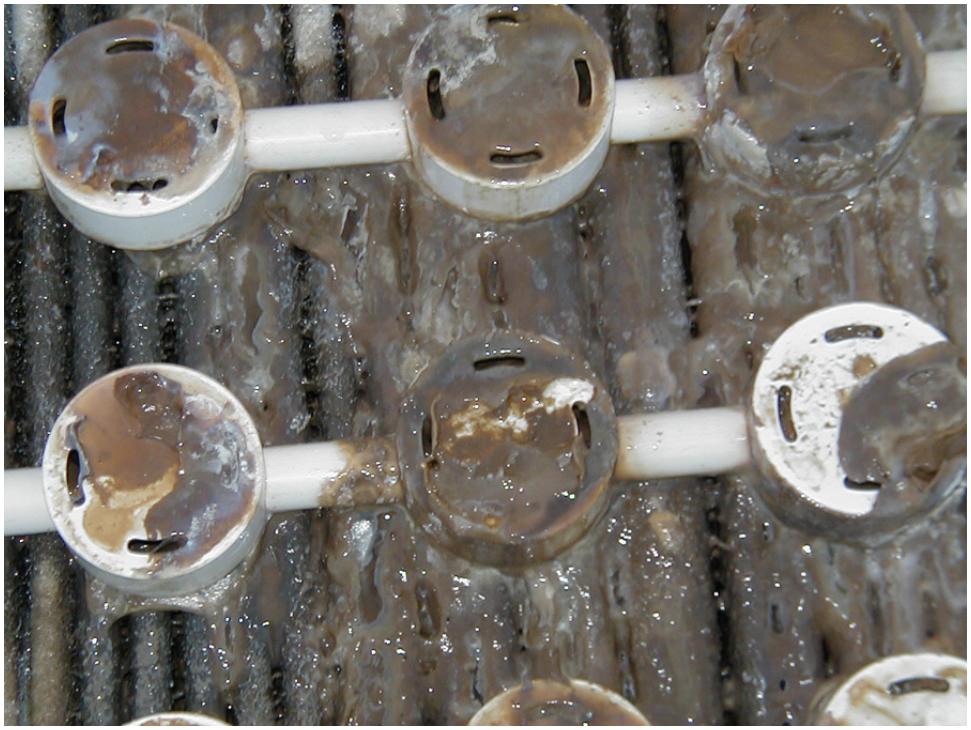
Scheduled Maintenance Reference Chart		Recommended Activity Period					
		Monthly	Quarterly	Semi-annually	Annually	Biannually	
Activity	Visual Inspection of Tank Liquid Levels	•[1]	•				
	Check Biotube® Effluent Filters; Clean as Required	•[1]	•				
	Check Biotube® Pump Vault Filters; Clean as Required	•[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.*

Poor Effluent Quality

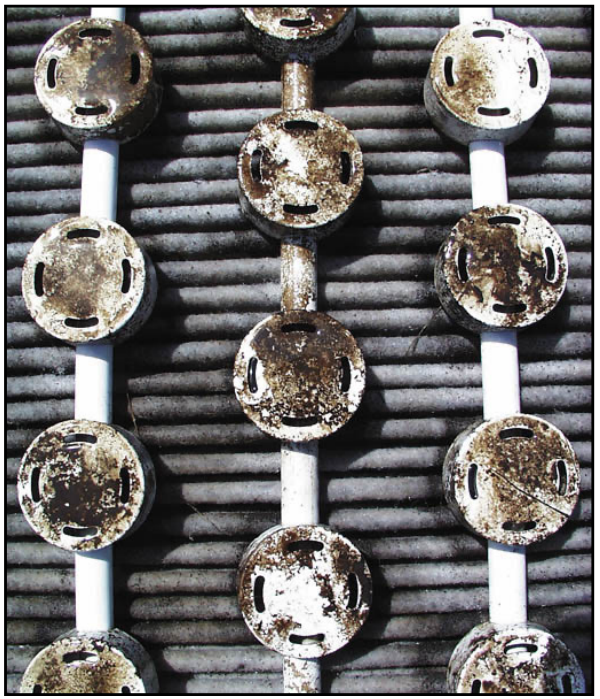
- Cloudy, turbid, odors, high BOD
- Check:
  - Biotube filter
  - Filter sheets
  - Recirculation ratios
  - Ventilation
  - DO levels
  - Pump



AdvanTex® Textile Filter

Characteristics of Biomat

- Color — Light to dark brown, not yellow
- Texture — Gelatinous, not lard-like
- Odor — Musty, not pungent
- Moisture — Moist, not ponding*



AdvanTex® Textile Filter

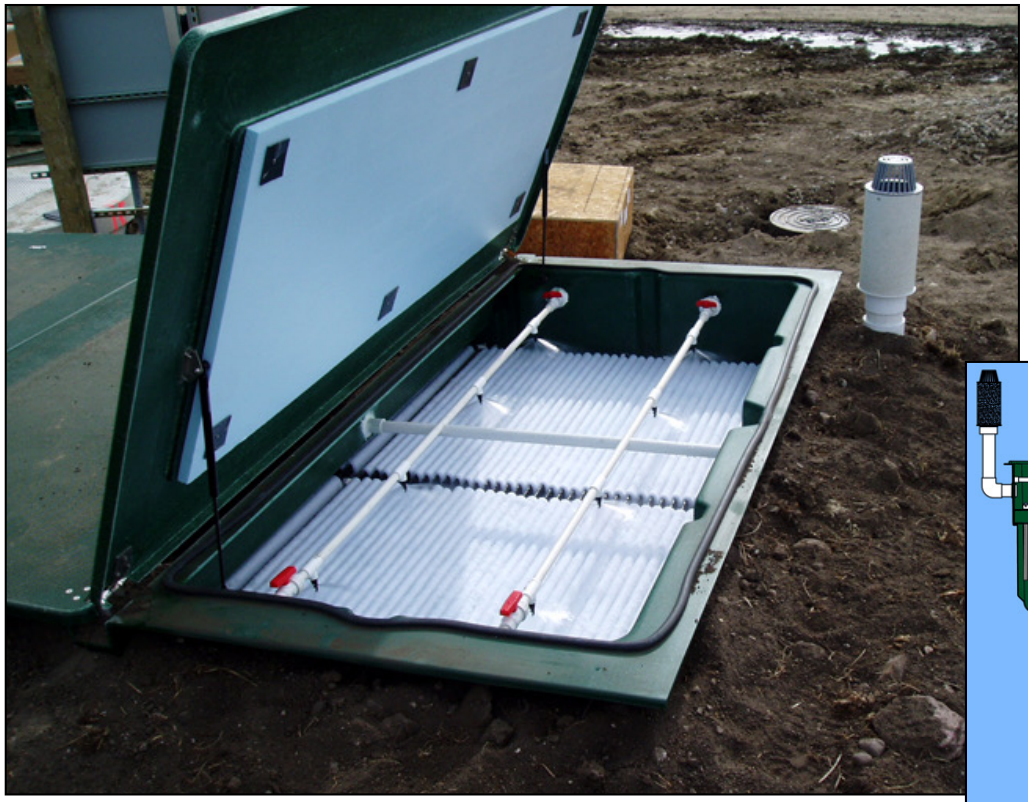
Oily Film

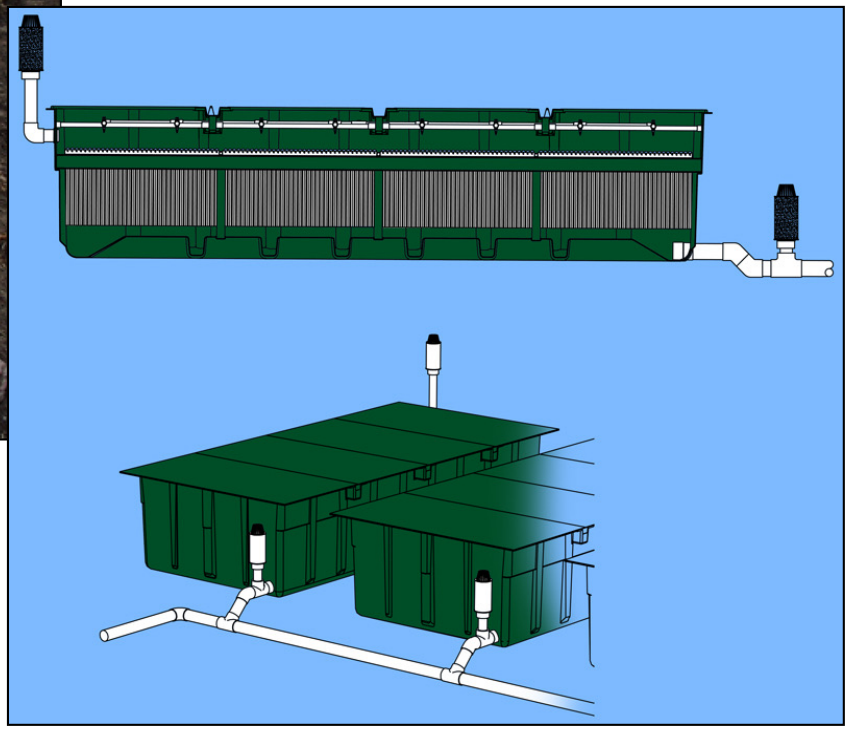
- There should be no signs of grease and oil on the textile or in the tank

AdvanTex® Textile Filter: Oily Film

- Excessive grease and oil is typically not a problem when commercial systems are properly designed and managed

Passive Air Ventilation





Checking Ventilation Fan Assembly

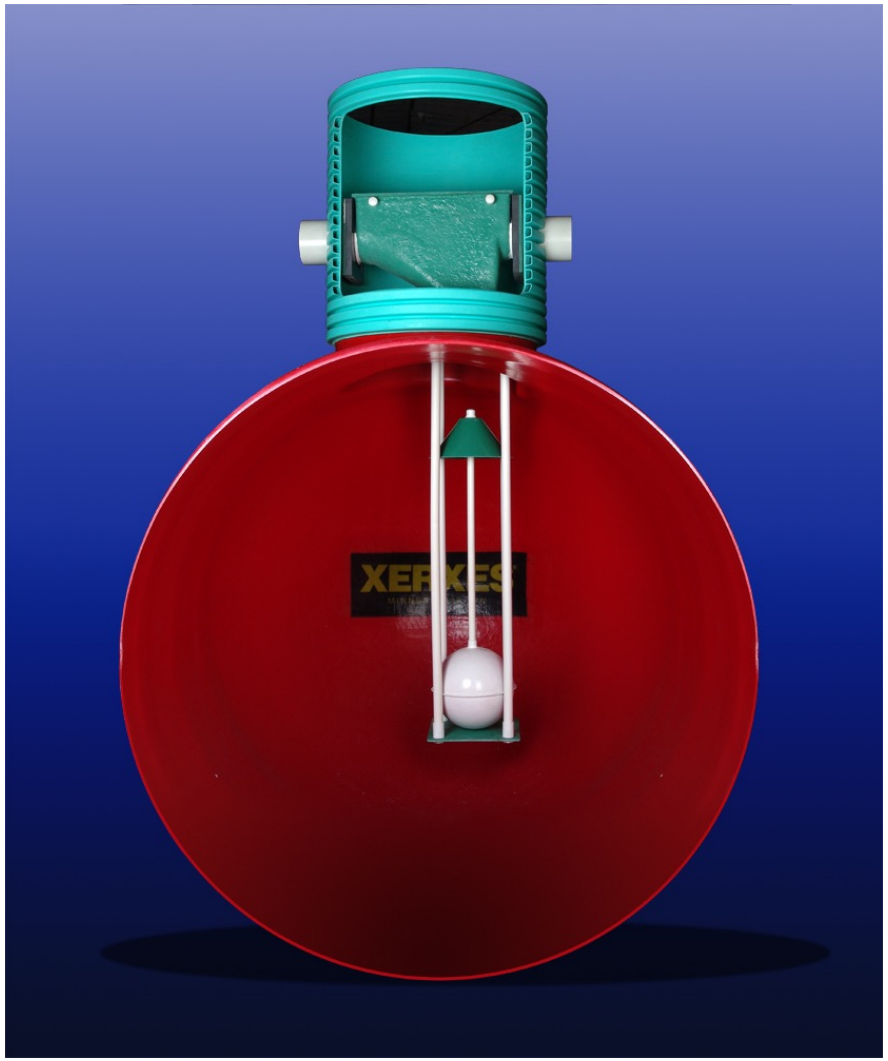
- Verify fan operation and air flow
- Clean ventilation fan assembly, as necessary
- Inspect and clean intake screen on air inlets
- Confirm pressure sensor or current sensor operation

Inspecting the Recirc/Blend Tank

- Little sludge and scum should be present

Inspecting the Recirculating Valve

- Check buoy for ...
  - ~ Proper inflation if it's an inflatable ball
  - ~ Free movement in the cage

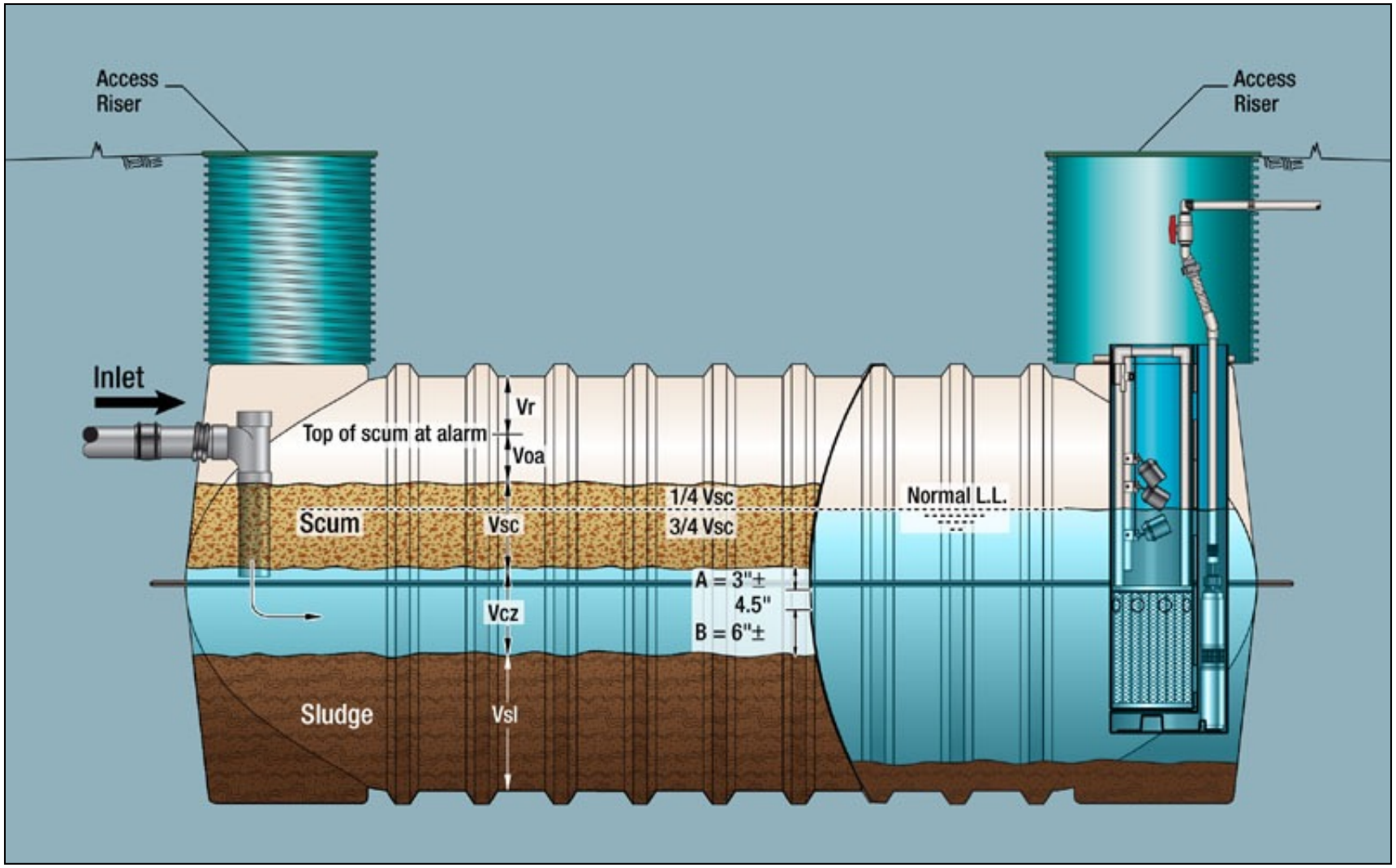


Inspecting the Tank
Measuring Sludge/Scum Thickness

- Measure sludge/scum accumulation every year

- Recommend pumping when ...
  - ~ Scum is about 3" above flow-through ports, or
  - ~ Sludge is about 6" below flow-through port
  - ~ Commercial/Municipal

Measuring Sludge/Scum Thickness



Nitrogen Reduction Process

- Standard AdvanTex System can reduce nitrogen by more than 60%
- Alternative configurations can reduce nitrogen by more than 80%

Data from “AdvanTex Performance Summary #2”, Doc # AHO-ATX-PERF-TN-1 (2012), Orenco Systems

Constituents

- NH_3 = Ammonia
- O_2 = Oxygen
- Alk = Alkalinity
- NO_2 = Nitrite
- NO_3 = Nitrate

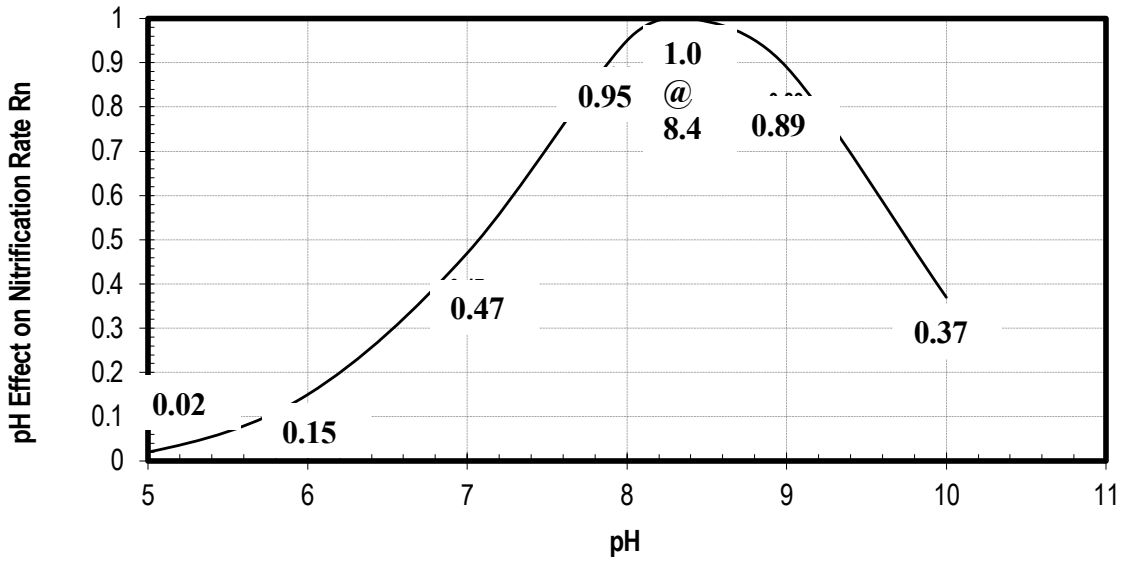
Optimum Nitrogen Reduction Requires

- Adequate alkalinity: >250 mg/L
- pH: 6.5 – 8.5
- D.O.: 2.5 – 6 mg/L
- Temperature: >50 degrees F
- Time for nitrifying bacteria to grow: 1-3 months
- Adequate BOD removal

* High BOD requires more oxygen

pH Effect on Nitrification

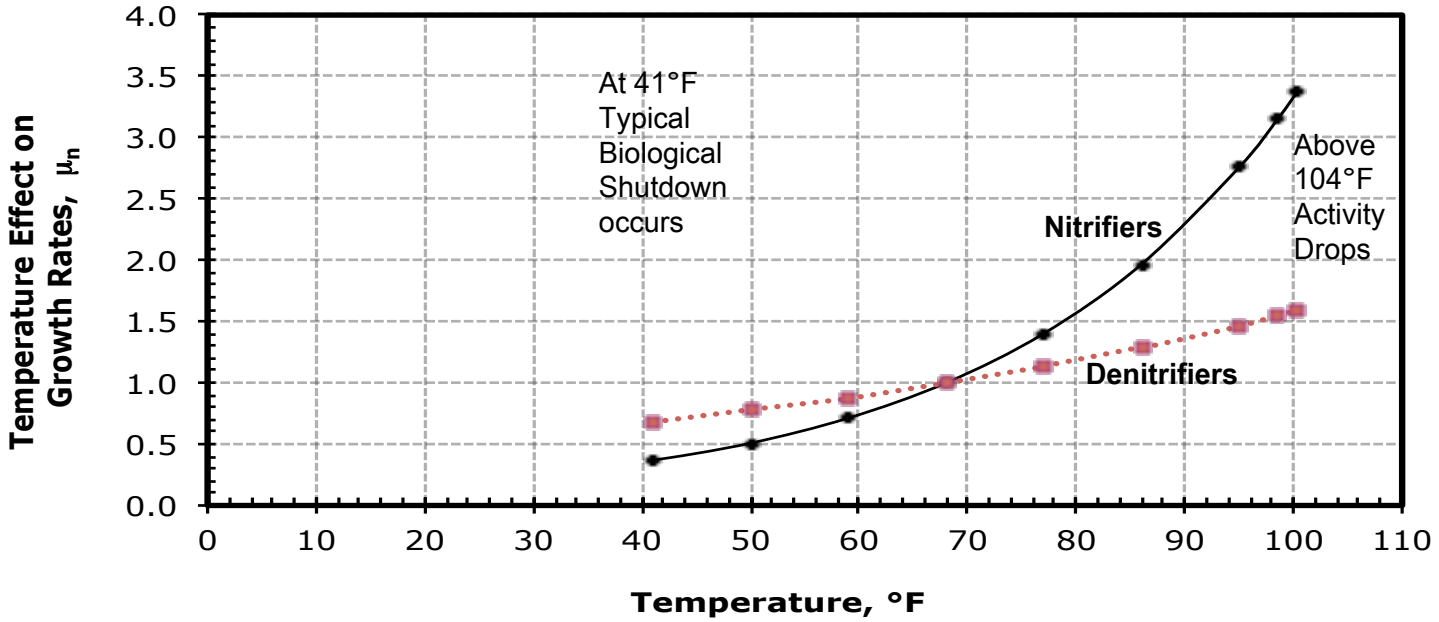
- See chart below to see impact on the effect reaction rate, R_n
- All system requiring enhanced nitrogen reduction should maintain a minimum pH value of 7
- Size alkalinity feed system for target residual of 100 mg/L



WEF MOP 11 Volume II Operation of Water Resource Recovery Facilities
Water Environment Federation Manual of Practice 11, Seventh Edition

Temperature Effect on Nitrogen Processes

- See chart below showing the impact of temperature on growth rates of the nitrifying bacteria
- All system requiring enhanced nitrogen reduction should maintain a minimum liquid temperature of 50ºF (10ºC) in winter and 59ºF (15ºC) in summer



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Nitrogen Reduction

- Nitrification
  - $NH_3 + O_2 + Alk + Bacteria = NO_2$
  - $NO_2 + O_2 + Alk + Bacteria = NO_3$
  - 4.6 parts O_2 + 7.1 parts Alk $\xrightarrow{convert}$ 1 part NH_3
- Denitrification
  - Need anoxic atmosphere
  - Need carbon source
  - $NO_3 \xrightarrow{convert} N_{(gas)} + O_2$ + 3.6 parts Alk

Troubleshooting Nitrogen Reduction

Check Influent

- Ammonia (NH_3)
- BOD
- Alkalinity
- pH
- High flows?

Check

- Effluent DO
- Filter
- Air flow
- Recirculation ratio

Remember! Nitrifying bacteria require 1-3 months to develop and temperature below 50 degrees F will impede growth

High Recirculation Ratio Causes:

- Drop in alkalinity
- Drop in pH
- Rise in Nitrate (NO_3)
- Drop in Ammonia (NH_3)
- Rise in DO (Dissolved Oxygen)

Lower Recirculation Ratio Causes

- Drop in Nitrate (NO_3)
- Rise in pH
- Rise in Alkalinity
- Decrease in DO

Before Leaving the Site

- Verify that valves are back to proper operating positions
- Place control panel switch back to “automatic”
- Make sure all points have been inspected and recorded on the FMR
- Secure all lids and panels, check breakers

Sampling Procedures

- Reasons for Sampling
  - Process control
  - Regulatory compliance
- Types of Samples
  - Grab samples
  - Composite sampling
- Objectives
  - Quantity
  - Quality
  - Representative

Sampling Procedures, cont.

- Proper sampling technique
  - Use proper safety precautions
  - Use clean plastic or glass containers
  - Avoid transfer to other containers
  - Label correctly
  - Normal system operation
  - Use proper preservation techniques

Sampling Procedures, cont.

- Representative – Effluent/Filtrate sample locations
  - Septic tank effluent – tank inspection riser
  - Residential AdvanTex – recirculation splitter valve
  - AX100 – recirculating splitter valve
  - AX Max – recirc-filtrate chamber
  - RSF – discharge pump basin
  - Other – MBR, SBR, Activated sludge

Sampling Filtrate

- Pull RSV out of its quick disconnect holster and lay it on the riser lid
- Collect a filtrate sample from the RSV inlet
- Refer to the “Field Sampling/Observations” in the Residential AdvanTex® O&M manual

What to Test For: Constituents

- BOD_5
- TSS
- pH
- Ammonia (NH_3)
- Nitrite/Nitrate (NO_2 and NO_3)
- TKN
- Turbidity
- Alkalinity
- Temperature
- FOG
- Dissolved Oxygen (DO)
- E.coli

Sampling Report Form

SAMPLING REPORT FORM

FACILITY:				SAMPLE DATE:			
				ANALYST:			
SAMPLE ID	NH3	NO3	NO2	ALK	D.O.	pH	Turbidity
COMMENTS:							

FACILITY:				SAMPLE DATE:			
				ANALYST:			
SAMPLE ID	NH3	NO3	NO2	ALK	D.O.	pH	Turbidity
COMMENTS:							

Ammonia = NH3
Nitrate = NO3
Nitrite = NO2
Alkalinity = ALK
Dissolved Oxygen = D.O.

Summary

- Understand the system
  - Layout
  - Components
  - Optimum performance
- Check common problems
  - Use the troubleshooting checklist
  - Review historical reports
- Advanced Troubleshooting
  - Sampling
  - System adjustments

Solutions for Decentralized Wastewater Treatment

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