Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor
11 State House Station
Augusta, ME 04333-0011

John Elias Baldacci
Governor

Brenda M. Harvey,
Commissioner

Dora Anne Mills, MD, MPH
Public Health Director
Maine CDC Director

July 18, 2006

Orenco Systems, Inc.
Attn.: Sam Carter, GRM
814 Airway Avenue
Sutherlin, OR 97479

Subject: Product Registration, Orenco Systems, Inc. **AdvanTex Treatment System**

Dear Mr. carter:

The Division of Environmental Health has completed a review of a registration application for your company's product. This information was submitted pursuant to Section 1802 of the Maine State Plumbing Code, Subsurface Wastewater Disposal Rules, for code registration, for use in Maine.

Product Description

The Orenco Systems, Inc. **AdvanTex Treatment System** consists of a recirculating textile packed bed filter comprised of a watertight tank with an upper distribution manifold and a lower collection manifold. The textile filter/fixed film media is located between the manifolds. The packed bed filter receives primary treated effluent form either an integral two compartment septic tank, or separate septic tank installed in series ahead of the packed bed filter. The Treated effluent is recirculated into the primary treatment tank until the desired treatment level is achieved, and then disposed of pursuant to applicable regulations.

Claim

According to the information you provided, the Orenco Systems, Inc. **AdvanTex Treatment System** received National Sanitation Foundation (NSF) Standard 40 approval in April of 2002. The system produces effluent with combined BOD_5 and TSS levels of 20 mg/l or less.

Determination

On the basis of the information submitted, in particular NSF Standard 40 approval, the Division has determined that the Orenco Systems, Inc. **AdvanTex Treatment System** is acceptable for use in the State of Maine, provided that it is installed, operated, and maintained in conformance with the manufacturer's directions. Effluent from the system shall be disposed of in accordance with the Maine Subsurface Wastewater Disposal Rules, CMR 241.

In the event that the product fails to perform as claimed by the applicant, use of the product in Maine, including all installations approved pursuant to Chapter 18 of the Rules, shall cease. Use of the product shall not resume until the applicant and the Division have reached a mutually acceptable agreement for resolving the failure to perform as claimed.

Because installation and owner maintenance has a significant effect on the working order of onsite sewage disposal systems, including their components, the Division makes no representation or guarantee as to the efficiency and/or operation of Orenco Systems, Inc. **AdvanTex Treatment System.** Further, registration of this product for use in the State of Maine does not represent Division preference or recommendation for this product over similar products.

If you have any questions please feel free to contact me at (207) 287-5695.

Sincerely,

James A. Jacobsen

James A. Jacobsen, Environmental Specialist IV
Wastewater and Plumbing Control Program
Division of Health Engineering
e-mail: james.jacobsen@state.me.us

/jaj

xc: Product File

June 28, 2006

Orenco Systems®
Incorporated

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SUTHERLIN, OREGON
97479

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WEB SITE:
www.orenco.com

Russell G. Martin, P.E.
Maine Division of Environmental Health
Department of Health & Human Resources
Maine Center for Disease Control and Prevention
Division of Environmental Health
11 State House Station
Augusta, ME 04333

RE: Orenco Systems, Inc. Products Approval Request

Dear Mr. Martin:

Please accept this letter as a formal request to approve the following products as manufactured by Orenco Systems, Inc. for General use in the State of Maine. I have enclosed information on each product line to support this request for approval.

AdvanTex® Treatment System

Orenco Systems Inc. has been conducting research and development on packed bed filters for over 25 years. Our efforts have produced the AdvanTex® Treatment System. AdvanTex incorporates a non-woven textile as the substrate for an attached growth (fixed film) treatment process. The textile media incorporates the best process treatment features of the Intermittent and Recirculating Sand Filters into one compact unit. The AdvanTex - AX filter system will significantly reduce BOD_5, TSS and Total Nitrogen in residential strength wastewater to levels that meet advanced wastewater treatment standards.

Enclosed you will find an Approvals Binder that includes an Approvals Summary, Frequently Asked Questions, Treatment System Overviews, Drawings, Design Criteria, AdvanTex Treatment System Performance Summary, Warranties, Installation Instructions, and Operation and Maintenance Procedures. Included in the appendix is information on the history of packed bed filters, as well as technical papers on textile packed bed filters.

Fiberglass Tank

Orenco's injection-molded, watertight tanks have been optimized for use in onsite wastewater collection and treatment systems (residential and commercial) and in communitywide effluent sewer systems. Tanks are made of fiberglass-reinforced polyester for durability, and injection-molded for unmatched part quality and consistency. Two sizes are available 1000-gallon and 1500-gallon.

Enclosed you will find an Orenco Fiberglass Tank Approvals Binder that includes drawings and detail sheets, installation instructions, and structural analysis.

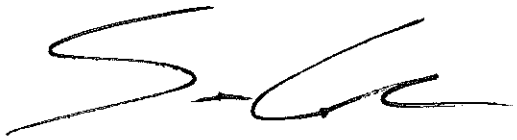
Biotube® Effluent Filters
Orenco's FT-Series Biotube effluent filters are used in new or existing tanks, for both residential and commercial applications. Each filter comes with a Biotube filter cartridge (in 4-, 8-, and 15-in. diameters), PVC housing, and extendible PVC handle. A shortened version of our standard 8- and 12-in. diameter filters, called a "base inlet filter", is available for low-profile tanks.

Enclosed you will find an Orenco Effluent Filter Folder that includes product sheets, drawings, and sizing information.

I have also enclosed a general Product Catalog that covers all the products Orenco Systems, Inc. manufactures which may require approval of some sort. Understandably you may need additional or more specific information on any of these products, that I would be happy to send you.

Please feel free to contact me to discuss what additional information you may need or if you have any questions.

Best Regards,



Sam Carter
Government Relations Manager
Orenco Systems, Inc.
1-800-536-4192
scarter@orenco.com

Orenco Systems®, Incorporated

AdvanTex® Treatment Systems

VERSION 2002

Approval Package

AX Series
- AdvanTex®-AX Treatment Systems Overview
- AX Brochure
- NSF Executive Summary
- AX Performance Summaries
- Design Criteria
- AX Drawings
- Tech Data Sheets
- Standard Packages
- General Specifications

Approvals & Warranty
- Approvals Summary
- AdvanTex® Warranty

Installation
- Installation Guide: AX Series
- Authorized Installer Certificate

Operation & Maintenance
- O & M Manual
- Sample Service Contract
- Authorized Service Provider Certificate
- Homeowner's Manual

Dealer Responsibilities
- Dealer Policy Manual
- Orenco Expectations of Partners

Technical Background
- AdvanTex® Q-A
- Case Studies
- *Intermittent and Recirculating Packed-Bed Filters,* Crites and Tchobanoglous
- *Performance of Packed Bed Filters,* Bounds et al

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Overview
AdvanTex® Treatment Systems

Orenco Systems®
Incorporated
1-800-348-9843

Orenco's AdvanTex® Treatment Systems are an innovative technology for onsite treatment of wastewater. The heart of the System is the AdvanTex filter, 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. That's because textile has a very large surface area for biological breakdown of wastewater components – about five times greater than that of an equivalent volume of sand. Yet the AdvanTex filter has a very small footprint.

System Performance

Orenco Systems® has been researching, designing, testing, and selling a variety of textile filters for about seven years. More than 5,000 textile filters have been installed throughout the United States and Canada, on sites ranging from federal demonstration projects to university testing facilities, single-family homes, commercial properties, and community systems.

Unlike other wastewater treatment technologies, the AdvanTex Treatment System provides consistent, reliable wastewater treatment, even during "peak flow" conditions. The AdvanTex Treatment System includes a processing tank and a control panel with a programmable dosing timer. So it discharges small amounts of treated wastewater, regularly, throughout the day.

AdvanTex treats residential-strength waste to better than "secondary" standards. Effluent can be used for drip or subsurface irrigation, or discharged to shallow, inconspicuous trenches. It can also be discharged to fine-grained polishing filters for coliform removal and water reuse.

Third-Party Performance Verification

AdvanTex Treatment Systems have undergone lengthy performance testing to ANSI and NSF/ANSI standards. This third party testing (NSF Final Report, April 2002) of treatment performance recorded a maximum 30-day arithmetic mean of 8 mg/L for $CBOD_5$ and 6 mg/L for suspended solids. Over the six-month course of the evaluation, the average effluent $CBOD_5$ was 5 mg/L, and the average effluent suspended solids was 4 mg/L.

System Benefits

Significantly smaller land area is required for the AdvanTex Treatment System than is required for sand and gravel filters. That's because textile has demonstrated the capacity to support microbial populations that can treat filtered processing tank effluent at greater hydraulic loading rates. In fact, loading rates for AdvanTex Treatment Systems are typically 5-20 times higher than for sand filters. In addition, reductions in drainfield size are often permitted with AdvanTex Treatment Systems. Moreover, textile is lightweight, making it ideal for prepackaging and shipping, which simplifies installation and reduces costs.

Applications

The AdvanTex Treatment System is ideal for...

- New construction
- System upgrades and repairs
- Pretreatment of moderately high-strength waste
- Wherever typical secondary treatment standards suffice

AdvanTex®-AX Filters Overview, cont.

System Operation and Maintenance

AdvanTex is easy to service, easy to clean, and generates virtually no troublesome activated sludge. Like most advanced technologies, the AdvanTex Treatment System requires regular maintenance. As a condition of warranty, property owners must purchase a service contract from a certified third party provider.

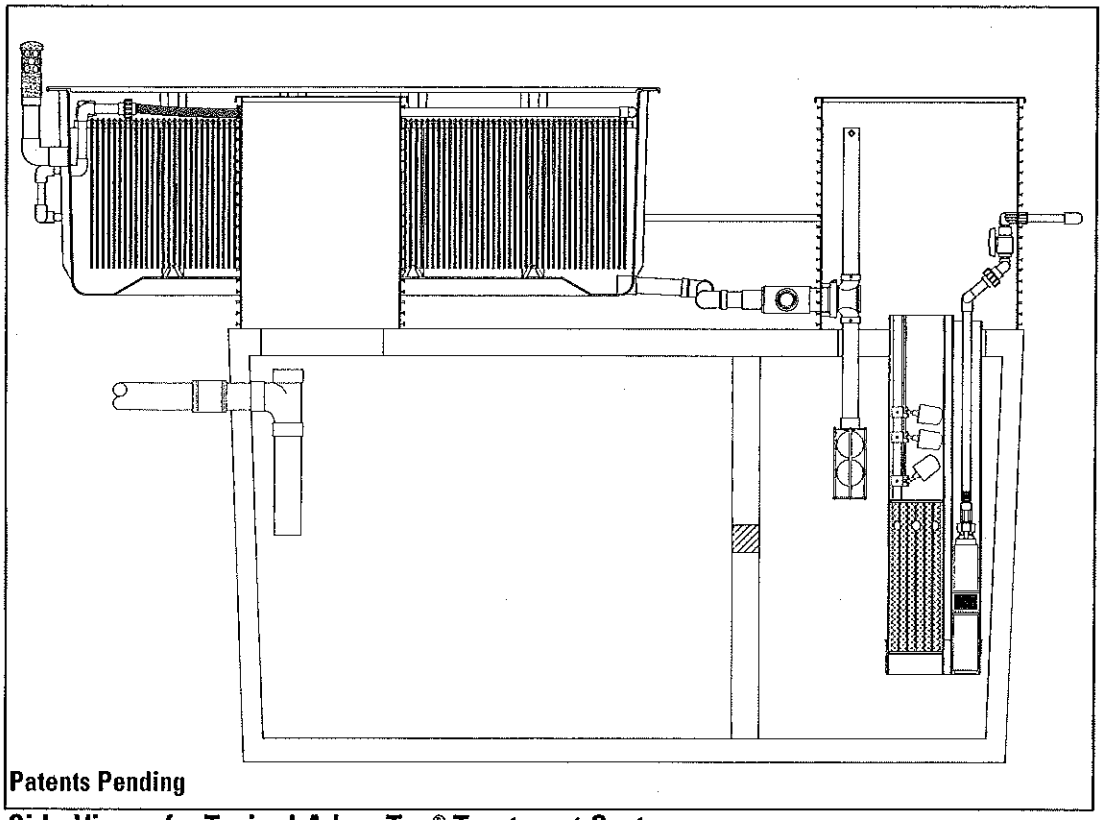
The AdvanTex Treatment System comes standard with a VeriComm® telemetry control panel with a web-based monitoring system, supervised by the System's service provider. Alarm notifications are automatically sent to the service provider's e-mail capable device. Messages are resent until the condition has been cleared. As a back-up, the VeriComm control panel also has an audible alarm. And the System is sized to allow for a minimum of 24 hours of wastewater storage (at average daily flows). That means an operator can provide service to the system during normal working hours, regardless of when an alarm occurs.

The AdvanTex System's pumps typically run 30-60 minutes per day, so AdvanTex uses very little power . . . an average of $1.25-2.50 per month (based on the national average of eight cents per kilowatt hour). Compare that to power costs of up to $20-$60 per month for many "activated sludge" aerobic treatment units.

Treatment Methodology

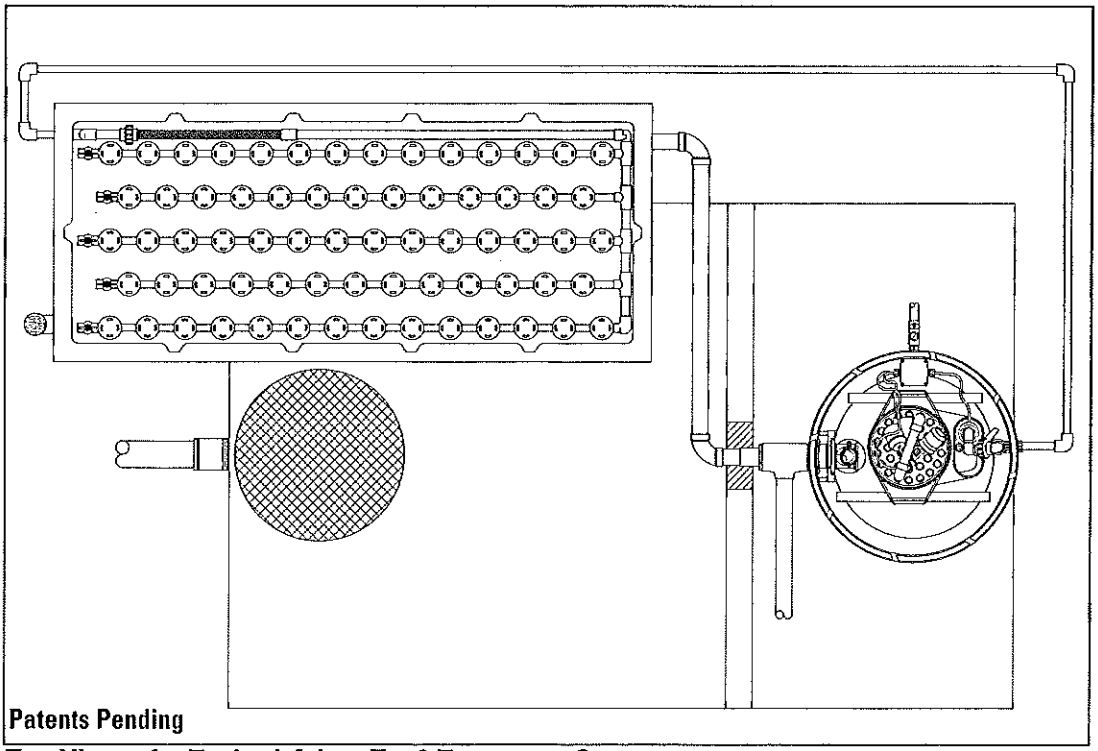
The AdvanTex Treatment System works just like a recirculating sand filter: a reliable, proven technology that Orenco's engineers have helped to perfect over the past 20 years. While the treatment process is similar, the proprietary treatment module is more efficient.

In an AdvanTex Treatment System, wastewater percolates through the textile media, whose complex fiber structure provides tremendous water-holding capacity and offers an extremely large surface area for biomass attachment. A visible biological film normally develops on the filter medium within a few days. BOD_5 and TSS reductions occur almost immediately.



Patents Pending

Side View of a Typical AdvanTex® Treatment System



Patents Pending

Top View of a Typical AdvanTex® Treatment System

About Orenco

Orenco Systems®, Inc. was founded in 1981 by President Hal Ball and Executive Vice President Terry Bounds to respond to widespread failures in Oregon's onsite wastewater systems.

Over the past 24 years, the company has grown to become an industry leader, with about 240 employees and more than 100 distributors and dealers, who represent most of the United States, Canada, New Zealand, and parts of Europe and South America. Research, Product Development, Engineering and Technical Services, Manufacturing, and Sales Support are handled out of our 23-acre facility in Sutherlin, Oregon.

Orenco designs and manufactures advanced onsite and decentralized wastewater technologies for individual properties, commercial facilities, and small communities – properties that are not connected to centralized sewers or whose sewers are failing or at capacity.

Our wastewater solutions involve watertight fiberglass tanks, in-tank filtration systems (Biotube® effluent filters and pump vaults), secondary treatment systems (AdvanTex® textile filters, intermittent sand filters, and recirculating sand filters), effluent sewer collection systems, ProSTEP® pumping packages, accessory items, and advanced electrical controls (see back).

Our products and systems allow treated effluent to be returned harmlessly to the environment via drainfield, subsurface irrigation, or surface discharge. We have a maintenance division and an environmental lab, and we invest time and money in a continuing research program, often in cooperation with colleges and universities.

Our research and technologies appear in numerous publications, including Metcalf & Eddy's *Wastewater Engineering: Treatment, Disposal, Reuse* and Crites & Tchobanoglous' *Small and Decentralized Wastewater Treatment Systems*. Our engineers are regularly asked to give workshops, and our systems have been installed all over the world.

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AHO-GEN-2
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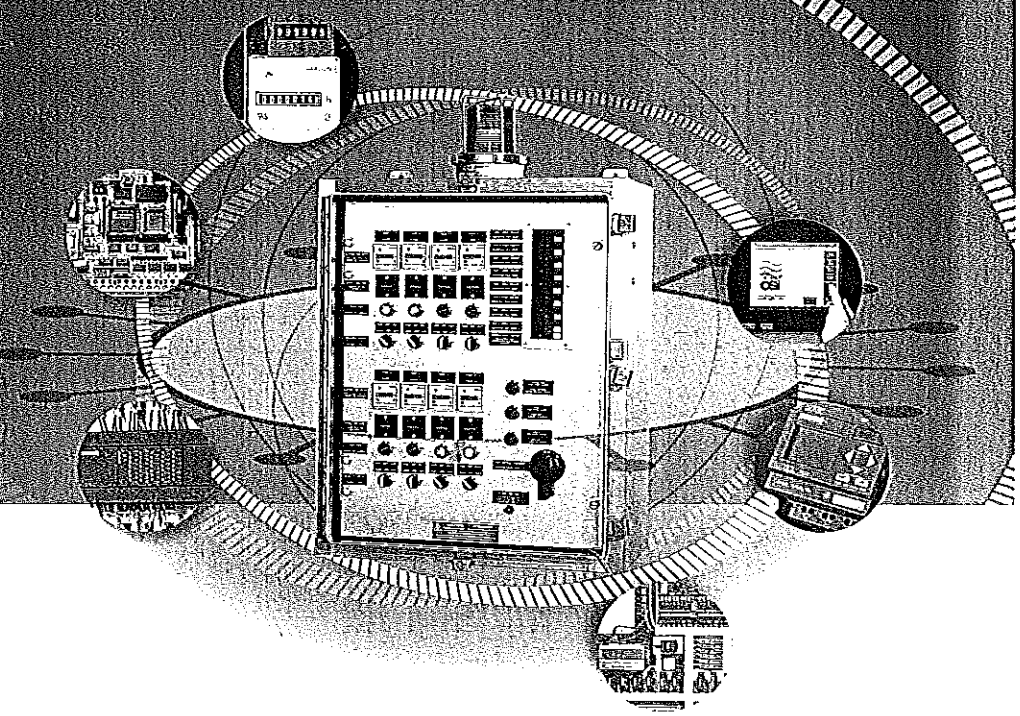
Orenco Systems®
Your Control Center



Orenco Systems® specializes in manufacturing control and monitoring systems for the water handling and wastewater industries. Our experts know what issues are important to designers, engineers, and system operators.

From a simple liquid level alarm to a custom-built control system featuring digital programmable logic or remote monitoring capabilities, Orenco offers the best value for your dollar. We use the finest precision-engineered components available, and we back up our panels with ongoing research and years of applied experience.

Orenco offers controls for a wide range of applications:

- Alarm panels
- Standard electromechanical panels
- MVP digital programmable panels
- VCOM remote telemetry panels (Web-based)
- TCOM remote telemetry panels (dial-up)

All Orenco panels include

- Touch-safe controls
- Three-year warranty
- NEMA 4X rating for wet locations
- UL 508 listing in the United States and Canada
- CE marking in Europe

UL 698A-listed products for hazardous locations (Class I, Division 1) are also available.

Although our panels are designed for use in onsite wastewater treatment, they can also be used in many other applications. In addition to the products in our catalog, we can supply OEM and customer-labeled components.

We're known for the high caliber of our panel support services. For assistance, call 800-348-9843.

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AdvanTex® Treatment Systems

Affordable, Reliable, Onsite Treatment of Residential Wastewater

NSF

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OSI

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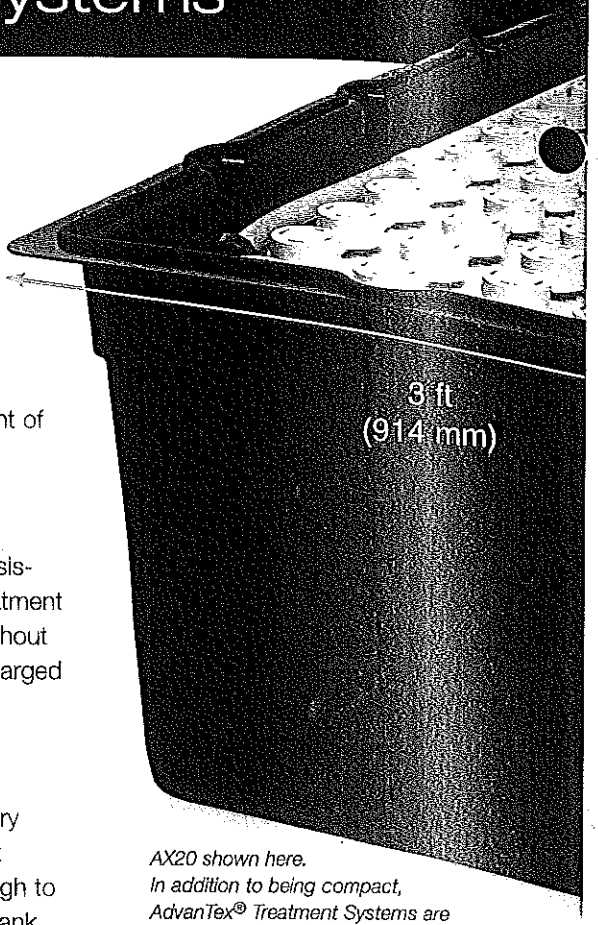
AdvanTex® – Treatment Systems

Finally! Affordable Wastewater Treatment — That Works!

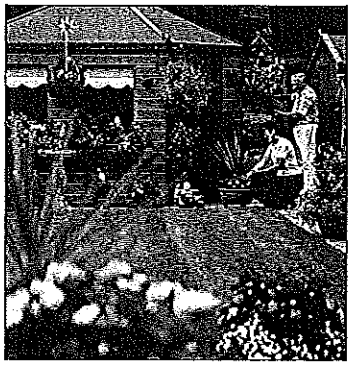


AX20 shown here.
In addition to being compact, AdvanTex® Treatment Systems are easier to operate and maintain than other wastewater technologies. No odors. No power-hungry, noisy blowers. No activated sludge to manage or pump. No discharge of untreated sewage during peak flows or emergencies.

Orenco's AdvanTex Treatment Systems are the ideal solution for onsite treatment of residential wastewater flows.

Outstanding Wastewater Treatment

Unlike other onsite wastewater treatment technologies, AdvanTex provides consistent, reliable treatment, even during "peak flow" conditions. Your AdvanTex Treatment System processes and discharges small amounts of treated wastewater throughout the day. Water so clean it can be used for drip or subsurface irrigation, or discharged to shallow, inconspicuous trenches.

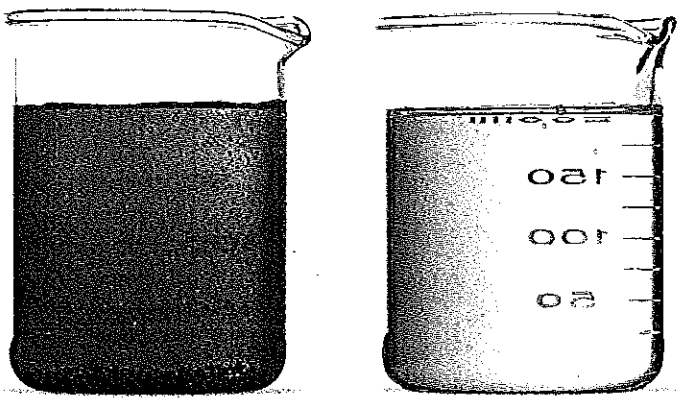


Fits Small Yards

Your AdvanTex Treatment System requires very little space. Its filter unit is 7.5 ft × 3 ft × 2.5 ft (2286 mm × 914 mm × 762 mm), small enough to fit under a deck or on top of the processing tank. And some jurisdictions allow a reduction in drainfield area with AdvanTex. So AdvanTex is ideal for small sites, for homes that require additional pretreatment of wastewater, or for homeowners who simply want more use of their yard.

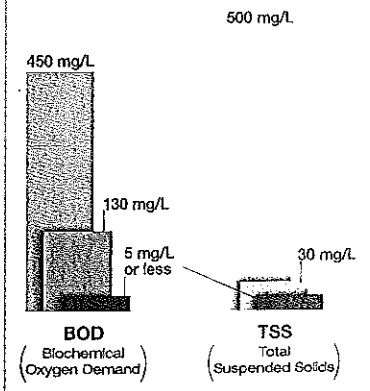
Low Installed Cost, Low Lifetime Cost

Best of all, the AdvanTex Treatment System is one of the most affordable wastewater treatment products currently on the market. And thanks to easy installation and low maintenance, installed costs and lifetime costs are kind to your pocketbook, too. Plus, AdvanTex filters protect and preserve your drainfield.



AdvanTex turns household wastewater into clear, odorless effluent you can reuse for subsurface irrigation.

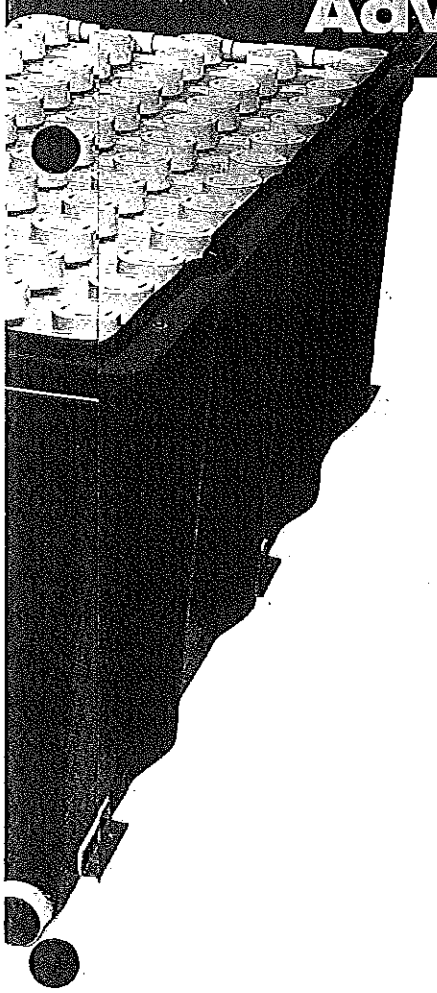
AdvanTex® Treatment Systems make raw wastewater up to 99% cleaner ... consistently producing effluent in the 5/5 mg/L range



1 Source: Derived from *Small and Decentralized Wastewater Management Systems*, Crites & Tchobanoglous, McGraw-Hill, 1998, p. 183.

2 Actual performance results, based on a six-month accumulative average from NSF (National Sanitation Foundation) testing on the AX20N at 500 gpd (1900 L/d), using composite sampling.

AdvanTex® – Treatment Systems



An Advanced Technology

The patented* AdvanTex Treatment System is a significant improvement on a proven method. AdvanTex works just like a recirculating sand filter (RSF), a reliable technology that Orenco has helped to perfect over the past 20 years.

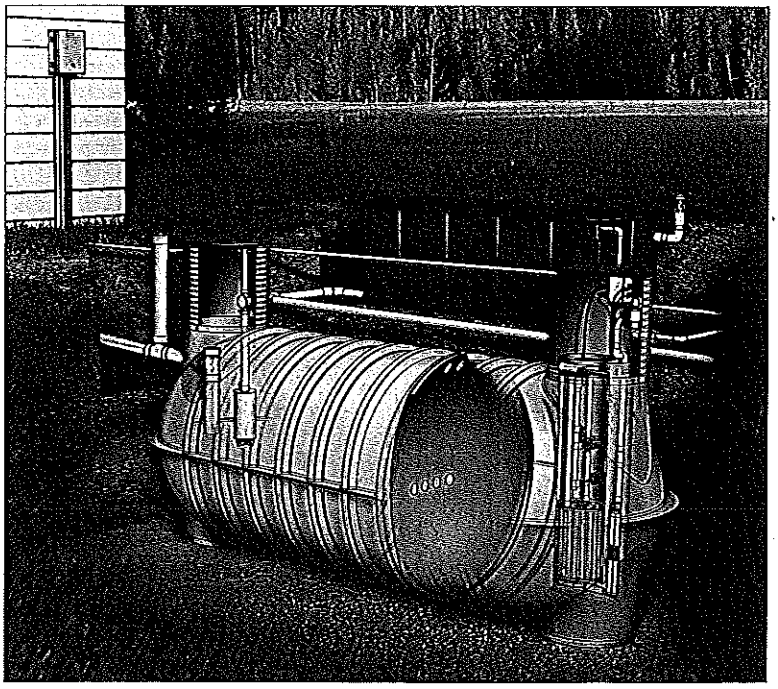
Just like an RSF, your AdvanTex system includes a processing tank and a control panel with a programmable timer for even, steady wastewater treatment, even under peak conditions — such as parties and weekend clothes washing.

The system also includes the AdvanTex textile filter, a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent material treats a tremendous amount of wastewater in a small space.

About 10,000 of Orenco's textile filters have been installed throughout the United States on sites ranging from federal demonstration projects to university testing facilities, single-family homes, commercial properties, and community systems. Third-party testing shows that AdvanTex Treatment Systems do a better job of treating wastewater than most municipal sewers.

"The effluent from the filter units typically was clear with no odor . . . the increased loading rate allows for a decrease in the footprint required by filter units (compared to sand and gravel filters) . . . in an onsite treatment scenario, textile filter effluent could be utilized for landscape irrigation . . ."

Leverenz, Darby, and Tchobanoglous, "Evaluation of Textile Filters for the Treatment of Septic Tank Effluent," University of California at Davis, October 2000.



This 3D illustration shows a representative backyard configuration for the key elements of an AdvanTex® Treatment System.

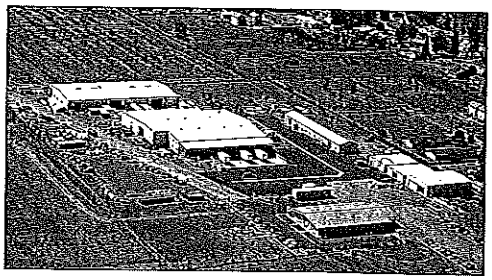
NOTE: * Covered by U.S. patent numbers 6,372,137; 5,980,748; 5,531,894; 5,480,561; 5,360,556; 5,492,635; 4,439,323; D461,870; and D445,476. Additional patents pending.

AdvanTex® – Treatment Systems

Orenco Systems is owned and managed by engineers who develop wastewater systems that work — systems based on sound science.

Clockwise from left: Eric Ball, P.E., Jeff Ball, P.E., Hal Ball, P.E., (front) Terry Bounds, P.E.

Carefully Engineered by Orenco



Your health is our priority. At Orenco Systems, we are committed to "Changing the Way the World Does Wastewater®."

Orenco Systems has been researching, designing, manufacturing, and selling leading-edge products for small-scale wastewater treatment systems since 1981. The company has grown to become an industry leader, with about 250 employees and with more than 100 distributors and dealers representing most of the United States, Canada, New Zealand, and parts of Europe and South America. Our systems have been installed in 40 countries all over the world.

Orenco maintains an environmental lab and employs more than a dozen civil, electrical, mechanical, and manufacturing engineers. Orenco's systems are based on sound scientific principles of chemistry, biology, mechanical structure, and hydraulics. As a result, our research appears in numerous publications, and our engineers are regularly asked to give workshops and offer trainings.

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

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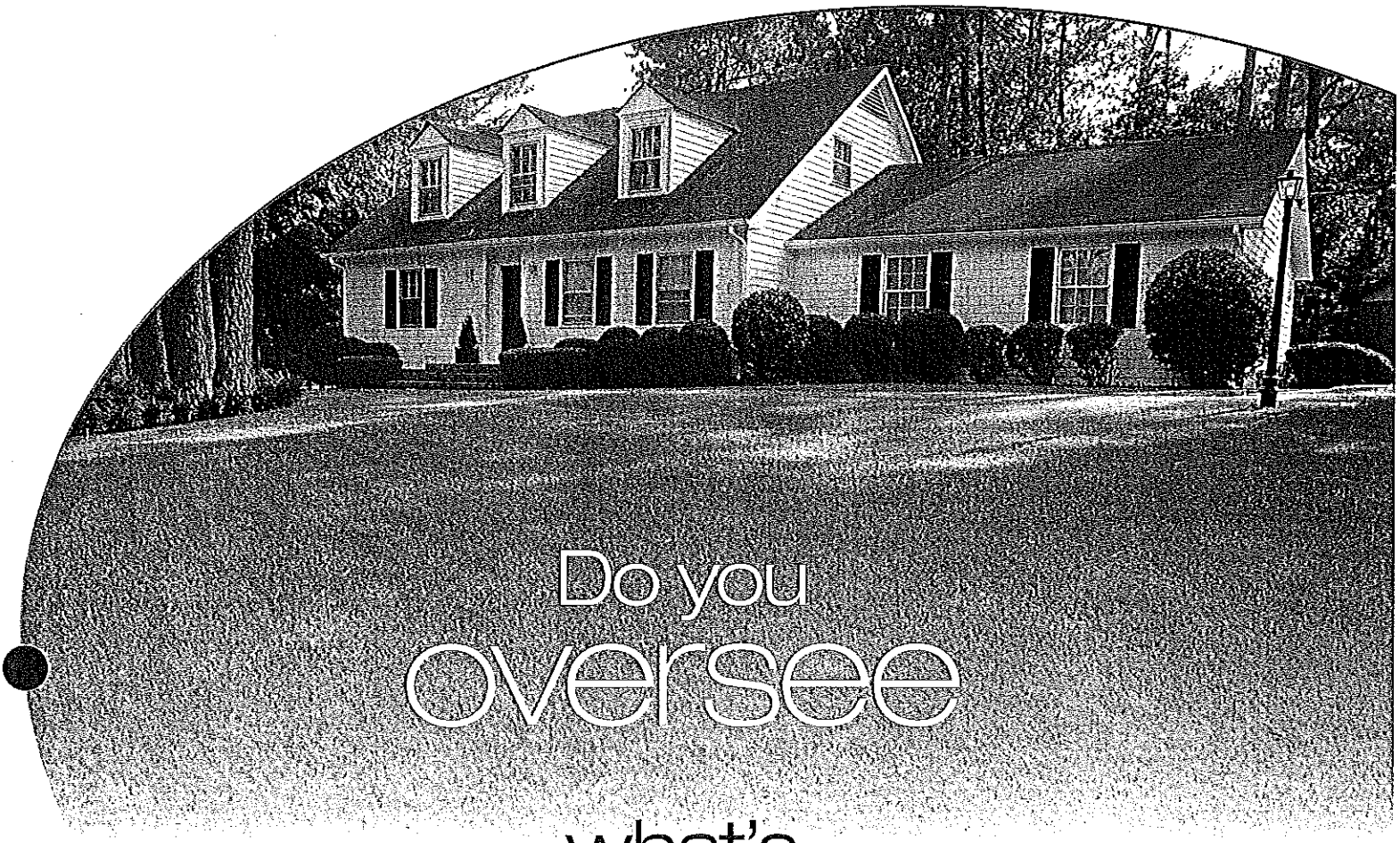
VeriComm® Monitoring System



Do you
oversee
what's
underground?

Remote monitoring and control
for decentralized wastewater
treatment systems

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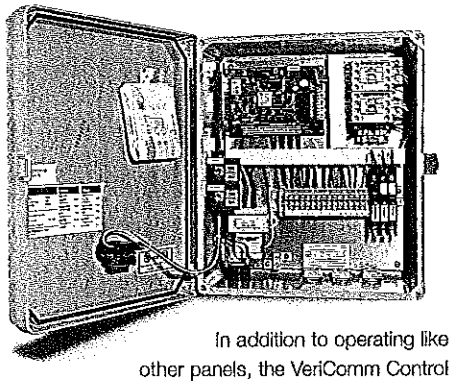
VeriComm® "Smart" Telemetry Control Panels

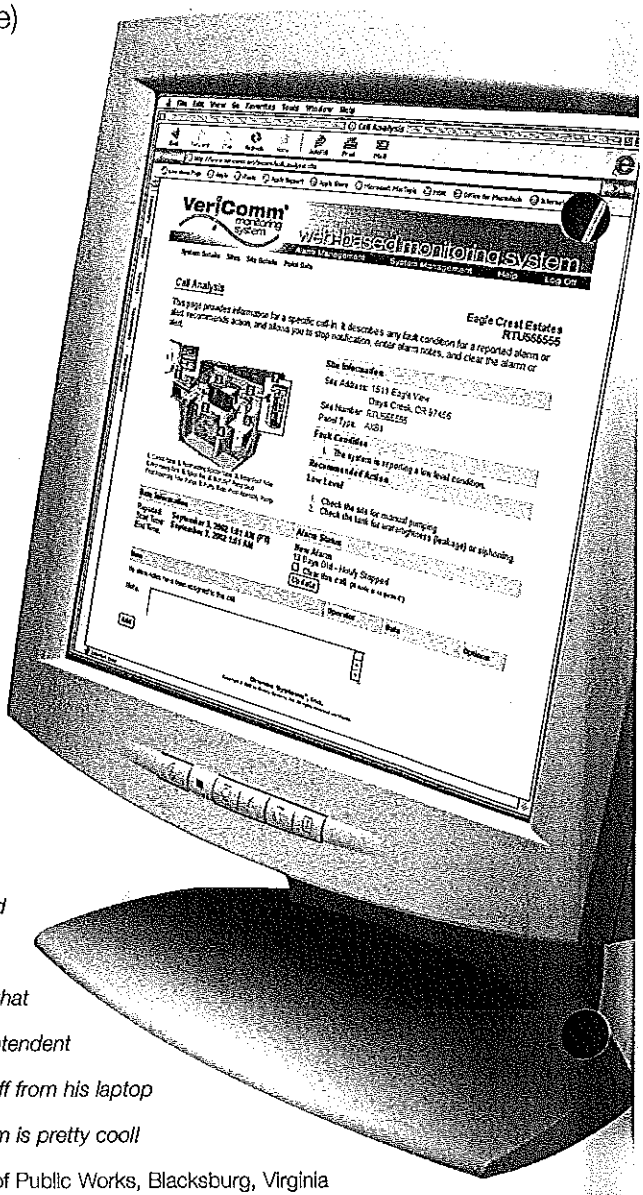
Are you responsible for designing, developing, managing, operating, or regulating a decentralized wastewater treatment system?

If so . . .



In addition to operating like other panels, the VeriComm Control Panel has four very "smart" functions: alarm management, data collection, troubleshooting, and advanced control logic (which recognizes float problems and makes self-corrections, based on historical trends).

- ✓ you need to know the system is operating
- ✓ you need to know that maintenance is being performed — and performed efficiently
- ✓ you need to know you can audit system performance and system reports
- ✓ you need to know the system is invisible (thus acceptable) to property owners



VeriComm®
Verifies and Communicates System Operation

Like you, our company stakes its reputation on the performance of onsite wastewater collection and treatment systems. That's why we developed our VeriComm® Telemetry Control Panels and VeriComm Monitoring System. VeriComm verifies and communicates system operation, remotely — 24 hours a day, 7 days a week.

System Data is Secure but Accessible

The decentralized wastewater treatment industry has many stakeholders. We developed VeriComm as a secure, Web-based monitoring system, so the data it collects is password-accessible. Operating data, alarm histories, site notes, and system reports are permanently available in a robust SQL database, viewable and printable from a user-friendly Web page.

We're managing the first STEP system of its kind in Virginia — a 200-home development called "The Village at Tom's Creek" — and it gives me confidence knowing we have the VeriComm system here. We love the fact that, when there's an alarm, VeriComm gives a diagnosis code that tells you 'this is what we think is wrong.' And the remote control is fantastic. Our Utility Superintendent lives 28 miles away. If he gets an alarm in the middle of the night, he can just shut the pump off from his laptop at home, then go out to the site in the morning. No middle-of-the-night service calls. VeriComm is pretty cool!

— Kelly Mattingly, Director of Public Works, Blacksburg, Virginia

VeriComm® Web-Based Monitoring System

VeriComm
Saves Time and Money in O & M

VeriComm Control Panels, coupled with the VeriComm Monitoring System, save money on system operation and maintenance by . . .

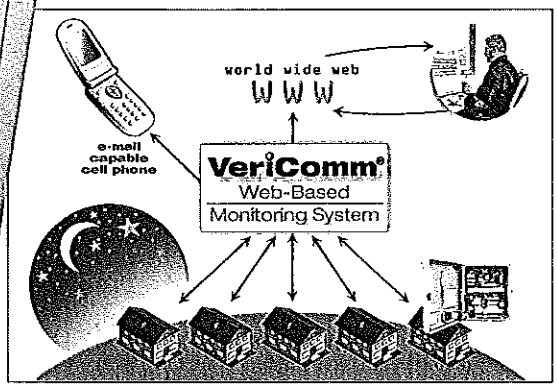
- notifying operators of alarms or alerts automatically
- diagnosing problems and making recommendations for action
- allowing operators to change many system settings remotely
- making self-adjustments via "artificial intelligence," based on trend data
- resolving problems before they become serious

With VeriComm, operators can make many system adjustments via the Web, so they'll make fewer service calls. And, when they have to go out on a site visit, they'll know just what equipment to bring.

VeriComm
Diagnoses the Following:

- High and low liquid levels
- Stuck float switches
- Pump failure
- Pump lockout from brownout
- Clogged filter
- Leaking tank
- Failed contactor
- Chattering contactor
- Excessive pump cycles/run time (a symptom of excess water use)

In addition to detecting and diagnosing, VeriComm also makes recommendations for action.



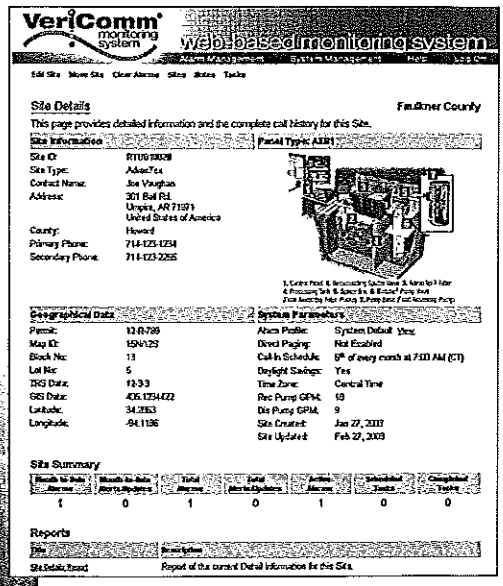
VeriComm
Telemetry with Monitoring Works Quietly, Invisibly

With VeriComm, "virtual O & M" is practically invisible to the property owner or resident. Here's how it works:

A telemetry-enabled VeriComm Control Panel is installed on a site. The panel calls the VeriComm Monitoring System, toll-free, to communicate operating data in the middle of the night . . . typically once a month. No dedicated phone line required.

If there is an Alarm or Alert condition, the panel calls in immediately, 24/7. A message is sent to the designated operator's e-mail-capable device (phone, pager, computer, personal digital assistant). Messages are re-sent, regularly, until the condition has been cleared.

All operating data is stored in the Monitoring System's database, where it is accessible via easy-to-read pages on our password-protected Web site.



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Bruce Silvester
Onsite Specialties
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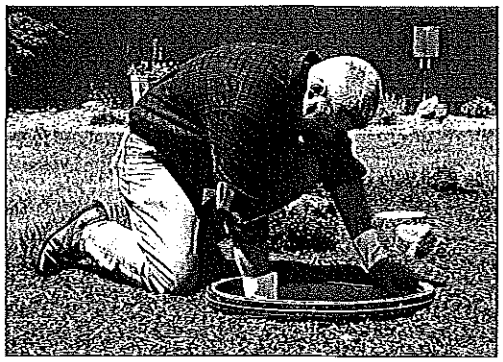
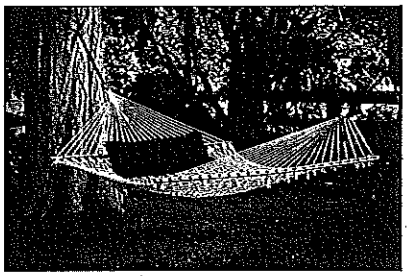
The VeriComm System was specifically developed for the onsite industry by Orenco Systems, a company known for its leading-edge solutions. Founded in 1981, Orenco distributes its wastewater products and technologies all over the world.



For More Information

Go to **www.orenco.com** or to **www.vericomm.net** and click on the icon for our online demo (free Flash Player version 6.0 required). You can e-mail us right from the online demo, or call Orenco at **800-348-9843**.



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EXECUTIVE SUMMARY

Testing of the Orenco Systems Advantex AX20N, rated at 500 gpd, was conducted under the provisions of ANSI/NSF Standard 40 for Residential Wastewater Treatment Systems (July 2000 revision). ANSI/NSF Standard 40 was developed by the NSF Joint Committee on Wastewater Technology.

The performance evaluation was conducted at the Mamquam Wastewater Technology Test Facility located in Squamish, British Columbia, using wastewater diverted from the Mamquam municipal wastewater treatment plant, which serves a predominantly residential neighborhood. The Mamquam Wastewater Technology Test Facility is a Standard 40 subcontractor for NSF. The evaluation consisted of six days of dosing prior to the start of sampling, followed by sixteen weeks of dosing at design flow, seven weeks of stress test and three weeks of dosing at design flow. Sampling started in the spring and continued into the fall, covering a range of operating temperatures. Over the course of the evaluation, the average effluent $CBOD_5$ was 5 mg/L, ranging between <2 and 25 mg/L, and the average effluent suspended solids was 4 mg/L, ranging between <2 mg/L and 42 mg/L. The Advantex AX20N produced an effluent that successfully met the performance requirements established by ANSI/NSF Standard 40 for Class I effluent:

> The maximum 7-day arithmetic mean was 14 mg/L for $CBOD_5$ and 11 mg/L for suspended solids, both below the allowed maximums of 40 and 45 mg/L respectively. The maximum 30-day arithmetic mean was 8 mg/L for $CBOD_5$ and 6 mg/L for suspended solids, both below the allowed maximums of 25 and 30 mg/L respectively. The effluent pH during the entire evaluation ranged between, 6.0 and 7.2, within the required range of 6.0 to 9.0. The plant met the requirements for noise levels (less than 60 dbA at a distance of 20 feet) and color, threshold odor, oily film and foam.

SUMMARY OF ANALYTICAL RESULTS

	Average	Std. Dev.	Minimum	Maximum	Median	Interquartile Range
$CBOD_5$ (mg/L)						
Influent	162	100	40	550	130	100-180
Effluent	5	4	<2	25	3	2-6
Suspended Solids (mg/L)						
Influent	291	267	34	1600	200	130-340
Effluent	4	5	<2	42	3	2-4
Turbidity (NTU)						
Effluent	3.8	1.1	2.0	7.8	3.6	3.0-4.4
pH						
Influent	-	-	6.5	7.6	7.0	6.8-7.1
Effluent	-	-	6.0	7.2	6.4	6.3-6.6
Temperature (C)						
Influent	16	2	13	20	17	15-18
Effluent	17	3	11	22	18	15-19

AdvanTex® Treatment Systems

Performance Summary
Provided by Orenco Systems®, Inc.

Since 2001, the performance of AdvanTex® Treatment Systems has been tested in nearly a dozen different programs. These include testing performed by outside companies or agencies (third-party); contract testing performed by Orenco distributors (second-party); and Orenco's own testing (first-party). More than 1000 data points are represented in these tests. The results show that AdvanTex systems easily meet advanced treatment standards for BOD, TSS, and total nitrogen.

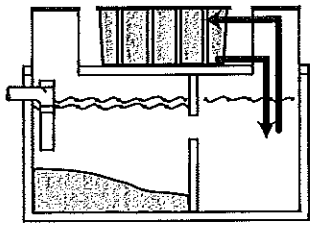
About System Configurations

As shown in the illustrations below, AdvanTex systems can be configured in two ways depending on the degree of total nitrogen reduction required. In Mode 1, filtrate from the AdvanTex pod is recirculated to the secondary chamber of the septic tank. In Mode 3, the filtrate is recirculated to the primary chamber, where the environment favors further denitrification.

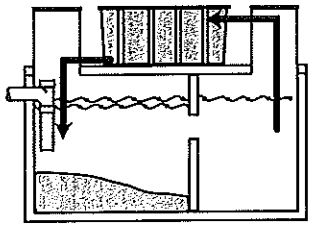
In Virginia, North Carolina, and Rhode Island, some of the systems tested in Mode 1 incorporated two tanks, a primary tank and a recirculation tank. In the primary tank, sludge and scum are separated from liquid effluent, which then flows into a separate recirculation tank, into which the AdvanTex filtrate is recirculated.

About the Results

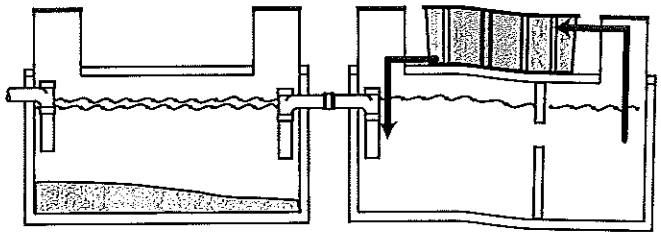
The pages that follow summarize the results of these testing programs. For ease of comparison, we have included information about the circumstances of each test. If you have any questions regarding this summary, please contact Sam Carter, Government Relations Manager, Orenco Systems, Inc., (800) 536-4192, e-mail: scarter@orenco.com.



Mode 1 with processing tank



Mode 3 with processing tank



Mode 1 with primary tank and recirculation tank

BRITISH COLUMBIA

NSF Standard 40 Testing, AX20 Mode 1
(Third-Party)

About the Testing: Orenco contracted with Novatec to test an AX20 Mode 1 system in support of its application for NSF approval. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in Squamish, British Columbia. Testing is done at a wastewater facility that serves a residential subdivision. Composite sampling was used throughout this evaluation.

Although the NSF/ANSI Standard 40 protocol does not require it, Orenco elected to sample for total nitrogen.

Dates: May 2001-November 2002
Total nitrogen testing: August 2001-February 2002

Average Daily Flow: 500 gpd

System Configuration: Mode 1 recirculating into the second compartment of a 1500-gallon tank

Processing Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)
Mean	166	292	33
Median	140	200	32
Standard Deviation	82	219	8
Number of Samples	108	108	27

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)	Turbidity (NTU)
Mean	**5**	**4**	**12**	**4**
Median	3	3	13	4
Standard Deviation	3	6	3	1
Number of Samples	109	109	27	118*
Percent Reduction	97%	99%	64%	NA

** Took samples during stress periods*

BRITISH COLUMBIA

Startup Testing, AX20 Mode 1 *(Third-Party)*

About the Testing: This was part of Orenco's NSF/ANSI Standard 40 official testing, conducted by Novatec. The Standard 40 protocol allows a start-up period of three weeks. We elected to start testing within *three days* of startup. Below is the average performance for the first five days. Composite sampling was used throughout this evaluation.

Dates: May 2001

Average Daily Flow: 500 gpd

System Configuration: Mode 1 recirculating into the second compartment of a 1500-gallon processing tank

Processing Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)
Mean	204	316
Number of Samples	5	5

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Turbidity (NTU)
Mean	**17**	**4**	**9**
Number of Samples	5	5	5
Percent Reduction	98%	99%	

BRITISH COLUMBIA

AX20 Mode 3 *(Third-Party)*

About the Testing: After completion of the NSF/ANSI Standard 40 testing, Orenco contracted with Novatec to evaluate denitrification performance of the same AX20 system in Mode 3. Composite sampling was used throughout this evaluation.

Dates: December 2002-December 2003

Average Daily Flow: 500 gpd

System Configuration: Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank

Processing Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)
Mean	112	170	34
Median	104	137	33
Standard Deviation	42	48	7
Number of Samples	7	7	5

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)	Turbidity (NTU)
Mean	**7**	**9**	**10**	**9**
Median	5	5	10	6
Standard Deviation	8	9	3	5
Number of Samples	9	9	24	23
Percent Reduction	94%	95%	71%	NA

COLORADO

Roger Shafer, "Use of a Recirculating Textile Filter Followed by a Polishing Sand Filter...,"* AX20 Mode 3 *(Second-Party)*

About the Testing: This test involved one AdvanTex system at a single-family home.

Dates: Summer 2001

Average Daily Flow: 209 gpd (April 2001-August 2001)

System Configuration: This system consisted of two AX10s (which together have the same treatment capacity as an AX20), configured in Mode 3, recirculating to the primary compartment of a 1500-gallon processing tank.

*Septic Tank Effluent***

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)	Fecal Coliform*** (col/100 mL)
Mean	154	96	38	>10,000
Number of Samples	5	5	5	5

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)	Fecal Coliform*** (col/100 mL)
Mean	**5**	**6**	**13**	**4522**
Number of Samples	5	5	5	5
Percent Reduction	97%	94%	66%	NA

** Roger Shafer, "Use of a Recirculating Textile Filter followed by a Polishing Sand Filter for Onsite Wastewater Treatment in Colorado's Fractured Bedrock Environment," presented at the Fractured-Rock Aquifers 2002 Conference, March 13-15, Denver, Colorado*

*** Five septic effluent samples were collected from the system between April and May 2001 using a 3/4-in. clear plastic tank sampler. Samples were collected from the outlet tee of the septic tank before installation of the AdvanTex system.*

**** Calculated as geometric mean*

COLORADO

Jefferson County Required Testing AX20 and AX30 Mode 3 *(Second-Party)*

About the Testing: Orenco distributor Roger Shafer sampled 27 systems at single-family residences as required by the Jefferson County Health Department as an operating permit requirement.

Dates: October 2003 and May 2004

System Configuration: Three AX20 systems and twenty-three AX30 (AX20 & AX10) systems were all configured as Mode 3, recirculating into the primary compartment of a processing tank.

AdvanTex Effluent

Total N (mg/L)	AX30	AX20
Mean	**17**	**17**
Median*	14	14
Standard Deviation*	5	2
Number of Samples	37	7

** For the 10 sites that have more than one sample*

NEW YORK

Skaneateles Demonstration Project
AX20 Mode 1 *(Third-Party)*

About the Testing: This testing is being performed as part of the Skaneateles Demonstration Project. The purpose of this project is to evaluate the performance and management of innovative technologies on single-family residences. As part of this project, one AX20 system was installed at a single-family residence and tested.

Dates: November 2004-December 2005

Average Daily Flow: 106 gpd

System Configuration: Mode 1 recirculating into the second compartment of a 1500-gallon processing tank.

Mode 1 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)
Mean	**4**	**3**	**20**
Median	2	3	19
Standard Deviation	4	2	4
Number of Samples	9	9	9

NEW ZEALAND

AX20 Mode 3 *(Third-Party)*

About the Testing: Testing of residential wastewater treatment systems was initiated by the Rotorua District Council and Environment Bay of Plenty, the Regional Council. The purpose of the project is to compare systems so that manufacturers that meet their specifications can be preapproved. The one-year trial is focused particularly on nitrogen reduction, and includes "stress testing" and vacation simulation as well as monitoring of each system's power usage.

Dates: May 2005-January 2006

Average Daily Flow: 265 gpd

System Configuration: Mode 1 recirculating into the second compartment of a 1500-gallon processing tank.

Processing Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)
Mean	199	301	66
Median	209	232	62
Standard Deviation	95	239	24
Number of Samples	33	31	60

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N (mg/L)
Mean	**3**	**4**	**22**
Median	3	4	17
Standard Deviation	2	3	10
Number of Samples	26	26	62
Percent Reduction	98%	99%	67%

NORTH CAROLINA

Controlled Demonstration Testing Program
AX20 Mode 1 and Mode 3 and AX100 *(Second-Party)*

About the Testing: This test, conducted under state oversight, involved 15 AdvanTex systems at single-family homes and vacation rentals. The data include results from both AX20 and AX100 systems.

Dates: August 2003-present

Average Daily Flow: 75-2200 gpd

System Configuration: All but one system were configured as Mode 1 with recirculation into a recirculation tank located after a separate primary septic tank. A single system was configured as Mode 3 with a single processing tank.

Mode 1 Systems, Septic Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N* (mg/L)	Fecal Coliform** (col/100 mL)
Mean	214	55	67	NA
Median	231	57	72	NA
Standard Deviation	90	13	19	NA
Number of Samples	30	30	26	NA

Mode 1 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N*** (mg/L)	Fecal Coliform** (col/100 mL)
Mean	**4**	**5**	**25**	**1655**
Median	4	5	22	1710
Standard Deviation	2	2	11	2857
Number of Samples	47	46	42	27
Percent Reduction	98%	91%	63%	NA

Mode 3 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Total N*** (mg/L)	Fecal Coliform** (col/100 mL)
Mean	**6**	**6**	**12**	**2312**
Median	5	6	12	2800
Standard Deviation	2	1	2	2652
Number of Samples	3	3	2	3

* *TN as TKN*

** *Calculated as geometric mean*

*** *TN = TKN + NO_3-N + NO_2-N*

OREGON

La Pine National Demonstration Project
AX20 Mode 3 *(Third-Party and First-Party)*

About the Testing: This project is a cooperative effort by the Deschutes County Environmental Health Division, the Oregon Department of Environmental Quality, and the U.S. Geological Survey. The purpose of the project was to evaluate innovative denitrification technologies in an area of the state where climate and soil conditions are unfavorable for denitrification and the risk of groundwater contamination is high. As part of the project, three AX20 systems were installed at single-family residences. In addition to the samples required for the project, some samples were collected by Orenco.

Dates: January 2002-present

Average Daily Flow: 108-334 gpd

System Configuration: Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank

*Septic Tank Effluent**

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*	*Fecal Coliform** (col/100 mL)*
Mean	288	112	61	5.5×10^4
Median	270	66	62	4.0×10^4
Standard Deviation	140	204	20	4.5×10^6
Number of Samples	70	70	70	70

* *Average of all other sites where septic tank effluent is being sampled*
** *Calculated as geometric mean*

Mode 3 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*	*Fecal Coliform* (col/100 mL)*
Mean	**11**	**7**	**17**	**2.0×10^4**
Median	10	6	16	2.3×10^4
Standard Deviation	5	3	6	9.9×10^3
Number of Samples	92	94	92	67
Percent Reduction	96%	94%	72%	64%

* *Calculated as geometric mean*

RHODE ISLAND

Green Hill Pond Watershed Demonstration Project
AX20 Mode 3 *(Third-Party)*

About the Testing: The University of Rhode Island Cooperative Extension On-site Wastewater Training Center constructed and is testing several innovative septic systems, including five AdvanTex systems, in the Green Hill Pond Watershed. The Training Center is evaluating the systems' performance and using the installations to train installers, homeowners, designers, and regulators.

Dates: August 2003-present

System Configuration: The project includes five AX20s at single-family homes, all configured as Mode 3, recirculating into the primary compartment of a 1500-gallon processing tank.

Mode 3 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*
Mean (all sites)	**7**	**5**	**19**
Median	4	2	13
Standard Deviation	6	8	18
Number of Samples	9	9	9

VIRGINIA

AX20 Mode 1 and Mode 3 *(Third-Party)*

About the Testing: Conducted by Mark Gross, PE, PhD, of the University of Arkansas Department of Civil Engineering, this test involved AX20 systems installed at 13 single-family homes.

Dates: October 2002-present

Average Daily Flow: 90-308 gpd

System Configuration: Mode 1 (4 sites) recirculating into a recirculating tank located after a separate primary septic tank; Mode 3 (13 sites) recirculating into the primary compartment of a 1500-gallon processing tank

Mode 3 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*
Mean	**5**	**7**	**19**
Median	4	7	18
Standard Deviation	7	7	11
Number of Samples	85	85	85

VARIOUS LOCATIONS

AX100 *(First-, Second-, and Third-Party)*

About the Testing: Data is being collected from twenty-one AX100 systems on various commercial and large residential applications.

Dates: June 2002-present

Average Daily Flow: 1100-120,000 gpd

System Configuration: All the systems are AX100s. None are configured to achieve the maximum amount of nitrogen reduction possible.

Septic Tank Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*
Mean	410	128	55
Median	361	77	53
Standard Deviation	261	171	24
Number of Samples	35	35	11

AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*Total N (mg/L)*
Mean	**7**	**7**	**18**
Median	5	5	19
Standard Deviation	5	4	15
Number of Samples	161	161	44
Percent Reduction	98%	95%	60%

AdvanTex® Design Criteria

Orenco Systems® Incorporated
1-800-348-9843

*For Residential Applications**

System Description and Treatment Process

The AdvanTex Treatment System is a multiple-pass, packed bed aerobic wastewater treatment system specifically designed and engineered for long-term processing of residential strength wastewater. See Figures 1a and 1b.

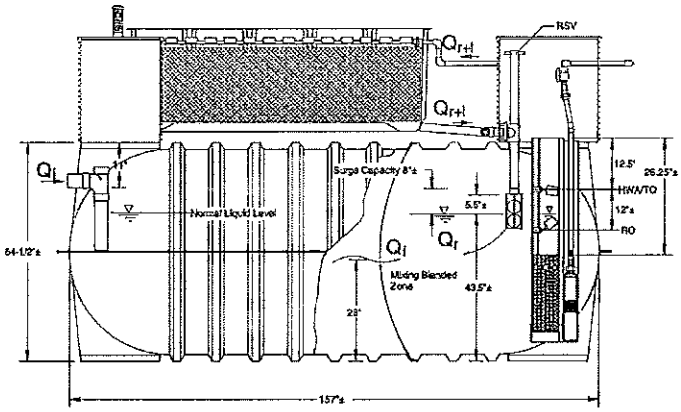


Fig. 1a
AdvanTex Treatment System: Side View

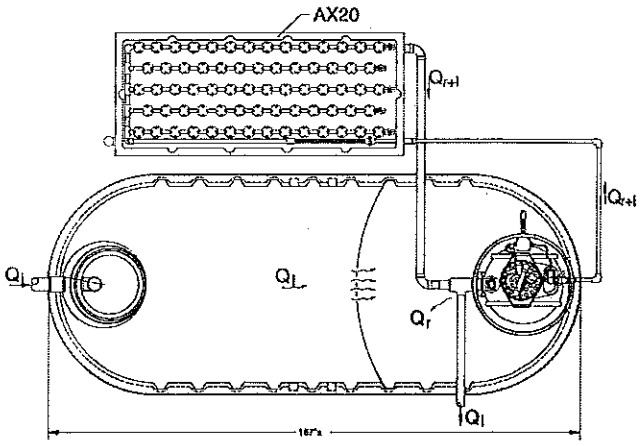


Fig. 1b
AdvanTex Treatment System: Top View

AdvanTex treatment systems are capable of processing residential strength wastewater to better than "secondary standards" (see page 4, Figures 2a and 2b). Raw sewage enters the two-compartment Processing Tank through its inlet tee. In the first compartment, the raw sewage separates into three distinct zones: a scum layer, a sludge layer, and a clear layer. A flow-through port(s) in the Tank's baffle wall allows effluent from the clear layer to flow into the second compartment of the tank. The Biotube® Pump Package in the second compartment pumps filtered effluent to a distribution manifold in the AdvanTex Filter. Effluent percolates down through the textile media and is collected in the bottom of the filter pod. The treated effluent flows out of the filter pod through the Filtrate Return Line that returns the treated effluent to the Recirculating Splitter Valve (RSV). The RSV automatically splits or diverts the flow between the Processing Tank and the final discharge. The RSV also controls the liquid level within the Processing Tank. During extended periods of no flow, 100% of the treated effluent is returned to the Processing Tank. The residential AdvanTex filters have a passive vent system and do not require the use of a fan.

**This document is for residential applications only. For commercial applications, call Orenco Systems' Engineering Department.*

System Selection: Configuration
Multiple-pass recirculation treatment systems can be configured in several Modes. Mode 1 (shown in Fig. 1a and 1b) is the operating configuration used most frequently. In Mode 1, the filtrate recirculates through the second compartment of the Processing Tank. In Mode 3 (a specialty mode), a portion or all of the filtrate may be recirculated through the primary chamber of the tank to enhance nutrient removal. Systems utilizing a separate Processing/Recirculation Tank, or systems that must provide high treatment levels, will be configured for Mode 1. Refer to AdvanTex Treatment System drawings for further details on Mode and discharge options.

System Requirements: Residential Strength Wastewater
Residential waste must meet the criteria in the "Residential Strength Wastewater" table, below. Consult Orenco or an authorized Dealer for larger system designs.

Table 1. Residential Strength Wastewater (Influent Characteristics)*

Characteristic	Average *mg/L*	Weekly Peak *mg/L*	Rarely Exceed *mg/L*
$cBOD_5$	130	200	300
TSS	40	60	150
TKN	65	75	150
G&O	20	25	25

**Maximum allowable wastewater strength pumped to an AdvanTex Treatment System is "Residential Strength Wastewater." Residential strength wastewater is defined as primary sewage effluent from a septic tank that does not exceed the above parameters.*

System Requirements: Processing Tank
Homes with up to four bedrooms require a minimum two-compartment, 1500 gallon tank with flow-through port(s) equaling a minimum flow-through area of not less than 12 square inches at 60-70% of the lowest normal liquid level (see "Typical Liquid Level Positions" drawing). In larger residential systems, the first compartment should be sized at approximately 2/3 to 3/4 of the total processing tank volume.

All tanks must meet minimum structural requirements, be completely watertight, and pass a watertight test including the riser/tank connection. For detailed specifications, see structural and watertightness criteria in Orenco's "General Specifications," document NDA-DG-SPEC-1 and tank specifications checklist in Orenco's "Concrete Tank Questionnaire."

System Selection: Recommended Tankage and Filter Units
AdvanTex treatment systems may be configured as shown in Table 2 to satisfy occupancy and flow requirements. The following charts summarize the recommended tankage and number of textile filter units based on the maximum design flow.

Recommendations assume that residential peak weekly average flows are typically two times normal average daily flows (i.e., Qpwa = 2Qa+) and peak weekly average flows meet typical regulations governing gpd-to-bedroom ratios.

Table 2. Required Tankage and Number of Filter Units

# Bedrooms[1]	AX Units[2] *models*	Occupants[3] *maximum*	Processing Tank[4] *minimum size (gal)*	Recirculation Tank[5] *minimum size (gal)*
4 or fewer	1-AX20	8	1500	500
5	2-AX20	10	2500	750
6*	2-AX20	12	3000	1000

[1] *Use as default sizing criteria.*

[2] *The nominal hydraulic application rate for all residential AX units is 29.1 gpd/ft², based upon actual flows.*

[3] *Systems with occupancies greater than the maximums shown or greater than eight occupants require a design with multiple units based on a minimum of 2.5 ft² of surface loading area per capita.*

[4] *Processing tank includes primary and secondary compartments. The secondary compartment functions as the recirc/blend chamber.*

[5] *With multiple tank configurations, a separate septic tank will precede the AdvanTex recirculation tank.*

* *System applications greater than 6 bedrooms will require a design review by Orenco Systems, Inc.*

Design Loading Rates

Orenco's suggested design loading rates are based on typical per capita flow rates and average strength characteristics expected from residential type installations, as shown above. Performance is a function of the expected typical loads with periodic weekly highs. Typically, the daily mass loading is based on the expected daily flows and parameter strength. Figures 2a and 2b show periodic peak loading capacity at 95% confidence level.

The void capacity, surface area per unit volume, and moisture-holding capacity of textile are many times greater than that of sands or gravels, thereby enabling equal treatment at higher loading rates. If the loading rate (or mass load) needs to be reduced to meet discharge limits, it's a simple matter of adding additional modular units. Operationally, the module's flexible and easily serviceable features make AdvanTex units an ideal, efficient, and effective solution for all wastewater treatment applications with domestic waste characteristics.

Orenco Systems, Inc.'s AX20 AdvanTex Treatment System is listed as an NSF/ANSI Standard 40 Class I treatment unit for flows up to 1500 gpd in various configurations. However, in applications that are greater than six bedrooms, please contact Orenco Systems, Inc.'s Systems Engineering Department for more information. AdvanTex AX20 units that are required to carry the NSF mark will be labeled AX20N per NSF protocol.

Typical Effluent Quality

Effluent quality is dependent on a number of factors, including influent characteristics and loading rates. The following charts show third party NSF 40 and ANSI testing results. The results demonstrate that low-to-moderate loading rates produce cBOD and TSS of <5 mg/L, while higher loading rates produce cBOD and TSS in the range of 15-25 mg/L.

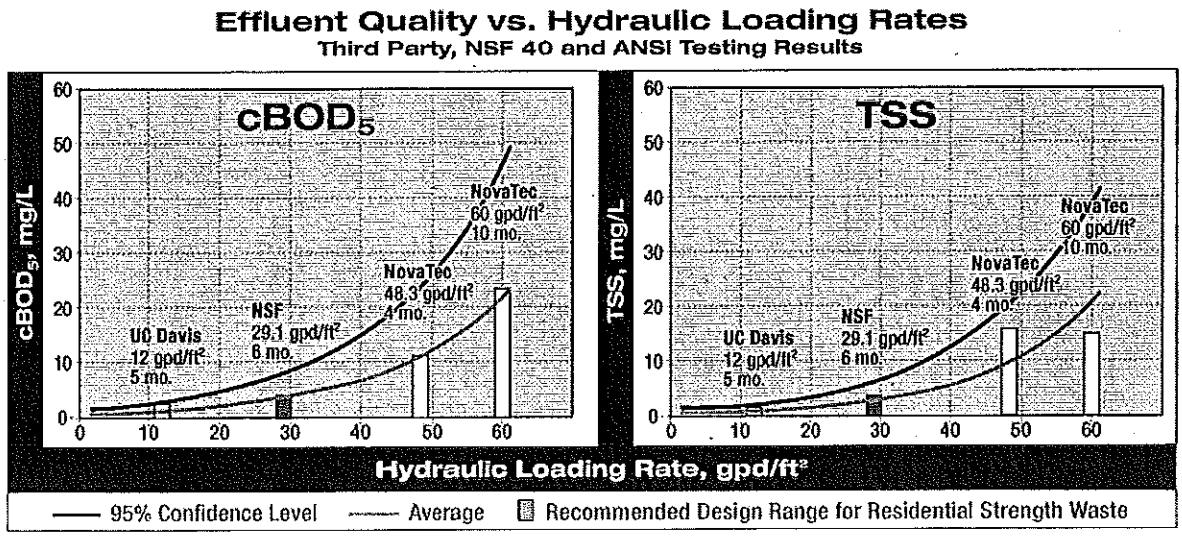


Fig. 2a – $cBOD_5$ **Fig. 2b – TSS**

Nitrogen reduction in Mode 1 will typically exceed 60 percent, with total nitrogen in the filtrate ranging between 25 and 35 mg/L±. In Mode 3, nitrogen reduction can reach 70 percent or better, depending on wastewater strength and other characteristics like grease and oils, pH, and alkalinity concentrations. Nitrification can be inhibited if the buffering capacity (alkalinity) of the wastewater is too low. On a theoretical basis, 7.14 mg/L of alkalinity as $CaCO_3$ is needed to nitrify 1 mg/L of NH_4+.

Pumping Equipment

The integrated treatment package includes an Orenco Biotube® pump package.

Residual Head Pressures

A 5 ft. residual pressure is used to determine the initial time-dosing settings. (Residual pressures, however, may range between 1 and 10 feet, depending on system hydraulics.) Consulting with Orenco is required when the residual pressure dosing falls outside the typical 3 to 6 foot range.

Recirculation Ratios and Timer Settings

The AdvanTex Treatment System's 4:1 recirculation ratio and initial timer settings have been established based on the expected average daily flow. If flows vary significantly from expected flows, timer settings can be recalculated. See *AdvanTex Installation Guide*, NIM-ATX-AX-1, "Appendix 1: Timer Settings Worksheet."

AdvanTex Control System

Critical to the success of the AdvanTex Treatment System is the method in which the effluent is loaded onto the AdvanTex textile filter. Over the past three decades, timer controlled applications have proven to play an essential role in optimizing the performance of both fixed and suspended growth biological systems. A timer-controlled pump in the processing tank periodically doses effluent to a distribution system on top of the AdvanTex Filter. Each time the filter is dosed, effluent percolates through the filter media and is treated by naturally occurring microorganisms that populate the filter. During periods of high flow, a timer override float will temporarily modify the timer settings to process the additional flow. Conversely, during periods of low flow, the timer settings can be modified to reduce loading onto the AdvanTex filter.

VeriComm® remote telemetry control panels and web-based monitoring system are incorporated into all AdvanTex Treatment System standard equipment packages. VeriComm gives wastewater system operators and maintenance organizations the ability to monitor and control each individual system's performance remotely. There are several additional operational benefits associated with telemetry-based controls, including Advanced Control Logic — functions that activate in the event of component malfunction to diagnose the system using pre-established trend data and, if necessary, modify the operation of the system until it can be serviced. VeriComm also provides additional alert and alarm functions to notify the operator/designer in the event that trend data indicate potential problem conditions (e.g. high flows).

Surge Volume

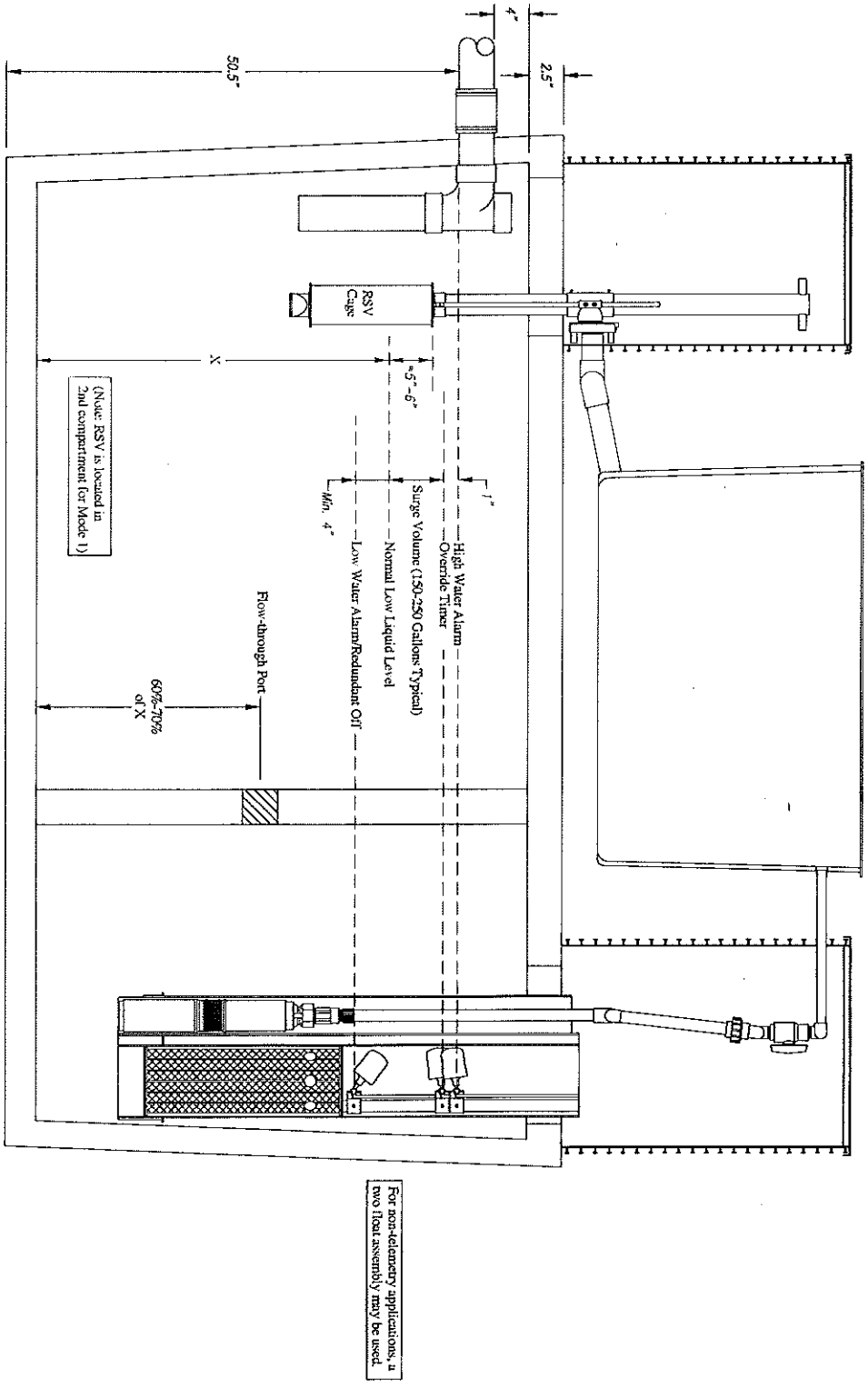
For most residential applications, the recommended surge volume is approximately 150 to 250 gallons. The actual surge volume used should be approximately 50-100% of the actual average daily flow. The surge volume is the volume between the normal low liquid level and the high water alarm float. The normal low liquid level is the level at which 100% of the filtrate returns to the tank. For most residential installations, the low liquid level will be approximately 5 to 6 inches below the top of the RSV cage. See the "Typical Liquid Level Positions" drawing for a description of typical RSV and float settings for residential systems installed in two-compartment tanks. Refer to AdvanTex Installation Guide, NIM-ATX-AX-1, for details.

Cold Weather Considerations

AX units are available with one inch of insulation attached to the bottom of the lid. Installing insulation around the sides of the filter pods themselves is optional and is done onsite as needed.

Other cold weather considerations include standard practices used with most onsite pump systems, such as allowing all lines to drain, insulating processing tank lids, and backfilling risers with pea gravel if frost-heave is a concern. Consult Orenco if supplementary options need to be considered.

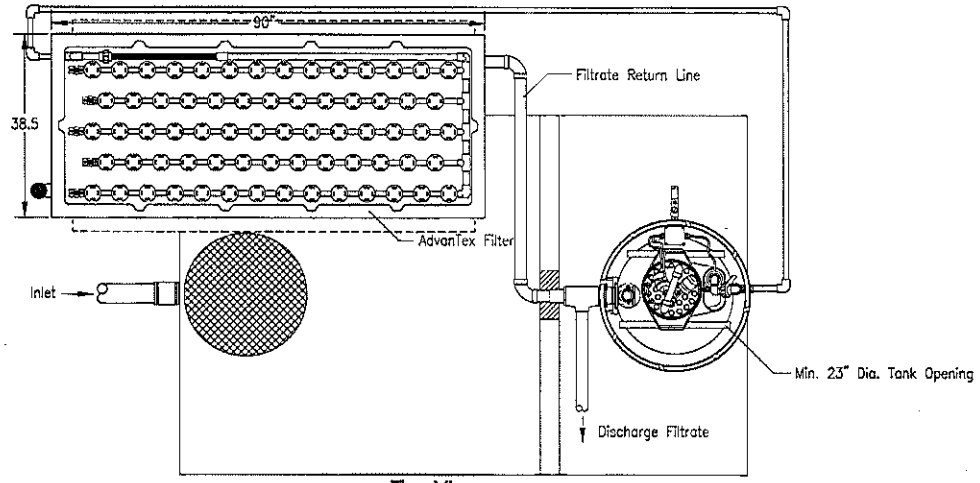
Typical Liquid Level Positions for Residential AdvanTex™ Treatment System



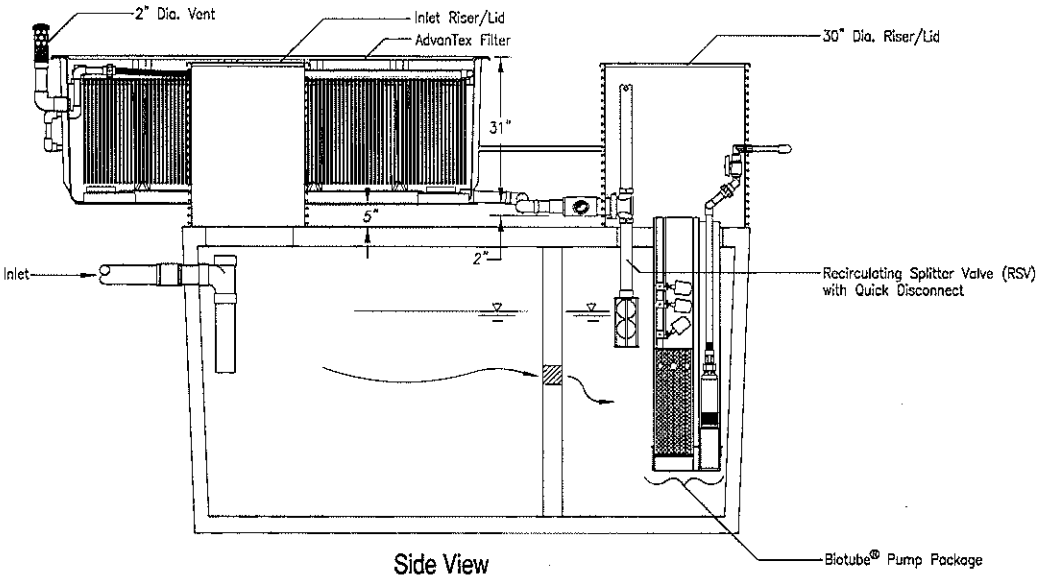
U.S. Patents 5,531,894 and 5,480,561 4,439,323 and 5,492,635 Other Patents Pending	Designed By: EB	Drawn By: CHRIS JORDAN	Title: Typical Liquid Level Positions for Residential AdvanTex™ Treatment System		Orenco Systems® Incorporated
	Approved By: GD	Drawing: 1 OF 1	Drawing No. NDA-ATX-MF-1		
	Date Approved: 6/27/01	Revision: 1	Date: 6/27/01	Scale: 1" = 1'-0"	

AdvanTex™ Treatment System

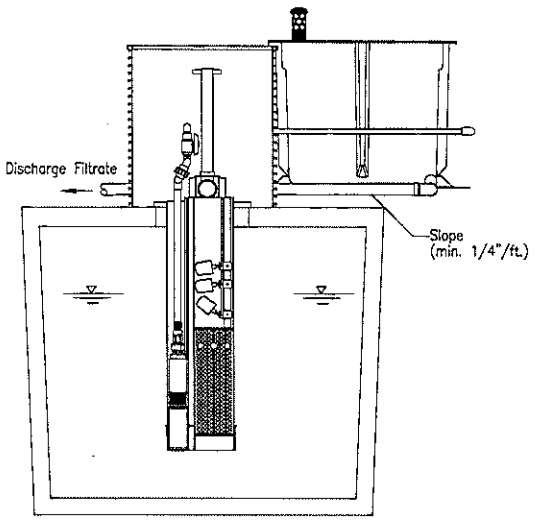
AX 20 Series - Mode 1a



Top View



Side View



End View

Orenco Systems® Incorporated

Title: AdvanTex™ - AX20 Mode 1A

Drawing No. MDW-ATX-AX20-1A

Scale: 1" = 2'-0"

Date: 12/05/04

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Revision: 2.1

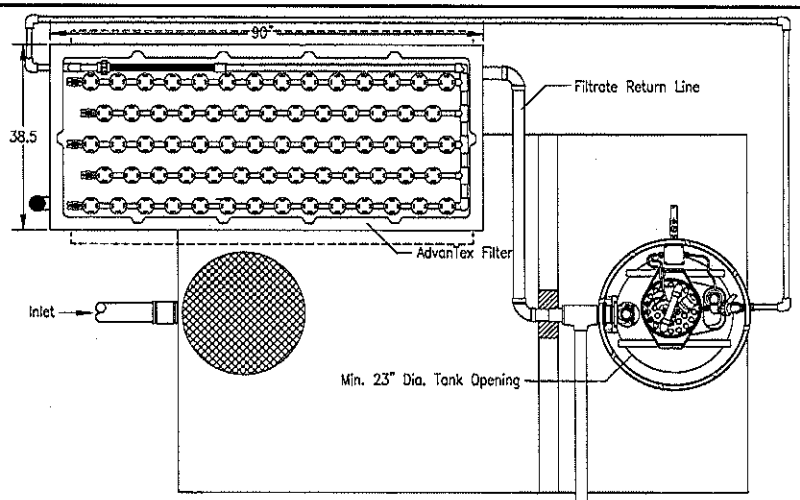
Designed By: ENGINEERING

Approved By:

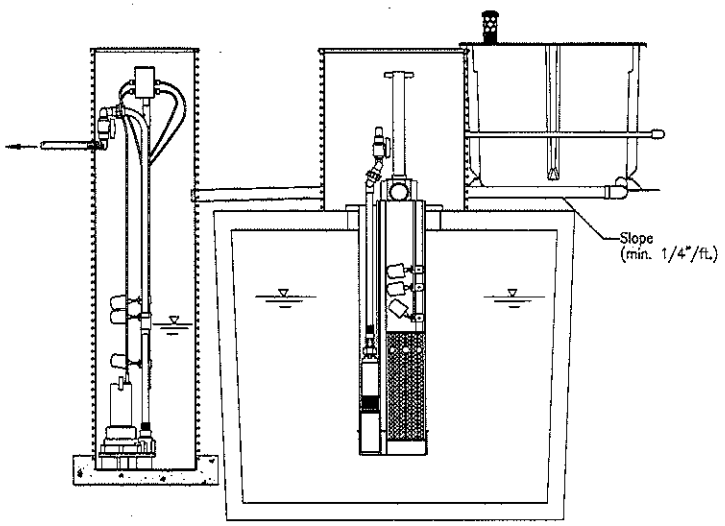
Date Approved:

AdvanTex™ Treatment System

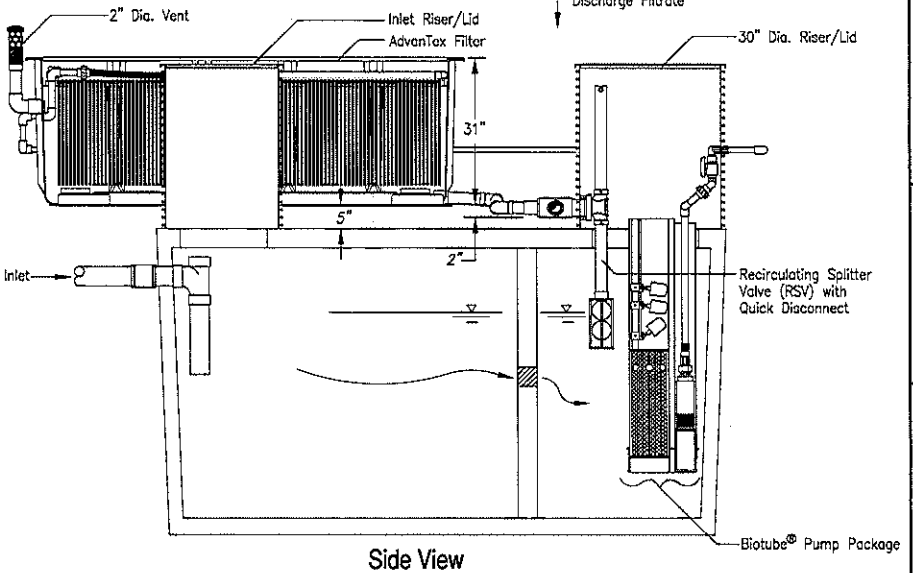
AX 20 Series - Mode 1b



Top View



End View



Side View

Orenco Systems® Incorporated

Title: AdvanTex™ - AX20 Mode 1B

Drawing No. NDW-ATX-AX20-1B

Scale: 1" = 2'-0"

Date: 12/03/04

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Revision: 2.1

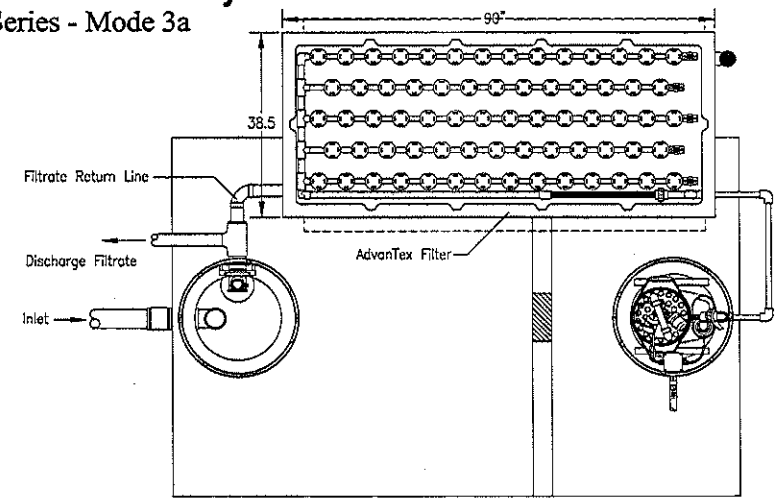
Designed By: ENGINEERING

Approved By:

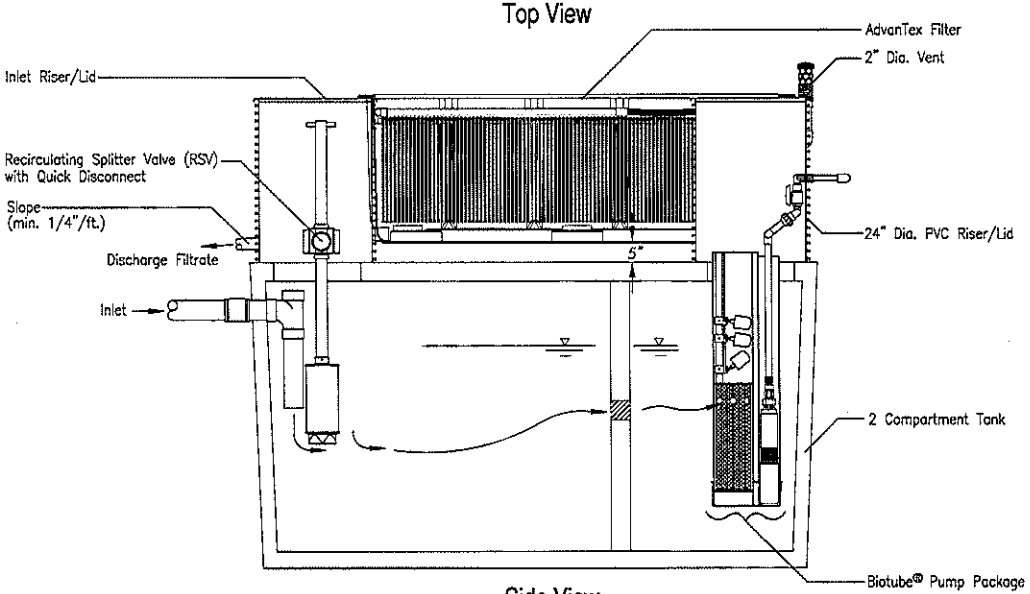
Date Approved:

AdvanTex™ Treatment System

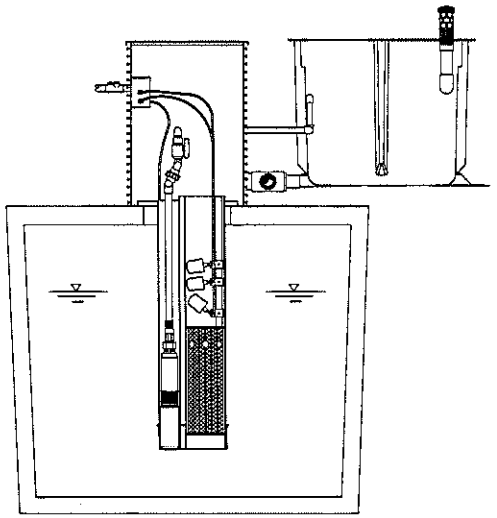
AX 20 Series - Mode 3a



Top View



Side View



End View

Orenco Systems® Incorporated

Title: AdvanTex™ - AX 20 Mode 3A

Drawing No. NDW-ATX-AX20-3A

Scale: 1" = 2'-0"

Date: 12/03/04

Designed By: ENGINEERING

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

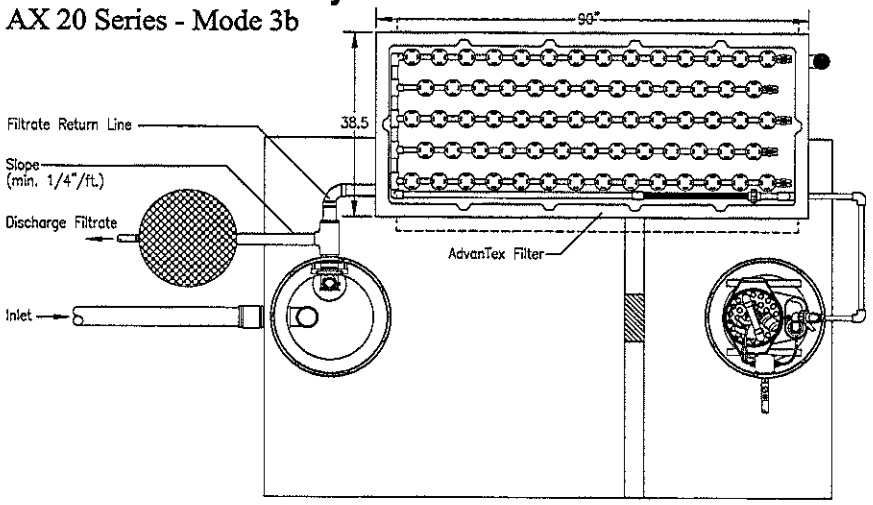
Approved By:

Revision: 2.1

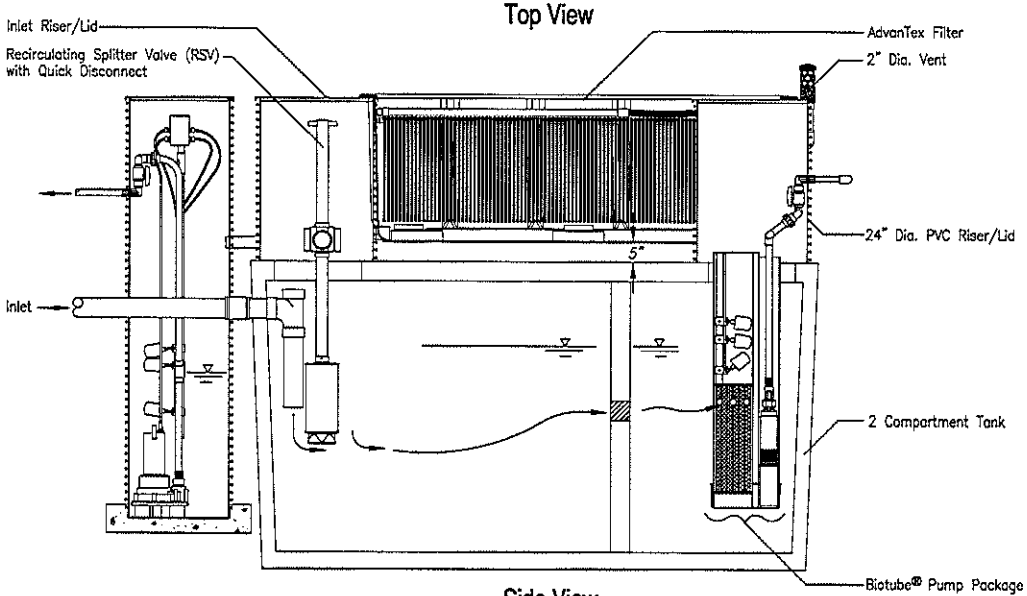
Date Approved:

AdvanTex™ Treatment System

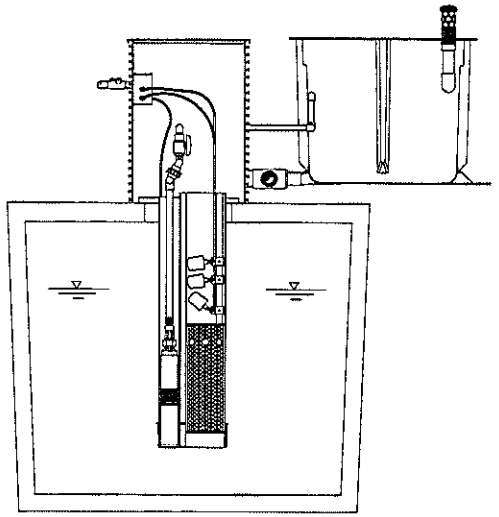
AX 20 Series - Mode 3b



Top View



Side View



End View

Orenco Systems® Incorporated

Title: AdvanTex™ - AX 20 Mode 3B

Drawing No. NDW-ATX-AX20-3B

Scale: 1" = 2'-0"

Date: 12/03/04

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Revision: 2.1

Designed By: ENGINEERING

Approved By:

Date Approved:

AdvanTex®-AX20 Filter

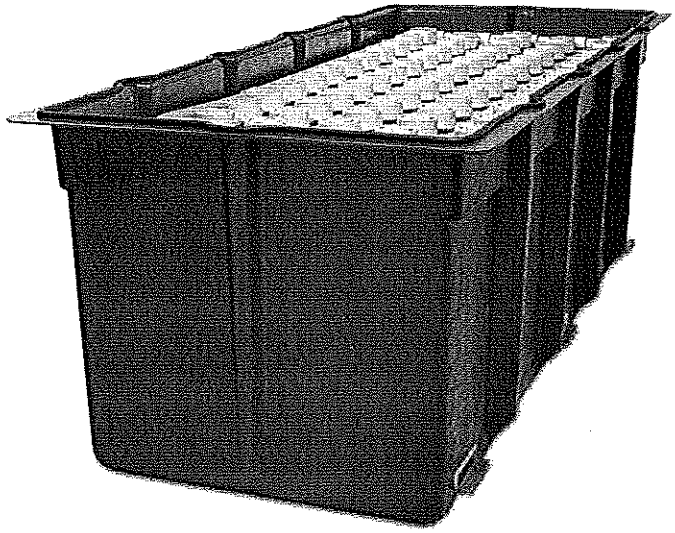
Residential Technical Data Sheet

Applications

Orenco's AdvanTex® Treatment System* is an innovative technology for onsite treatment of residential wastewater. The heart of the System is the AdvanTex® Filter, 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® Treatment System is ideal for:

- Small sites
- System upgrades and repairs
- New construction
- Poor soils
- Nitrogen reduction
- Price-sensitive markets
- Pretreatment

For sizing, see "AdvanTex® Design Criteria," NDA-ATX-2.



The heart of the AdvanTex® Treatment System is this sturdy, watertight fiberglass basin filled with an engineered textile material.

**Covered by U.S. patent numbers 5,980,748; 5,531,894; 5,480,561; 5,360,556; 5,492,635; and 4,439,323. Additional patents pending.*

Features/Unique Specifications

To specify this product, require the following:

- Wastewater treatment to better than "Secondary" Treatment Standards
- Consistent treatment, even during peak flows
- Timer operation for flow monitoring, flow modulation, and surge control
- Fixed film textile media (a polyester plastic), operated in an unsaturated condition
- Consistent media quality
- Low maintenance beyond annual servicing
- Low energy consumption (under $1.25-2.50/month power cost at national average electric rate of $.08 kWh)
- Complete pre-manufactured package, ready-to-install
- Watertight construction, corrosion-proof materials, tamper-proof lid bolts
- Anti-flotation flanges
- Quiet operation

Standard Models

AX20, AX20N

(AX20 units carrying the NSF logomark are labeled AX20N, per NSF protocol.)

Physical Specifications

Approximate Dimensions**

Filter Basin Length	91 in.
Width	40 in.
Height	31 in.
Area (footprint)	20 sq. ft.
Filter Dry Weight	300 lbs.

***See AdvanTex® Treatment System drawings for exact dimensions*

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

ATD-ATX-AX-2
Rev. 1.4, 10/05

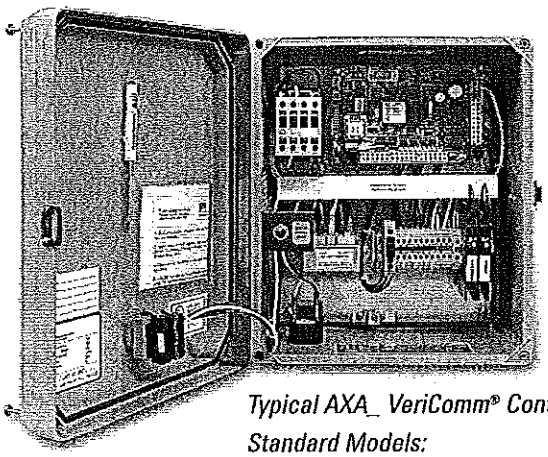
VeriComm® AXA_ Control Panels

Technical Data Sheet

For AdvanTex® Treatment Systems

Applications

VeriComm® AXA1 and AXA2 remote telemetry control panels are used with simplex pumping operations — timed recirculation, with gravity discharge — for AdvanTex® Treatment Systems. Coupled with the VeriComm Web-based Monitoring System, these affordable control panels give water/wastewater system operators and maintenance organizations the ability to monitor and control each individual system's operation remotely, with real-time efficiency, while remaining invisible to the homeowner. VeriComm AXA panels allow remote operators to change system parameters, including timer settings, from the Web interface.



Typical AXA_ VeriComm® Control Panel

Standard Models:
VCOM AXA1, VCOM AXA2

To Specify...

To specify this panel for your installation, require the following:

Basic Control Logic: Two Operating Modes

- A "Normal Mode" that manages day-to-day functions.
- A "Test Mode" that suspends data collection and alarm reporting during installation and service.

Data Collection and Utilization

- Data logs of system conditions and events, such as pump run times, pump cycles, and alarm conditions.

Troubleshooting and Diagnostic Logic

- Troubleshooting capabilities that can report suspected failed components, which then trigger Alarms.

Advanced Control Logic

- Advanced control logic that activates during float malfunctions to diagnose the situation and keep the system operating normally until servicing.

Communication and Alarm Management

- Remote telemetry capabilities coupled with a Web-based monitoring application (see *VeriComm Monitoring System*, ATD-WEB-VCOM-1) for communication and alarm management. Updating of point values (including timer settings) and receipt of queued changes during each communication session with host. Communication sessions that occur monthly, at a minimum, and more frequently during alarm conditions.
- Multiple methods of communication, as follows:

Call-In to VeriComm® Host

- Automatic notification to host of "Alarms," which signal fault conditions that need to be addressed immediately (e.g., pump failure).
- Automatic notification to host of "Alerts," which signal less critical fault conditions and which trigger the panel's troubleshooting logic and alternative operating mode (e.g., stuck float switch).
- Automatic notification to host of "Updates," which include alarm updates or all-clear notifications following Alarms/Alerts, as well as normally scheduled monthly panel reports.
- Manual, forced communication from panel to host to effect an updating of point values and receipt of queued changes.

Real-Time Direct Connection to Panel

- Manual, direct connection at the site via RS-232 serial port, to allow a local operator real-time access to detailed logged data and the ability to change point values from a laptop.
- Manual, forced communication by local operator/homeowner at the site to initiate an auto-answer mode, allowing a remote operator real-time access to detailed logged data and the ability to change point values.

During real-time, manual connections, software with open architecture (and password security) is used; no proprietary software is required. VT100 protocol allows access and control from any computer modem (Mac or PC) with a simple communication program (e.g., Windows® HyperTerminal); multilevel password protection in panel ensures that only qualified personnel can access the panel's data.

Additional Features

- Status light indicators on the board, including . . .
  - Flashing green LED for normal operation
  - Yellow LEDs for status of digital inputs
  - Red LEDs for status of digital outputs and modem activity
- UL-recognized and FCC-approved

For more information, try our online demo at www.vericomm.net (no password required).

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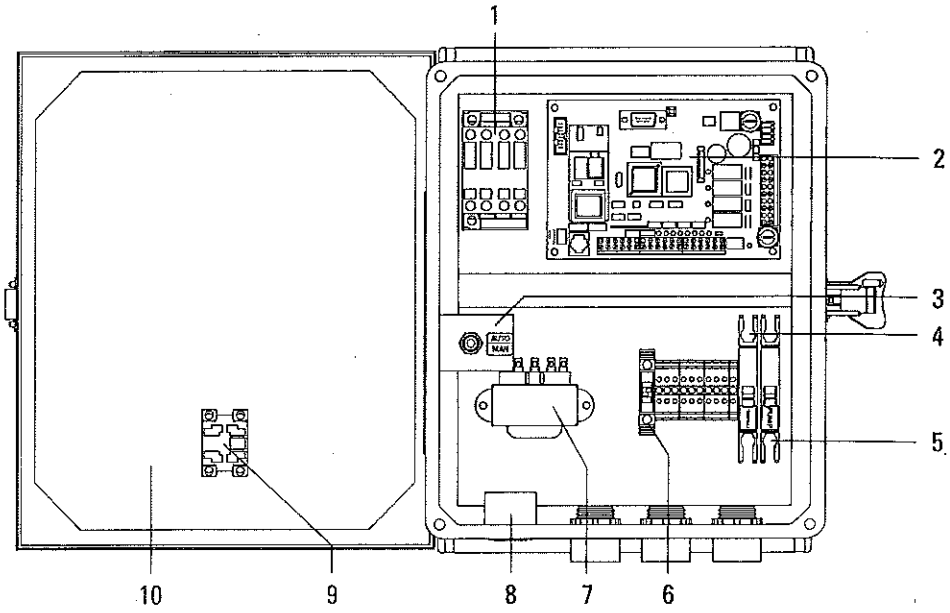
VeriComm® AXA_ Control Panels

Technical Data Sheet

1. Motor-Start Contactor
2. VeriComm® Remote Telemetry Board
3. Toggle Switch
4. Control Circuit Breaker
5. Pump Circuit Breaker
6. Fuse
7. Transformer
8. Audio Alarm
9. Visual Alarm
10. Panel Enclosure



Standard Components

Feature	Specifications
1. Motor-Start Contactor	120 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA).
	240 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA).
2. VeriComm® Remote Telemetry Unit*	ATRTU-100: 36/18 VAC (center tap transformer), 8 digital inputs, 4 analog inputs, 4 digital outputs, 0 analog outputs, on-board modem (2400 baud), LED input and output indicators, 1-year battery backup of data and program settings.
3. Toggle Switch	Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 A, 1 hp.
4. Control Circuit Breaker	10 A, OFF/ON switch. Single-pole 120 VAC, double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
5. Pump Circuit Breaker	20 A, OFF/ON switch. Single-pole 120 VAC, double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
6. Fuse	120 VAC Primary, 36 VCT @ 0.85 A Secondary.
7. Transformer	250 VAC, 1 A.
8. Audio Alarm	80 dB at 24 in. (610 mm), warble-tone sound.
9. Visual Alarm	7/8 in. (22 mm) diameter red lens, "Push-to-silence." NEMA 4, 1 W bulb, 120 VAC.
10. Panel Enclosure	Measures 13.51 in. high x 11.29 in. wide x 5.58 in. deep (343 mm x 287 mm x 142 mm). NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
VCOM-AXA1	120 VAC, 3/4 hp, 14 A, single-phase, 60 Hz.
VCOM-AXA2	240 VAC, 2 hp, 14 A, single-phase, 60 Hz.

Optional Components

Feature	Specifications	Product Code Adder
Pump Run Light	7/8 in. (22 mm) diameter green lens. NEMA 4, 1 W bulb, 120 VAC.	PRL
Anticondensation Heater	Self-adjusting; radiates additional wattage as temperature drops.	HT
UV Disinfection Compatibility	UV grounded power circuit and alarm contacts. Pump disable upon UV failure.	UV

** See VeriComm® Remote Telemetry Unit (ATD-CP-VCOM-1) and VeriComm® Monitoring System (ATD-WEB-VCOM-1) for details.*

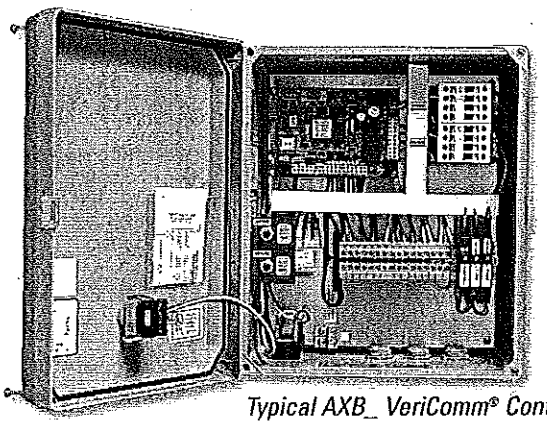
VeriComm® AXB_ Control Panels

Technical Data Sheet

For AdvanTex® Treatment Systems

Applications

VeriComm® AXB1 and AXB2 remote telemetry control panels are used with two-pump operations — recirculation and discharge (on-demand or timed) — for AdvanTex® Treatment Systems. Coupled with the VeriComm Web-based Monitoring System, these affordable control panels give water/wastewater system operators and maintenance organizations the ability to monitor and control each individual system's operation remotely, with real-time efficiency, while remaining invisible to the homeowner. VeriComm AXB panels allow remote operators to change system parameters, including timer settings, from the Web interface.



Typical AXB_ VeriComm® Control Panel

Standard Models:
VCOM AXB1, VCOM AXB2

To Specify...

To specify this panel for your installation, require the following:

Basic Control Logic: Three Operating Modes

- A "Start-up Mode" for the initial 30 days, during which the system collects trend data to establish operating standards for future reference.
- A "Normal Mode" that manages day-to-day functions.
- A "Test Mode" that suspends data collection and alarm reporting during installation and service.

Data Collection and Utilization

- Data logs of system conditions and events, such as pump run times, pump cycles, and alarm conditions.

Troubleshooting and Diagnostic Logic

- Troubleshooting capabilities that can report suspected failed components, which then trigger Alarms.

Advanced Control Logic

- Advanced control logic that activates during float malfunctions to diagnose the situation and keep the system operating normally until servicing.

Communication and Alarm Management

- Remote telemetry capabilities coupled with a Web-based monitoring application (see *VeriComm Monitoring System*, ATD-WEB-VCOM-1) for communication and alarm management. Updating of point values (including timer settings) and receipt of queued changes during each communication session with host. Communication sessions that occur monthly, at a minimum, and more frequently during alarm conditions.
- Multiple methods of communication, as follows:

Call-In to VeriComm® Host

- Automatic notification to host of "Alarms," which signal fault conditions that need to be addressed immediately (e.g., pump failure).
- Automatic notification to host of "Alerts," which signal less critical fault conditions and which trigger the panel's troubleshooting logic and alternative operating mode (e.g., stuck float switch).
- Automatic notification to host of "Updates," which include alarm updates or all-clear notifications following Alarms/Alerts, as well as normally scheduled monthly panel reports.
- Manual, forced communication from panel to host to effect an updating of point values and receipt of queued changes.

Real-Time Direct Connection to Panel

- Manual, direct connection at the site via RS-232 serial port, to allow a local operator real-time access to detailed logged data and the ability to change point values from a laptop.
- Manual, forced communication by local operator/homeowner at the site to initiate an auto-answer mode, allowing a remote operator real-time access to detailed logged data and the ability to change point values.

During real-time, manual connections, software with open architecture (and password security) is used; no proprietary software is required. VT100 protocol allows access and control from any computer modem (Mac or PC) with a simple communication program (e.g., Windows® HyperTerminal); multilevel password protection in panel ensures that only qualified personnel can access the panel's data.

Additional Features

- Status light indicators on the board, including . . .
  - Flashing green LED for normal operation
  - Yellow LEDs for status of digital inputs
  - Red LEDs for status of digital outputs and modem activity
- UL-recognized and FCC-approved

For more information, try our online demo at www.vericomm.net (no password required).

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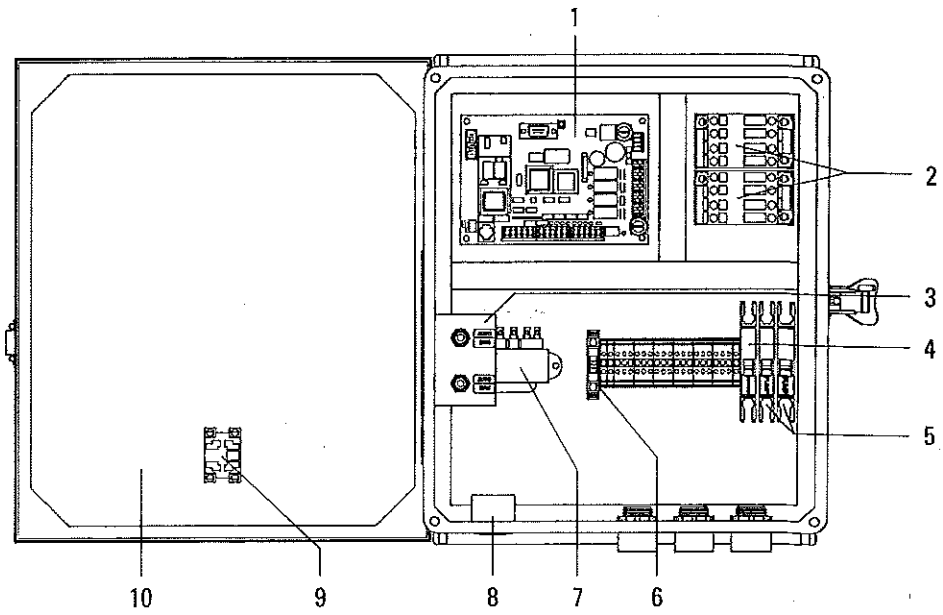
VeriComm® AXB_ Control Panels

Technical Data Sheet

1. VeriComm® Remote Telemetry Board
2. Motor-Start Contactors
3. Toggle Switches
4. Control Circuit Breaker
5. Pump Circuit Breakers
6. Fuse
7. Transformer
8. Audio Alarm
9. Visual Alarm
10. Panel Enclosure



Standard Components

Feature	Specifications
1. VeriComm® Remote Telemetry Unit*	ATRTU-100: 36/18 VAC (center tap transformer), 8 digital inputs, 4 analog inputs, 4 digital outputs, 0 analog outputs, on-board modem (2400 baud), LED input and output indicators, 1-year battery backup of data and program settings.
2. Motor-Start Contactors	120 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 240 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA).
3. Toggle Switches	Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 A, 1 hp.
4. Control Circuit Breaker	10 A, OFF/ON switch. Single-pole 120 VAC, double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
5. Pump Circuit Breakers	20 A, OFF/ON switch. Single-pole 120 VAC, double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
6. Fuse	120 VAC Primary, 36 VCT @ 0.85 A Secondary.
7. Transformer	250 VAC, 1 A.
8. Audio Alarm	80 dB at 24 in. (610 mm), warble-tone sound.
9. Visual Alarm	7/8 in. (22 mm) diameter red lens, "Push-to-silence." NEMA 4, 1 W bulb, 120 VAC.
10. Panel Enclosure	Measures 15.5 in. high x 13.3 in. wide x 6.7 in. deep (384 mm x 338 mm x 170 mm). NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
VCOM-AXB1	120 VAC, 3/4 hp, 14 A, single-phase, 60 Hz.
VCOM-AXB2	240 VAC, 2 hp, 14 A, single-phase, 60 Hz.

Optional Components

Feature	Specifications	Product Code Adder
Pump Run Light	7/8 in. (22 mm) diameter green lens. NEMA 4, 1 W bulb, 120 VAC.	PRL
Anticondensation Heater	Self-adjusting: radiates additional wattage as temperature drops.	HT
Programmable Timer	Discharge side timed dosing.	PT
UV Disinfection Compatibility	UV grounded power circuit and alarm contacts. Pump disable upon UV failure.	UV

** See VeriComm® Remote Telemetry Unit (ATD-CP-VCOM-1) and VeriComm® Monitoring System (ATD-WEB-VCOM-1) for more detail.*

VeriComm® Monitoring System

Technical Data Sheet

Applications

Orenco's web-based VeriComm® Monitoring System (www.vericomm.net), together with Orenco's VCOM (telemetry-enabled) control panels, gives water/wastewater system operators and maintenance organizations the ability to remotely monitor, maintain, manage, and control each individual installation.

VeriComm® monitoring system

To Specify . . .

To specify the VeriComm Monitoring System for your installation, require the following:

Security Features

- Site data stored in a robust Microsoft SQL Server database
- Password-protected site with multiple levels of security
- Operator access restricted to specific systems/sites
- Automatic logoff after ten minutes of user inactivity

Alarm Management

- Ability to simultaneously ***receive*** multiple incoming alarms from multiple sites, 24/7, utilizing a toll-free number
- Ability to disable a panel from calling the system
- Ability to retrieve alarm logs remotely
- Ability to simultaneously ***manage*** multiple incoming alarms from multiple sites, 24/7, with the help of the following:
  - Automatic notification of fault condition via
    1) e-mail
    2) alphanumeric pager (e-mail-capable)
  - A preestablished alarm protocol, including designated recipients and frequency of notifications (*Alarm Profile Details* page)
  - An online list of all active alarms and alerts, by site address and unique identification number (*Alarm Management* page)
  - Extensive online diagnostic data for each alarm and alert, including a description of the fault condition; recommended actions; and the ability to e-mail operators, stop e-mailed alarm notifications, and clear alarms (*Call Analysis* page; see sample on back)
  - Fields for online input and review of alarm response documentation for every individual site (*Call Analysis* page)
  - Date- and time-stamping for alarms and alarm notes

Site Management

- Ability to simultaneously manage multiple systems comprised of an unlimited number of sites, with the help of the following:
  - Editable online information about every site, including location, contacts, kind of system, panel type, call-in schedule, alarm protocol, alarm history, and access to all monthly call histories (*Site Details* page)
  - Fields for online input and review of pertinent site information (*Site Notes* page)
  - An online, tabular display of all the operating data (hundreds of separate "points") reported during alarm/alert conditions or routine, monthly updates, as well as the ability to alter certain system settings (*Current Point Data* page)
  - Editable summary lists of all systems, sites, operators, and alarm contacts (*System Management*, *Sites*, *Operators*, and *Alarm Contacts* pages)
  - Standard and custom reports
- Ability to set site defaults (timer settings, etc.)

Additional Features

- Automatic site upgrades
- *Quick Start Guide* and comprehensive *User Manual*
- Subscriber setup and support

Continued on back

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

www.orenco.com

ATD-WEB-VCOM-1
Rev. 2.0, © 6/02

Call Analysis

Back Forward Stop Refresh Home AutoFill Print Mail

Address http://www.vericomm.net

Live Home Page Apple Computer Apple Support Apple Store Microsoft MacTopia MSN Office for Macintosh Internet Explorer

Favorites History Search Scrapbook Page Holder

VeriComm® monitoring system

web-based monitoring system

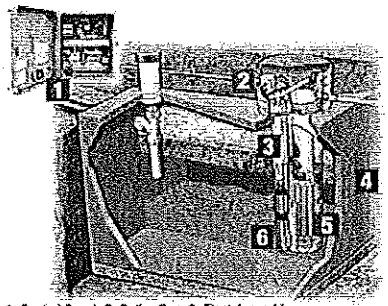
Alarm Management | System Management | Help | Log Off

System Details | Sites | Site Details | Point Data

Call Analysis

Eagle Crest Estates
RTU100235

This page provides information for a specific call-in. It describes any fault condition for a reported alarm or alert, recommends actions, and allows you to stop notification, enter alarm notes, and clear the alarm or alert.



1. Control Panel 2. Splice Box 3. Float Assembly
4. Processing Tank 5. Biotube® Filter 6. Pump

Site Information

Site Address: 1511 Eagle View
Days Creek, QC 97456
Site Number: RTU100235
Panel Type: S1RO

Fault Conditions

1. The system is reporting a low level condition.

Recommended Actions

Low Level

1. Check the site for manual pumping.
2. Check the tank for watertightness (leakage) or siphoning.

Date Information

Reported: April 10, 2002 1:01 PM (PT)
Start Time: April 10, 2002 1:00 PM
End Time:

Alarm Status

New Alarm
48 Days Old - Notify Active
Continue Sending Notification? ◉ Yes ○ No
☐ Clear this call. (A note describing how this was resolved is required.)

Update

Note	Operator	Date	Options
No alarm notes have been assigned to this call.			

Note:

Add

Internet zone

Sample screen capture of VeriComm® *Call Analysis* page

Standard Packages

Orenco Systems® Incorporated
1-800-348-9843

AdvanTex®-AX Treatment Systems

Standard Package Components Supplied by Orenco Systems, Inc.

AX Series - Mode 1a and Mode 1a CW

PVC Splice Box
Universal Biotube Pump Vault, 57 in. typical height
Discharge Assembly
Float Switch Assembly
Orenco Pump, 115V
VCOM AdvanTex® AXA Panel, 115V
Recirc Splitter Valve Assembly
AdvanTex Filter with Vent Assembly and Antiflotation Flanges

Accessories*

Processing Tank Equipment

AX Series - Mode 1b and Mode 1b CW

PVC Splice Box
Universal Biotube Pump Vault, 57 in. typical height
Discharge Assembly
Float Switch Assembly
Orenco Pump, 115V
VCOM AdvanTex AXB Panel, 115V
Recirc Splitter Valve Assembly
AdvanTex Filter with Vent Assembly and Antiflotation Flanges

Accessories*

Processing Tank Equipment
Pump Basin Equipment

AX Series – Mode 3a and Mode 3a CW

PVC Splice Box
Universal Biotube Pump Vault, 57 in. typical height
Discharge Assembly
Float Switch Assembly
Orenco Pump, 115V
VCOM AdvanTex AXA Panel, 115V
Recirc Splitter Valve Assembly
AdvanTex Filter with Vent Assembly and Antiflotation Flanges

Accessories*

Processing Tank Equipment

Standard Packages (continued)

AX Series – Mode 3b and Mode 3b CW

PVC Splice Box
Universal Biotube Pump Vault, 57 in. typical height
Discharge Assembly
Float Switch Assembly
Orenco Pump, 115V
VCOM AdvanTex AXB Panel, 115V
Recirc Splitter Valve Assembly
AdvanTex Filter with Vent Assembly and Antiflotation Flanges

Accessories*

Processing Tank Equipment
Pump Basin Equipment

+Cold weather treatment systems include insulation on the lid of the AdvanTex filter, an anticondensation heater in the Control Panel, and a drainback style discharge assembly.

****Additional components provided by Orenco Systems, Inc. Processing tank and pump basin equipment varies on a case-by-case basis. Typical accessory equipment might include:***

Processing Tank Equipment

24 in. Dia, 34 in. typical height, with lid
30 in. Dia, 34 in. typical height, with lid and necessary grommets
24 in. Dia tank adapter with bolt down kit and adhesive
30 in. Dia tank adapter with bolt down kit and adhesive

Pump Basin Equipment

PVC Pump Basin, 24 in. Dia, 72 in. typical height with lid
PVC Splice Box
Discharge Assembly
Float Switch Assembly
Orenco Pump, 115V

Components Not Supplied by Orenco Systems, Inc.

Processing tank
Sewer pipe from building to processing tank
External piping between tank, filter and final dispersal area
Ventilation piping
Electrical conduit and fittings
Dispersal area materials, such as rock, lateral piping, etc.

General Specifications

Orenco Systems®
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479

TOLL FREE:
(800) 348-9843

TELEPHONE:
(541) 459-4449

FACSIMILE:
(541) 459-2884

This General Specifications document is designed to provide the engineer or designer with recommended wording that can be used when specifying equipment for an effluent sewer system. In some cases, different sizes or variations of the same product are available. The engineer or designer should review this document carefully to choose the most exact wording possible when specifying equipment. Any product or design questions should be directed to the appropriate support person at Orenco Systems®, Inc.

The Specifications wording contained herein can also be used in projects other than effluent sewers. In these cases, the designer should confirm that the appropriate Orenco Systems, Inc. products are being specified for the application.

Orenco Systems®, Inc. recommends that the engineer or designer include the following wording in their specification document to avoid questions related to the meaning of the often-misinterpreted phrase "or equal":

> *Throughout this document, the terms "or engineer-approved equal" and "or approved equal" are used. For this project the terms "engineer-approved equal" or "approved equal" shall mean equal in the judgment of the engineer. Bidders seeking approval of products as an "approved equal" shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards, the bidder shall furnish evidence of such conformance in the form of test or inspection reports. Bidders seeking approval of products as an "approved equal", shall provide submissions, meeting the above requirements, no fewer than 10 days prior to bid opening for review by the engineer. Failure to provide complete data will be cause for rejection of the product.*

A. ONSITE INTERCEPTOR TANKS

1. General:

a. The manufacturer shall provide the structural design and certification to the engineer for review. The design shall be in accordance with accepted engineering practice. Precast concrete or fiberglass tanks shall have been designed by a registered engineer and approved by state or local regulatory agencies or authorities. To achieve effective performance and minimize pump-out occurrences, residential interceptor tanks shall have a nominal liquid capacity of 1000 gallons for up to 2 bedrooms, 1500

gallons for 3 bedrooms, 2000 gallons for 4 bedrooms, and, for more than 4 bedrooms, the sizing shall be determined based on an occupancy assessment and shall be in accord with Figure 1.

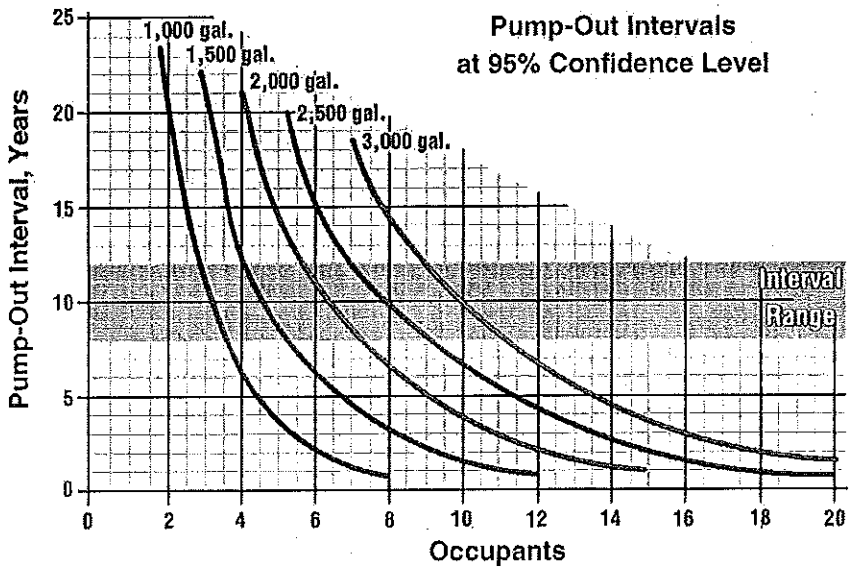


Figure 1. Interceptor Tank Pump-Out Intervals

Average flow (Q_a) is based upon typical weekly discharges. Wastewater flows for single-family dwellings typically range from *40 to 60 gallons per capita per day (gpcd)*; **50 gpcd** is a commonly used design parameter and is the value used in calculations herein. The number of individuals (capita) is assumed to average three per dwelling. Typical occupancies and flow relationships are shown in Table 1.

Table 1: Relationship between Number of Bedrooms, Occupancies, and Flow

Bedrooms	Q_p[a]	Occupants[b]	Q_c	Q_a
	gpd/DU	*capita*	*gpcd*	*gpd/DU*
1	200	2	55	110
2	300	3	50	150
3	375	4	50	200
4	450	5	45	225

a. Peak day bedroom flows (Q_p) are based on typical administrative rules.

b. Occupancy is based on typical usage of two occupants for the first bedroom and one occupant per additional bedroom.

b. Loading Criteria:

- There shall be 140 lbs./cu.ft. for minimum weight of saturated backfill, or 127 lbs./cu.ft. for unsaturated backfill (500 lbs./sq.ft.minimum).
- Minimum lateral loading shall be 62.4 lbs./cu.ft. Lateral loading shall be determined from ground surface.
- The tank shall also support a concentrated wheel load of 2500 lbs.

There are four (4) typical loading conditions that should be analyzed:

1. 4 ft. Bury + Full Exterior Hydrostatic Load
2. 4 ft. Bury + Full Exterior Hydrostatic Load + 2500 lb. Wheel Load.
3. 1 ft. Bury + 2500 lb. Wheel Load.
4. Tank Full, Interior Hydrostatic Load and Unsupported by Soil.

Load Case 4 represents the tank full of liquid at 62.4 lbs/cu.ft. This condition addresses seam and haunch stress-strain relationships that occur during watertightness testing, as well as poor soil bedding conditions that provide inadequate support.

c. Tanks requiring deep burial (>48") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12" shall be used, unless specified otherwise by manufacturer.)

d. *All tanks shall be structurally sound and watertight* and shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not be limited liability to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.

e. Tanks shall be manufactured and furnished with access openings 20" in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.

f. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth.) The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

g. Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.

h. All tanks shall be installed in strict accordance with the manufacturer's recommended installation instructions.

2. Concrete Tanks:

a. Walls, bottom and top of reinforced concrete tanks shall be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically constructed tanks may be determined by analyzing the tank cross-section as a continuous fixed frame.

b. The walls and bottom slab shall be poured monolithically; alternatively, water stops may be provided.

c. Reinforcing steel shall be ASTM A-615 Grade 60, fy = 60,000 psi. Details and placement shall be in accordance with ACI 315 and ACI 318.

d. Concrete shall be ready-mix with cement conforming to ASTM CI50, Type II. It shall have a cement content of not less than six (6) sacks per cubic yard and maximum aggregate size of 3/4". Water/cement ratio shall be kept low (0.35±), and concrete shall achieve a minimum compressive strength of 4000 psi in 28 days. The Contractor shall submit a concrete mix design to the Engineer for review and approval. Three (3) concrete sample cylinders shall be taken and tested for each tank manufactured until the manufacturer and Engineer are satisfied that the minimum compression strength is being obtained. To ensure compliance, the manufacturer shall then make and set three (3) sample cylinders for a minimum of 20% of the remaining tanks at the discretion of the Engineer. If the minimum compressive strength is not being obtained, the manufacturer shall be required to make and test sample cylinders for each tank manufactured. Calcium chloride will not be allowed in the mix design. The cost of testing cylinders shall be the tank manufacturer's responsibility. The tank manufacturer may supply a Swiss hammer for compressive testing in the field in lieu of sample cylinders.

e. Tanks may be protected by applying a heavy cement-base waterproof coating (Thoroseal® or approved equal), on both inside and outside surfaces, in compliance with Council of American Building Officials (CABO) report #NRB-168; 6181; however, the tank should be watertight without the addition of seal coatings.

f. Form release used on tank molds shall be Nox Crete™ or approved equal. Diesel or other petroleum products are not acceptable.

g. Tanks shall not be moved from the manufacturing site to the job site until the tank has cured for seven (7) days or has reached two-thirds of the design strength.

h. Tanks shall be manufactured and furnished with access openings of the size and configuration to accommodate individual packaged pump systems. For 24" diameter access risers, the tank manufacturer shall cast in place a flanged tank adapter to facilitate the bonding of a 24" diameter access riser. The flanged tank adapter shall be made of 1/4" thick ABS and shall have an outside diameter of 27" and an inside diameter of 22-3/4". The flanged adapter shall be Orenco Systems®, Inc. Model PRTA24 or engineer-approved equal. The adapter must have an overall height of no less than 3" to allow 1-1/2" exposed for sufficient bonding area once the adapter is installed in the tank. For 21" and 30" diameter access risers, either a grooved tank adapter plate (Model RRFTA or RRFTA30) or a flanged tank adapter (Model PRTA30) may be installed in the tank. The adapter shall be manufactured of fiberglass or ABS and shall accommodate either a 21" or 30" diameter access riser.

i. The septic tank and the top slab shall be sealed with a preformed flexible plastic gasket. The flexible plastic gasket shall be equal to the flexible butyl resin sealant congeal CS-102 or CS-202 as manufactured by Concrete Sealants, Inc. of New Carlisle, Ohio, and shall conform to federal specification SS-S-00210(2iOA) and AASHTO M-198. A mechanical fastening method shall be used if the seasonal groundwater level may reach the top slab seam of the tank.

j. In order to demonstrate watertightness, tanks shall be tested at the factory and again on-site prior to acceptance. Inlets to the septic tank will be watertight pipe seal Cast-A-Seal™ (Manufactured by Press-Seal Gasket Corporation) or approved equal. Each tank shall be tested at the factory, prior to shipping, by filling with water to the soffit and letting stand. After 24 hours, the tank shall be refilled to the soffit and the exfiltration rate shall be determined by measuring the water loss during the next two (2) hours. Any leakage shall be cause for rejection. After installation is completed and before backfilling, each tank shall be filled with water to a

point 2" above the top of the tank and the water loss measured after a twenty four-hour period. After it has been determined that there is no leakage, test the access riser seam. Backfill to a minimum depth of 2" above the riser seam to prevent damage from hydrostatic uplift. Fill the tank to a point 2" above the riser seam (the field test period may be reduced to not less than two (2) hours). No tank will be accepted if there is any leakage over the two (2) hour period.

3. Fiberglass Tanks:

a. Method of Calculations:

1. Fiberglass tanks shall be analyzed using finite element analysis for buried structures.

2. Calculations shall address the following:

- strength
- buckling
- deflection of 5% of the tank diameter, based on service load (including long-term deflection lag)
- buoyancy

3. Performance testing

Material Properties and Laminates

The laminates considered in this analysis shall be fiberglass reinforced polyester resin, using grades of resin and fiberglass considered acceptable for use with septic tank construction. The thicknesses for different regions of the tanks shall be described and shown in shop drawings for each individual tank.

Typical primary strength properties are listed below:

Tensile Modulus (psi)	1,000,000
Ultimate Tensile strength (psi)	10,000
Ultimate Compressive strength (psi)	21,000
Ultimate Flexural strength (psi)	18,000
Ultimate Shear In-Plane (psi)	7,000

b. In lieu of calculations for fiberglass tanks, the supplier may elect in-situ performance testing.

c. In-situ testing of each tank model shall include use of strain gauge and deflection gauge. The tank will be subjected to external forces equal to twice the actual load.

d. Maximum initial deflection based on test loading shall not exceed 3% of the tank diameter.

e. Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on any of the tank models.

f. The tank shall be constructed with a glass fiber and resin content specified by the manufacturer and with no exposed glass fibers. Any permanent metal part shall be 300 series stainless steel.

g. Inspections may be made by the engineer in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16". If the wall thickness is suspected to be less than 3/16" or if delamination is suspected within any portion of the tank, the engineer may drill a 1/4" diameter hole through the tank wall for inspection purposes. If the required minimum 3/16" thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this bid will become suspect of substandard quality and subject to rejection by the engineer. If the required minimum 3/16" thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the engineer.

h. The engineer shall specify the minimum weight of each tank model that will be allowed. The manufacturer will permanently mark the weight of each tank on the top near the access hole.

i. The minimum tank weight shall be specified by the manufacturer's engineer (e.g., 330 lbs for 1000-gallon tanks, 450 lbs for 1500-gallon tanks; add 30 lbs for internal baffle).

j. Holes specified for the tank shall be provided by the manufacturer. Resin or other appropriate sealant shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.

k. Orenco Systems®, Inc. EPDM gaskets, or approved equal, shall be used at the inlet to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.

l. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height;

in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

m. In order to demonstrate watertightness, tanks shall be tested at the factory and again on-site prior to acceptance. Each tank shall be tested at the factory, prior to shipping, by filling with water to the soffit and letting stand for a minimum of two (2) hours. Any leakage shall be cause for rejection. After installation is completed and before backfilling, completely fill the tank with water, to a level two (2) inches into the riser. Wait a minimum of two (2) hours (or as required by local rules) and inspect the tank for leaks. There should be no drop in liquid level and no visual leakage from seams, pinholes, or other imperfections. Once the tank is proven to be watertight, drop the water level in the tank below the invert – but not below the mid-seam.

n. Each tank shall be marked in the uppermost surface above or near the outlet and include a permit or identification number, weight of tank, type of tank, and date of manufacture.

o. Installation shall be in accordance with the manufacturer's recommendations, or as shown on the Contract Plans, whichever is more stringent–no variations.

B. RISERS & LIDS:

1. Risers:

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend 3" above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18" in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24" in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30" in nominal diameter when the depth of bury is 36" or greater. All other risers shall be a minimum of 24" in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be a two-part adhesive, Model MA320, SS115, SS140 or approved equal, or a single component adhesive Model ADH100 or approved equal. If backfilling the same day is desired, a combination of Model MA320 and Model ADH100 adhesives or approved equals should be used. To ensure product compatibility, a single manufacturer shall supply risers, lids, and attachment components.

2. **Inlet Risers:**

Inlet risers (required only on two-compartment tanks and tanks with greater than 1500-gallon capacity) shall be Perma-Loc, Ultra-Rib, KOR FLO or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of a 1/2 an inch. Risers shall extend to 3 inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 18 inches.

3. **Outlet Risers:**

Outlet risers shall be Perma-Loc, Ultra-Rib, KOR FLO or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall be at least 12 inches high, shall have a minimum nominal diameter of 24 inches for simplex pumping applications or 30 inches when used in a duplex pumping application and shall be factory-equipped with the following:

a. Electrical and Discharge Grommets: when applicable, Orenco Systems®, Inc. EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The manufacturer of the access risers shall install the grommets at the factory.

b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part adhesive, one pint required per 18" or 24" diameter riser and one quart required per 30" diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part adhesive, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal shall be used.

4. **Riser-To-Tank Attachment:**

Risers shall be attached to tanks with one of the following attachment systems, or approved equal: (1) Orenco Systems®, Inc. Model RUBDKIT attachment kit; (2) Orenco Systems, Inc. Model PRTA24 tank adapter used with Model PRTA24BDKIT bolt down kit, and Model ADH100 and/or

MA320 adhesives; (3) Orenco Systems, Inc. Model RRFTA tank adapter used with Model RRFTABDKIT bolt down kit and Model ADHP10 adhesive; (4) Orenco Systems, Inc. Model PRTA30 tank adapter used with Model PRTA30BDKIT bolt down kit and Model ADH100 and/or MA320 adhesives. All attachment components shall be constructed of waterproof, non-corrosive materials, such as PVC, ABS, fiberglass, or stainless steel. Adhesives and sealants shall be waterproof, corrosion resistant and approved for the intended application. The riser-to-tank connection shall be watertight and structurally sound. The riser-to-tank connection shall be capable of withstanding a vertical uplift of 5000 pounds to prevent riser separation due to tank settlement, frost heave, or accidental vehicle traffic over the tank.

5. **Lids:**

One lid shall be furnished with each access riser. Lids shall be Orenco Systems®, Inc. Model FL18G-4BU, FL21G, FL24-4B, FL24G-4BU, or FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8" is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 3/4 of an inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Optional Components

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, part number 6024, 3060, 4036, as manufactured by Sather Manufacturing Co., Inc., or approved equal, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch or 4-inch thickness shall be attached to the underside of the lid. Any mechanical fasteners shall be

made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

6. **Riser Installation:**
   Riser installation shall be accomplished according to the manufacturer's instructions.

C. SEPTIC TANK EFFLUENT GRAVITY ASSEMBLIES:

1. **Outlet Risers:**
   Outlet risers shall be Perma-Loc, Ultra-Rib, KOR FLO or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (54 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall be at least 12 inches high, shall have a minimum nominal diameter of 18 inches over an effluent filter, or 24 inches if a splice box is located in the riser and shall be factory-equipped with the following:

   a. Electrical Grommets: when applicable, Orenco Systems®, Inc. EPDM grommets shall be installed by the manufacturer for the electrical conduit to assure a watertight seal. The manufacturer of the access risers shall install the grommets at the factory.

   b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part adhesive, one pint required per 18" or 24" diameter riser and one quart required per 30" diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part adhesive, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal shall be used.

2. **Riser-To-Tank Attachment:**
   Same as section B4 above.

3. **Lids:**
   Same as section B5 above.

4. **Riser Installation:**

Riser installation shall be accomplished according to the manufacturer's instructions.

5. Effluent Filter:

All filter systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. Effluent filters shall prevent particles larger than 1/8-inch in diameter from leaving the tank. Effluent filters shall have a solid bottom or deflecting device that prevents vertically rising solids from reaching the filtering surface area during ebullition (sludge bulking).

Gravity system tanks for single-family dwellings of less than four bedrooms shall be equipped with an Orenco Systems®, Inc. Biotube® Effluent Filter (FT04 Model Series) or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have an effective flow area of no less than 172 square inches.

For single-family dwellings of four bedrooms or larger, the tanks shall be a minimum of 1,500 gallons and equipped with an Orenco Systems®, Inc. Biotube® Effluent Filter (FT08 Model Series) or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have an effective flow area of no less than 220 square inches.

The Effluent Filter shall consist of either a 4" or 8" diameter PVC vault with eight holes (1-1/8" in diameter for the 4" filter, 1-3/8" diameter for the 8" filter) evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). The Biotube® cartridge shall be made with 1/8" mesh polypropylene and with a solid base (to prevent solids from entering through the bottom during ebullition). The Biotube cartridge shall be housed inside the PVC vault.

The direct-coupled outlet for the 4" filter shall contain two (2) 1/2" diameter flow-modulating orifices and one (1) 1/2" diameter vent hole. The direct-coupled outlet for the 8" filter shall contain two (2) 1-1/8" diameter flow-modulating orifices and one (1) 3/4" diameter vent hole. The lateral from the tank to the collection line shall be laid to a uniform grade with no high points.

Note: Commercial and multiple-user tanks require larger Effluent Filters, the sizes of which must be individually determined and spelled out in the specifications. Commercial applications should be sized according to the Orenco Systems®, Inc. document titled "Biotube® Effluent Filter Sizing."

D. SEPTIC TANK EFFLUENT PUMPING ASSEMBLIES:

For Single-Family Dwellings

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or engineer-approved equal, composed of:

1. **Risers & Lids:**
   Same as section B, 1 through 7, above.

2. **Pump Vault:**
   Orenco Systems®, Inc. Model PVU57-1819, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 14.5 square feet. (Note: Commercial and multiple-user tanks may require a larger or duplex Biotube Pump Vault, the sizes of which must be individually determined and spelled out in the specifications.) The Biotube Pump Vault shall consist of a 12-inch diameter, 57-inch deep HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube® assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

3. **Discharge Hose and Valve Assembly:**
   Orenco Systems®, Inc. Model HV100BC, 1-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with working pressure rating of 100 psi, and Schedule-40-PVC pipe. When pumping downhill, include anti-siphon assembly (Model HVAS100). Six-gpm flow controllers (Model FC) are available, if necessary.

4. **Float Switch Assembly (also see Alternate):**
   Orenco Systems®, Inc. Model MFABT with three switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms and on/off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

   Alternate: VeriComm® Remote Telemetry Float Control System

Orenco Systems®, Inc. Model MF3A with three switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms and on/off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

5. **High-Head Effluent Pump:**

   Must be approved for use in pump vault as described in D2. For most applications, an Orenco Systems®, Inc. Model P100511, 1/2 hp, 115 VAC, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be capable of providing a flow rate of 5 gpm against a head of 200 feet, or 10 gpm against a head of 120 feet. When used in conjunction with a flow controller, the pump shall be capable of providing 5 gpm against a head of 190 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty. Larger horsepower units are available (3/4 to 1-1/2 hp, 230 VAC).

6. **Electrical Splice Box:**

   Orenco Systems®, Inc. Model SB4, UL approved for wet locations, equipped with four electrical cord grips and a 3/4-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit.

7. **Controls and Alarms (also see Alternate):**

   Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model S1RO or S2RO control panel meeting the following:

   Standard Components:

   a. Motor-Start Contactor: 115 VAC: 16 FLA, 1 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

   b. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.

c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

d. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC. Double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

e. Audio Alarm: 80 dB at 24", warble-tone sound.

f. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

g. Panel Enclosure: Measures 11" high x 9.3" wide x 5.4" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

h. S1RO Panel Ratings: 115 VAC, 1 hp, 16 amps, single phase, 60 Hz.

i. S2RO Panel Ratings: 230 VAC, 3 hp, 16 amps, single phase, 60 Hz.

Optional Components:

j. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

k. Surge Arrestor: AG2401 120/230V, three 18" leads, rated for a maximum of 32,000amps, UL/CSA listed.

l. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.

m. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 913, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.

n. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

o. Event Counter: 115 VAC, 6-digit, non-resettable.

p. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

Alternate: VeriComm® Remote Telemetry Control System

Panel shall be Orenco Systems®, Inc. Model VCOM-S1RO or VCOM-S2RO control panel. The system will be monitored via remote telemetry, UL-recognized and FCC-approved for the application, and shall contain the following operating modes:

- A "Start-up Mode" during which the system will collect trend data for establishing future operating standards,
- A "Normal Mode" that manages day-to-day functions of the system,
- A "Test Mode" that suspends data collection and communications with the central server so that operators can install and service the system without affecting the panel's trend data and web-based communication.

In addition, the control system shall be capable of the following functions:

- Data Collection and Utilization: Logs data of system conditions and events, such as pump run time, pump cycles, alarm conditions, and alert conditions.
- Troubleshooting and Diagnostic Logic: Programmed to identify and report suspected failed components (Alarms) and negative trends in operating data (Alerts).
- Advanced Control Logic: Advanced control logic will activate in the event of component malfunction to diagnose the system using pre-established trend data and, if necessary, modify the operation of the system until the system can be serviced.
- Communications and Alarm Management: The control and monitoring system shall operate such that the telemetry control unit will communicate with a web-based monitoring application for reporting and alarm management. The system shall provide for a minimum of three levels of password-protected security access and control to ensure only qualified personnel can access and communicate with the panel. The communication protocol shall allow the operator to communicate with the telemetry unit using any modem (Mac or PC) and a web browser, or a simple communication program (e.g. HyperTerminal or Z-Term). Telemetry units requiring proprietary software shall not be considered.

The telemetry unit will provide automatic notification or call-in to the host in the event of:

- Alarms, which signal fault conditions that need to be addressed immediately (e.g. high or low liquid levels, pump failure, failed contactor, etc.);

- Alerts, which signal less critical conditions that require attention, but which will engage the panel's troubleshooting and diagnostic logic and alternative operating modes (e.g. stuck float switch, leaking tank, brownout, high flows, etc.);

- Updates, which include follow-up reminders or all-clear notifications following Alarms/Alerts, as well as scheduled panel reports;

- Manual forced communication, from panel to host to effect an update of queued programming changes.

In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

Standard Components:

a. Motor-Start Contactor: 115 VAC: 16 FLA, 1 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 amps, 1 hp.

c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

d. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

e. Audio Alarm: 80 dB at 24", warble-tone sound.

f. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

g. Panel Enclosure: Measures 13.5" high x 11.3" wide x 5.6" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

h. VCOM-S1RO Panel Ratings: 115 VAC, 1 hp, 16 amps, single phase, 60 Hz.

i. VCOM-S2RO Panel Ratings: 230 VAC, 3 hp, 16 amps, single phase, 60 Hz.

j. Remote Telemetry Unit: ATRTU-100; 36/18 VAC (center tap transformer), 8 digital inputs, 4 analog inputs, 4 digital outputs, on-board modem (2400 baud), LED input and output indicators, battery backup.

Optional Components:

k. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

l. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.

m. Surge Arrestor: AG2401 120/230V, three 18" leads, rated for a maximum of 32,000amps, UL/CSA listed.

n. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 698A, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.

o. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

p. Event Counter: 115 VAC, 6-digit, non-resettable.

q. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

8. Installation:

All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

9. Location:

The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

E. SEPTIC TANK EFFLUENT PUMPING ASSEMBLIES

For Commercial or Multiple-User Tanks

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or engineer-approved equal, composed of:

1. **Risers & Lids:**
   Same as section B, 1 through 7, above.

2. **Pump Vault:**
   Orenco Systems, Inc. Model PVU Series, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 19.6 square feet. (Note: Commercial and multiple-user tanks may require a larger or duplex Biotube® Pump Vault, the sizes of which must be individually determined and spelled out in the specifications.) The Biotube Pump Vault shall consist of a 12-inch diameter HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

3. **Discharge Hose and Valve Assemblies:**
   Orenco Systems®, Inc. Model HV125BC, 1-1/4-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with working pressure rating of 80 psi, and Schedule 40 PVC pipe. When pumping downhill,

include anti-siphon assembly (Model HVAS125). Larger diameter models are available if necessary.

4. **Float Switch Assembly:**

   Orenco Systems®, Inc. Model MF4A with four switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms and on/off functions shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

5. **High-Head Effluent Pumps:**

   For most applications, an Orenco Systems®, Inc. Model P200511, 1/2 hp, 115 VAC, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be capable of providing a flow rate of 20 gpm against a head of 105 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty. Larger horsepower units are available (3/4 to 1-1/2 hp, 230 VAC).

6. **Electrical Splice Boxes:**

   Orenco Systems®, Inc. Models SB6, UL approved for wet locations, equipped with six electrical cord grips and a 1" outlet fitting. Also included shall be UL listed waterproof butt splice connectors. Substitute Model SB4, equipped with four electrical cord grips and a 3/4"outlet fitting and Model SBX-D for Class 1, Division 1 applications.

7. **Controls and Alarms (also see Alternate):**

   Shall be listed per UL 508 or UL 698A for Class 1, Division 1. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model MVP-DAX1RO or MVP-DAX2RO control panel meeting the following:

   Standard Components:

   a. Programmable Logic Unit: 115/230 VAC programmable logic unit with built-in LCD screen and programming keys. Provides control functions and timing for panel operation.

   b. Motor-Start Contactor: 115 VAC: 16 FLA, 1 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC:

16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

c. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.

d. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

e. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC. Double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

f. Audio Alarm: 80 dB at 24", warble-tone sound.

g. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC.

h. Panel Enclosure: Measures 13.5" high x 11.3" wide x 5.6" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

i. MVP-DAX1RO Panel Ratings: 115 VAC, 1 hp, 16 amps, single phase, 60 Hz.

j. MVP-DAX2RO Panel Ratings: 230 VAC, 3 hp, 16 amps, single phase, 60 Hz.

k. Event Counter: 115 VAC, 6-digit, non-resettable.

l. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

Optional Components:

m. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

n. Effluent Alarm: 95db at 24", warble-tone sound.

o. Flashing Light: Flashing Light: Lexan lens, flanged based, Red, UL – recognized

p. 3 way (main, auto, off) manual power transfer/disconnect switch

q. 115VAC Ground fault interrupter (GFI)

r. Surge Arrestor: AG2401 120/230V, three 18" leads, rated for a maximum of 32,000amps, UL/CSA listed.

s. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.

t. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 913, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.

u. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch

v. Event Counter: 115 VAC, 6-digit, non-resettable.

w. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

Alternate: Remote Telemetry Control System

Control panel shall be Orenco Systems®, Inc. TCOM-DAX1RO or TCOM-DAX2RO or engineer-approved equal. The system will be monitored via remote telemetry, UL-recognized and FCC-approved for the application, and shall contain the following operating modes:

- A "Start-up Mode" during which the system will collect trend data for establishing future operating standards,
- A "Normal Mode" that manages day-to-day functions of the system,
- A "Test Mode" that suspends data collection and communications with the central server so that operators can install and service the system without affecting the panel's trend data and web-based communication.

In addition, the control system shall be capable of the following functions:

- Data Collection and Utilization: Logs data of system conditions and events, such as pump run time, pump cycles, alarm conditions, and alert conditions.
- Troubleshooting and Diagnostic Logic: Programmed to identify and report suspected failed components (Alarms) and negative trends in operating data (Alerts).

- Advanced Control Logic: Advanced control logic will activate in the event of component malfunction to diagnose the system using pre-established trend data and, if necessary, modify the operation of the system until the system can be serviced.

- Communications and Alarm Management: The control and monitoring system shall operate such that the telemetry control unit will communicate with a web-based monitoring application for reporting and alarm management. The system shall provide for a minimum of three levels of password-protected security access and control to ensure only qualified personnel can access and communicate with the panel. The communication protocol shall allow the operator to communicate with the telemetry unit using any modem (Mac or PC) and a web browser, or a simple communication program (e.g. HyperTerminal or Z-Term). Telemetry units requiring proprietary software shall not be considered.

The telemetry unit will provide automatic notification or call-in to the host in the event of:

- Alarms, which signal fault conditions that need to be addressed immediately (e.g. high or low liquid levels, pump failure, failed contactor, etc.);

- Alerts, which signal less critical conditions that require attention, but which will engage the panel's troubleshooting and diagnostic logic and alternative operating modes (e.g. stuck float switch, leaking tank, brownout, high flows, etc.);

- Updates, which include follow-up reminders or all-clear notifications following Alarms/Alerts, as well as scheduled panel reports;

- Manual forced communication, from panel to host to effect an update of queued programming changes.

In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

Standard Components:

a. Motor-Start Contactor: 115 VAC: 16 FLA, 1 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC:

16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 amps, 1 hp.

c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

d. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC. Double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

e. Audio Alarm: 80 dB at 24", warble-tone sound.

f. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

g. Panel Enclosure: Measures 15.5" high x 13.3" wide x 6.7" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

h. TCOM DAX1RO Panel Ratings: 115 VAC, 1 hp, 16 amps, single phase, 60 Hz.

i. TCOM DAX2RO Panel Ratings: 230 VAC, 3 hp, 16 amps, single phase, 60 Hz.

j. Remote Telemetry Unit: ATRTU-PCMNet; 24 VDC (center tap transformer), 8 digital inputs, 6 analog inputs, 8 digital outputs, on-board modem (9600 baud), and battery backup.

Optional Components:

k. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

l. Effluent Alarm: 95db at 24", warble-tone sound.

m. Flashing Light: Flashing Light: Lexan lens, flanged based, Red, UL – recognized

n. 3 way (main, auto, off) manual power transfer/disconnect switch

o. 115VAC Ground fault interrupter (GFI)

p. Surge Arrestor: AG2401 120/230V, three 18" leads, rated for a maximum of 32,000amps, UL/CSA listed.

q. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.

r. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 698A, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.

s. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

t. Event Counter: 115 VAC, 6-digit, non-resettable.

u. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

8. Installation:

All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

9. Location:

The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

F. TOOLS FOR SEPTAGE MEASUREMENT

1. Scum Measuring Utility Gauge (SMUG):

Contractor shall provide a minimum of one scum measuring utility gauge per 100 units. The gauge shall consist of a minimum 3/8" diameter stainless steel rod with an incremental scale for measuring scum levels. The rod shall be bent at a 90-degree angle at the base to aid in identifying the scum "by

feeling." The gauge shall be Orenco Systems®, Inc. Model SMUG or engineer-approved equal.

2. **Sludge Measuring Device**:

   Contractor shall provide a minimum of one engineer-approved sludge-measuring device per 100 interceptor tanks.

Approvals Summary

Orenco Systems®
Incorporated
1-800-348-9843

Basis for Approvals

AdvanTex® Treatment Systems

Orenco's AdvanTex Treatment System incorporates a packed bed filter unit that uses textile media. The effectiveness of wastewater treatment using packed bed filters has been well documented over the past century.

Orenco Systems has been researching and developing textile packed bed filters since 1996, and about 10,000 systems have been installed in the U.S. and Canada, on all sorts of sites: single-family homes, commercial properties, and community systems. The company's 25 years of experience with research, design, and construction of all types of intermittent and recirculating sand filters has been invaluable during this process. The principles and practices used in sand filters are very much like those used with textile filters.

Following is a summary of AdvanTex approvals and installations. Currently, AdvanTex is approved in over 90 jurisdictions (states, counties, and provinces). Additional supporting information is available. If you have any questions, please call Sam Carter, Orenco Systems, Inc., (800) 348-9843, ext. 327.

Documented Approvals and Installations

AdvanTex Treatment Systems have undergone third-party evaluation and have successfully passed ANSI testing protocols. Our AX20, rated at 500 gpd, successfully passed the NSFANSI Standard 40 testing protocol for Class 1 Systems.

Orenco's AdvanTex Treatment Systems have also been approved and installed in numerous locations, many of which are being actively monitored, including EPA Demonstration Sites.

Following is a summary of principal approvals and installations, arranged alphabetically by state, with contact names and phone numbers. Jurisdictional approvals, EPA Demonstration Sites, and significant research projects have been underlined, for quick reference.

Alabama: Statewide approval was given to the AdvanTex Treatment System on 8/30/2002. Two 20,000 gpd commercial systems were installed in July 2001. Seven residential systems have also been installed. Contact: Billy McLean, (334) 342-0778.

Alaska: Approval was given to the AdvanTex Treatment System by The Municipality of Anchorage in 2002. Over 200 AdvanTex systems have been approved and installed in the City of Anchorage, primarily for nitrogen reduction. Contacts: Dan Roth, Anchorage Dept. of Health (907) 343-4761; Jeff Garness, PE, (907) 337-6179.

Arizona: Statewide approval was given to the AdvanTex Treatment System. About 350 AdvanTex Treatment Systems have been installed over the past four years, mostly due to nitrogen concerns. In Mohave County, the Total Nitrogen limit for effluent is typically 15 mg/L. Virtually every test taken at the installations in Mohave County have met this requirement. Commercial systems include a 20,000 gpd camp, a 1,350 gpd vet clinic, and a 3,000 gpd restaurant. Contact: Joelle Wirth, Coconino County, (928) 226-2770.

Arkansas: Statewide approval was given to the AdvanTex Treatment System. Approximately 70 residential and nine commercial systems have been installed in the state. Contact: Sam Dunn, Franklin County, (479) 667-2555.

California: AdvanTex has received various degrees of approval in numerous California counties. These counties include: Calaveras, Humboldt, Lake, Los Angeles, Marin, Mariposa, Mendocino, Nevada, Placer, Riverside, San Diego, Santa Barbara, Santa Cruz, Solano, Sonoma, Sutter, Tehama, Tuolumne, and Yuba. Three demonstration AdvanTex systems were monitored in a research program at the University of California at Davis, under the direction of Dr. George Tchobanoglous. This research produced a report titled "Evaluation of Textile Filters for the Treatment of Septic Tank Effluent." Installed in June of 1999, these three units consistently produced excellent results. Contact: George Tchobanoglous,
(530) 756-5747.

Colorado: Statewide approval was given to the AdvanTex Treatment System on 7/3/2001. Approximately 100 residential and 15 commercial AdvanTex systems have been installed over the past four years, primarily because of nitrogen limitations. Contact: Roger Shafer, PE, (303) 838-0611.

Florida: Statewide approval was given to the AdvanTex Treatment System on 12/18/2003. Contact: Paul Booher, Florida Department of Health, (352) 955-2159.

Georgia: Statewide approval was given to the AdvanTex Treatment System on 5/20/2003. Contact: Scott Ulich, Georgia Department of Human Resources, Division of Public Health, (404) 657-6534.

Hawaii: Statewide approval was given to the AdvanTex Treatment System on 9/11/2003. Contact: Harold Yee, Hawaii Department of Health, (808) 586-4294.

Idaho: Statewide approval was given to the AdvanTex Treatment System. Contact: AJ Maupin, Idaho Department of Environmental Quality, (208) 373-0140.

Illinois: Statewide approval has been given to the AdvanTex Treatment System 4/13/2004. Contact: Charlie Ray, Orenco Systems, Inc., (260) 637-9443.

Indiana: AdvanTex is approved as an experimental system. Contact: Charlie Ray, Orenco Systems, Inc., (260) 637-9443.

Iowa: Statewide approval has been given to the AdvanTex Treatment System. Contact: Justin Volrath, Volrath Sales, (515) 251-8926.

Kansas: AdvanTex is currently being installed in various counties on a case-by-case basis. Contact: Darren Simme, Orenco Systems, Inc, (800) 348-9843.

Louisiana: Statewide approval was given to the AdvanTex Treatment System on 5/23/2003. Douglas Vincent, Louisiana Office of Public Health, (225) 765-5040.

Massachusetts: Provisional approval was given to the AdvanTex Treatment System based on its ability to reduce Total Nitrogen on 9/19/2005. General approval was given to the AdvanTex Treatment System based on BOD and TSS reduction on 10/19/2004. Remedial approval was given to the AdvanTex Treatment System on 1/30/2003. Contact: Steve Corr, Innovative/Alternative Systems Program Director, (617) 292-5920.

Michigan: AdvanTex has received various degrees of approval in thirty-two Michigan counties. Contact: Mike Volrath, Volrath Sales, (515) 250-4618.

Minnesota: AdvanTex is approved on a county-by-county basis. Several AdvanTex Treatment Systems have been installed. Contact: John Walsh, designer/contractor and AdvanTex Dealer, 218-476-2201 or 218-390-7453.

Missouri: Experimental approval was given to the AdvanTex Treatment System. Several large commercial AdvanTex systems and approximately 80 residential systems have been installed in the state. Contact: Justin Volrath, Volrath Sales, (515) 249-4616; Leland Nehr, Missouri Department of Natural Resources, (573) 751-1300.

Mississippi: Statewide approval was given to the AdvanTex Treatment System 12/16/2003. Ralph Turnbo, Mississippi State Department of Health, (601) 576-7695.

Montana: AdvanTex is approved as a Nitrogen Reducing System 8/4/2004. Eight AdvanTex systems have been installed around Flathead Lake because of nitrogen contamination of the lake. Contact: Terry Murphy, Lake County, (406) 883-7236.

Nevada: Statewide approval was given to the AdvanTex Treatment System 09/19/2003. Contact: Norm Downey, Jensen Precast, (800) 648-1134, ext. 350.

New Hampshire: Statewide approval was given to the AdvanTex Treatment System 10/29/2001 with a 50% drainfield reduction. Contact: Dave Cotton, (802) 869-3432.

New Jersey: AdvanTex is allowed to be installed under state regulations. Contact: Ted Mott, Cupshaw Septic, (201) 280-3449

New Mexico: Statewide approval was given to the AdvanTex Treatment System 6/12/2001. About five AdvanTex Treatment Systems have been installed over the past three years, many for nitrogen reduction. Contact: Gene Bassett, (505) 281-3155.

North Carolina: AdvanTex was approved as an Innovative System on 4/6/2005. Over 50 residential AdvanTex Treatment Systems have been installed. Contact: Steve Berkowitz, North Carolina Department of Environmental Health, Environmental Engineer, (919) 715-3271.

Ohio: Statewide approval was given to the AdvanTex Treatment System on 6/4/2002. Part of an EPA demonstration project, the first AdvanTex Treatment System was installed in Clermont County in early 1999. Contact: Ralph Benson, Clermont County, (513) 732-7603.

Oregon: Statewide approval was given to the AdvanTex Treatment System on 6/17/2002. Several residential and commercial AdvanTex systems have been installed. Three of the residential systems are Oregon DEQ demonstration sites that are heavily monitored and tested. Commercial AdvanTex Treatment Systems include (1) a 3,000 gpd Forest Service Ranger Station, which replaced a conventional package treatment plant, (2) a convenience store with deli that had a failing drainfield, limited space, and groundwater near the surface, and (3) a 2,400 gpd resort with restaurant, situated along a pristine river. Contacts: Uri Papish, Oregon DEQ, (503) 229-5013; Steve Wert, Wert & Associates, (541) 617-9100; Terry Bounds, Orenco Systems, (800) 348-9843.

Pennsylvania: Experimental approval was given to AdvanTex. It is currently being tested through the states Technology Verification Testing Program. Contact: Ed Corriveau, Pennsylvania Department of Environmental Protection, (717) 705-4805.

Rhode Island: Statewide approval has been given to the AdvanTex Treatment System 1/8/2004. More than 80 AdvanTex Treatment Systems have been installed over the past four years, primarily because of nitrogen concerns. Most of these systems are part of State or EPA demonstration projects. Contact: George Loomis, University of Rhode Island, (401) 874-5950.

Texas: Statewide approval has been given to the AdvanTex Treatment System 8/1/2003. Contact: Colin Bishop, (409) 466-4644.

Vermont: Over 100 residential and commercial AdvanTex Systems have been installed over the past three years, including multiple units at the Mountain View Mobile Home Park. Commercial systems include an 18,000 gpd system installed at Marlboro College. Contact: Dave Cotton, (802) 869-3219.

Virginia: Provisional Approval has been given to AdvanTex Treatment Systems on 10/19/2001. Approximately 650 residential systems and 6 commercial systems have been installed. Contact: Don Alexander, Director Division of Onsite Sewage and Water, (804)-864-7452.

Washington: The AdvanTex AX20 has been accepted for inclusion on the approved list as a Category 1 Proprietary Packed Bed Filter (PBF) 5/2/2002. Over 300 residential systems have been installed so far. Contact: John Eliasson, Washington Department of Health, (360) 236-3041.

Wisconsin: Statewide approval was given to the AdvanTex Treatment System 8/14/2001. Over 75 AdvanTex Treatment Systems have been installed so far. Contact: Mark Prevost, (715) 552-1934.

Alberta, Canada: Approval has been given to AdvanTex Treatment Systems installed under a variance. Over 230 residential units have been installed in the province so far. Contact: Bruce Silvester, (780) 464-7426.

ADVANTEX® TREATMENT SYSTEMS

Certificate of Completion

Authorized Installer

Name: AdvanTex® Installer

Company Name

Jurisdictions

has completed training in the proper siting, installation, start-up, and documentation procedures for AdvanTex Treatment Systems, manufactured by Orenco Systems®, Inc., for the jurisdictions listed above. As such, he/she is recognized as an Authorized AdvanTex Installer by Orenco Systems, Inc. and by Orenco's Authorized AdvanTex Treatment System Dealers, as of the date below, for those jurisdictions. Continued recognition as an Authorized AdvanTex Installer in those jurisdictions will require future training to update siting, installation, start-up, and documentation procedures.

Signature: Orenco Systems, Inc. Representative

Date

Name and Company Name: Orenco Systems, Inc. Representative

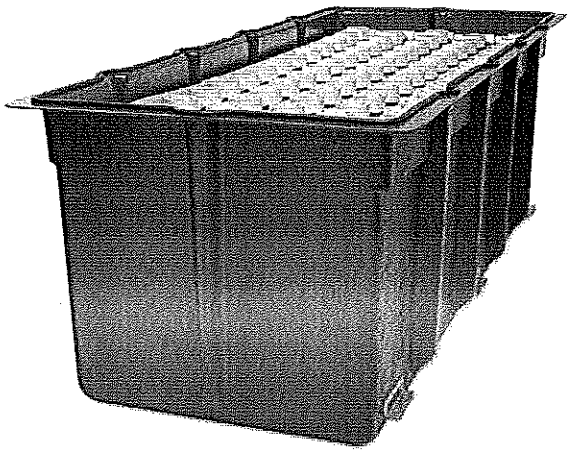
Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

800-348-9843
www.orenco.com

AdvanTex® Treatment System

For Residential Applications
3-Year Limited Warranty



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.orenco.com

W A R R A N T Y

Commitment to Quality

Since 1981, Orenco Systems®, Incorporated (hereinafter referred to as Orenco) has been known as a company that researches, designs, manufactures, and sells high-quality products. We see ourselves as more than a "business." We see ourselves as a company that makes the planet a cleaner, healthier place, a company that is *Changing the Way the World Does Wastewater®*.

Any wastewater treatment system can be affected by improper design, installation, lack of maintenance, or system abuse. Although our components are carefully designed and constructed, it's still important to pay strict attention to system design and installation instructions and to follow through with intelligent usage (see *Homeowner's Manual*) and regular maintenance.

Warranty Coverage

Orenco warrants all materials and workmanship of the AdvanTex® Treatment System to be free of defects for a period of three years from the date of installation in a residential application, as long as the System is continuously covered by a three-year service contract provided by an Orenco authorized service provider.

If Orenco determines that a component supplied by Orenco as part of the AdvanTex® Treatment System has failed because of a defect in workmanship or materials, then Orenco will replace or repair that failed component. If requested by Orenco, the defective components must be returned to Orenco's Sutherlin facility through an authorized AdvanTex® Dealer, transportation prepaid. Repaired or replaced components shall be shipped FOB from Orenco's Sutherlin, Oregon plant or Dealer's site.

Obtaining Warranty Service

To make a claim under this warranty, put your claim in writing and mail or deliver it to your authorized Orenco AdvanTex® Treatment System Dealer. Your Dealer will process your claim. If for some reason your Dealer is unavailable, mail your claim to the following address:

Sales Manager
Orenco Systems, Incorporated
814 Airway Avenue
Sutherlin, OR 97479

Any warranty claim must be received no later than three years from the date of installation of the AdvanTex® Treatment System.

Exclusions and Limitations

Repair or replacement of the defective component (at Orenco's discretion) as provided under this warranty shall be the exclusive remedy of the System owner. Orenco shall not be liable for any incidental or consequential damage for breach of any express or implied warranty on any component of the AdvanTex® Treatment System. This warranty is void if the System is not continuously covered by a three-year service contract provided by an Orenco authorized service provider.

This warranty does not cover cosmetic damage or damage due to acts of Nature, misuse, abuse, modification, incorrect design or incorrect installation. This warranty is void if the System owner fails to comply with any required System maintenance, or if any person who is not an Orenco authorized service provider performs any service on the System. It is also void if any System components are altered or replaced by parts not supplied or approved by Orenco, including, but not limited to, attachment of any water softener brine discharge into the treatment system. This warranty does not apply to commercial applications.

In no event shall the liability of Orenco under this warranty exceed the total invoiced price, excluding installation costs, of the AdvanTex® Treatment System to the customer.

Entire Agreement Amendment

This agreement constitutes the entire warranty agreement between the parties hereto with respect to the AdvanTex® Treatment System warranty. It cannot be changed or modified except by written agreement executed by both parties. Jurisdictional permitting or legal compliance may require maintenance or servicing of AdvanTex® Treatment Systems. In such cases, the terms of service or maintenance contracts shall be independent of this warranty except for defects in materials and workmanship as provided for under the terms of this warranty. The system owner does not need to return a warranty card of any kind. Sales information is permanently archived by the authorized AdvanTex® Dealer.

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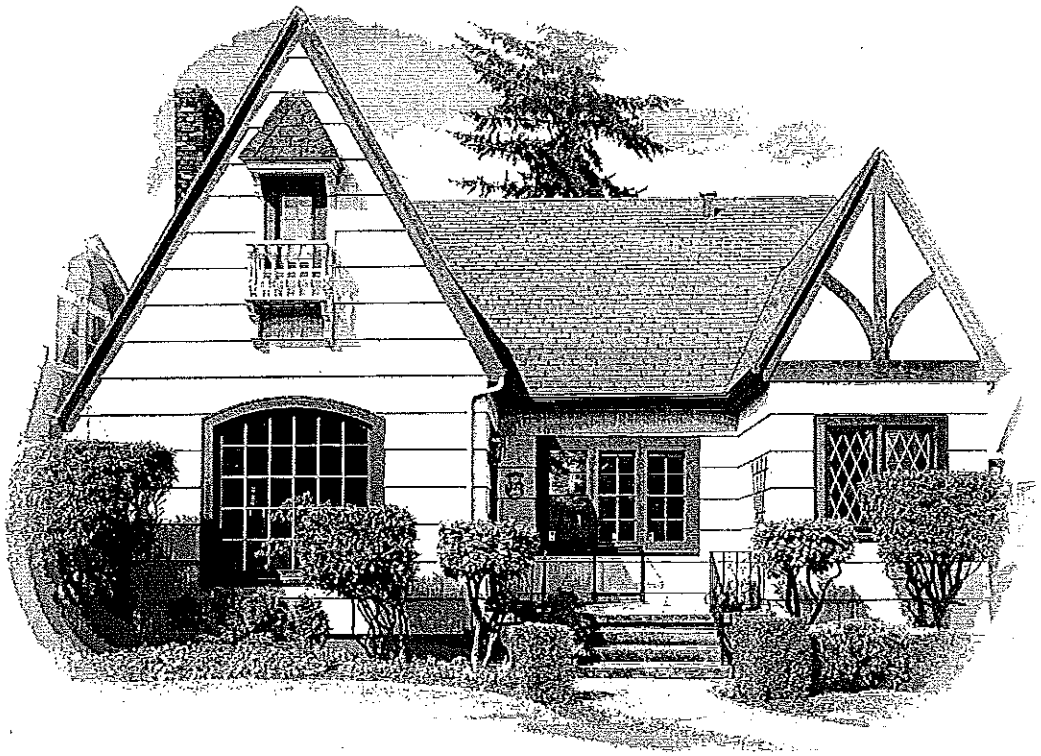
Orenco Systems®, Inc.

HOMEOWNER'S MANUAL

Onsite Wastewater Collection & Treatment Systems



Preventive Maintenance for

Homes with Onsite Wastewater

Collection and Treatment

Systems

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

800-348-9843
www.orenco.com

Congratulations!

Your home includes reliable, carefully engineered equipment – manufactured by Orenco Systems®, Inc. – for the collection and/or treatment of household wastewater.

When properly designed and installed, onsite wastewater treatment does a terrific job of decomposing household waste and recycling precious water resources. Our systems frequently outperform municipal sewage treatment plants. And the treated effluent is often returned harmlessly to the soil, where it receives final polishing and filtration for groundwater recharge. There's no degrading of our nation's rivers and oceans . . . which is so often the case with municipal sewage.

As with any engineered system, such as your car or your heat pump, your onsite wastewater system will work better and last longer if it is regularly maintained by a qualified service provider. Your service provider should be present during installation, so he or she is familiar with your system, especially those service lines, conduits, and connections that get buried. And your service provider should have a copy of this manual. (Call 1-800-348-9843 and we'll send you another.)

Your system will also work better and last longer if you learn what can go into it – and what can not. Little effort is required. Just read and practice the "do's and don'ts" that follow. Every member of your household should be familiar with these. And if you have guests who want to "help out in the kitchen," be sure to tell them, too. With this preventive maintenance, along with periodic inspections, your onsite wastewater system should function for decades. And you'll save water and energy, too!

There's a place on the back of this Homeowner's Manual to record "Important System Facts." If those have not been filled in for you, please record those now, before you file this Manual away. And give a copy of these facts to your service provider, especially if your service provider changes. You'll be glad you did.

Preventive Maintenance for Homes with Onsite Wastewater Collection and Treatment Systems

DO'S AND DON'TS FOR INSIDE THE HOUSE

There are a numbe of do's and don'ts that will help ensure a long life and minimal maintenance for your system. As a general rule, nothing should be disposed into any wastewater syste that hasn't first been ingested, other than toilet tissue, mild deter gents, and wash water. Here are some additional guidelines.

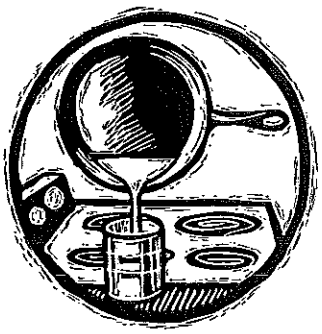
DON'T flush dangerous and damaging substances into your wastewater treatment system. (Please refer to the "Substitutes for Household Hazardous Waste," on page 4) Specifically, do not flush . . .

- Pharmaceuticals
- Excessive amounts of bath or body oils
- Water softener backwash
- Flammable or toxic products
- Household cleaners, especially floor wax and rug cleaners
- Chlorine bleach, chlorides, and pool or spa products
- Pesticides, herbicides, or agricultural chemicals or fertilizers

DON'T use special additives that are touted to enhance the performance of your tank or system. Additives can cause major damage to your drainfield and other areas in the collection system. The natural microorganisms that grow in your system generate their own enzymes that are sufficient for breaking down and digesting nutrients in the wastewater.

DO use your trash can to dispose of substances that cause maintenance problems and/or increase the need for septage pumping. Dispose of the following with your trash:

- Egg shells, cantaloupe seeds, gum, coffee grounds, tea bags, chewing tobacco, cigarette butts
- Paper towels, newspapers, sanitary napkins, diapers, kitty litter, candy wrappers
- Cooking grease
- Rags, large amounts of hair



DO collect grease in a container and dispose with your trash. And avoid using garbage disposals excessively. Compost scraps or dispose with your trash, also. Food byproducts accelerate the need for septage pumping and increase maintenance.

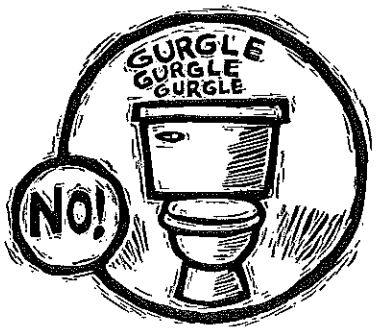
DO'S AND DON'TS FOR INSIDE THE HOUSE

DON'T leave interior faucets on to protect water lines during cold spells. A running faucet can easily increase your wastewater flow by 1,000 to 3,000 gallons per day and hydraulically overload your system. Instead, properly insulate or heat your faucets and plumbing.

DON'T use excessive amounts of water. Using 50 gallons per person per day is typical. If your household does not practice any of the "water conserving tips" below, you may be using too much water.

DO conserve water:

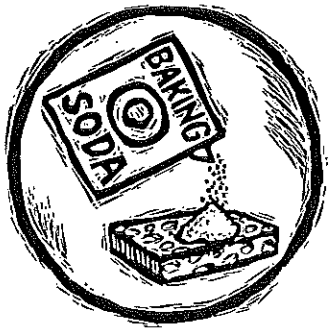
- Take shorter showers or baths with a partially filled tub. Be cautious about excessive use of large soaking tubs.
- Don't let water run unnecessarily while brushing teeth or washing hands, food, dishes, etc.
- Wash dishes and clothes when you have a full load.
- When possible, avoid doing several loads in one day.
- Use water saving devices on faucets and showerheads.
- When replacing old toilets, buy low-flush models.



DON'T ignore leaky plumbing fixtures; repair them. A leaky toilet can waste up to 2,000 gallons of water in a single day. That's 10-20 times more water than a household's typical daily usage. Leaky plumbing fixtures increase your water bill, waste natural resources, and overload your system.

DO keep lint out of your wastewater treatment system by cleaning the lint filters on your washing machine and dryer before every load. Installing a supplemental lint filter on your washing machine would be a good precautionary measure. (This normally takes just a few minutes. Lint and other such materials can make an extreme difference in the frequency and cost of pumping out your primary treatment tank.)

DO'S AND DON'TS FOR INSIDE THE HOUSE



DO use substitutes for household hazardous waste. Replace the following hazardous products with products that are less environmentally harmful. The hazardous cleaners are listed below, followed by the suggested substitute.

Ammonia-based cleaners: Sprinkle baking soda on a damp sponge. For windows, use a solution of 2 tbs. white vinegar to 1 qt. water. Place the mixture into a spray bottle.

Disinfectants: Use borax: 1/2 cup in a gallon of water; deodorizes also.

Drain decloggers: Use a plunger or metal snake, or remove and clean trap.

Scouring cleaners & powders: Sprinkle baking soda on a damp sponge or add 4 tbs. baking soda to 1 qt. warm water. Or use Bon Ami; it's cheaper and won't scratch.

Carpet/upholstery cleaners: Sprinkle dry cornstarch or baking soda on, then vacuum. For tougher stains, blot with white vinegar in soapy water.

Toilet cleaners: Sprinkle on baking soda or Bon Ami, then scrub with a toilet brush.

Furniture/floor polishes: To clean, use oil soap and warm water. Dry with soft cloth. Polish with 1 part lemon juice and 2 parts oil (any kind), or use natural products with lemon oil or beeswax in mineral oil.

Metal cleaners: Brass and copper: scrub with a used half of lemon dipped in salt. Stainless steel: use scouring pad and soapy water. Silver: rub gently with toothpaste and soft wet cloth.

Oven cleaners: Quickly sprinkle salt on drips, then scrub. Use baking soda and scouring pads on older spills.

Laundry detergents: Choose one with a zero phosphate content or use soap flakes with 1/3 cup of washing soda. (Before switching, wash clothes in pure washing soda to remove residues.)

DO'S AND DON'TS FOR OUTSIDE THE HOUSE

DON'T dig without knowing the location of your wastewater treatment system. As much as possible, plan landscaping and permanent outdoor structures before installation. But easily removable items, such as bird baths and picnic tables, are OK to place on top of your system.

DON'T drive over your tank or any buried components in your system, unless it's been equipped with a special traffic lid. If the system is subject to possible traffic, put up a barricade or a row of shrubs.

DON'T dump RV waste into your wastewater treatment system and tanks. It will increase the frequency of required septage pumping. When dumped directly into the pumping vault, RV waste clogs or fouls equipment, causing undue maintenance and repair costs. (Some RV waste may contain chemicals that are toxic or that may retard the biological digestion occurring within the tank.)

DON'T ever connect rain gutters or storm drains to the sewer or allow surface water to drain into it. And don't discharge hot tub water into your system. The additional water will increase costs, reduce the capacity of the collection and treatment systems, and flood the drainfield. It can also wash excess solids through the tank.

DO keep the tank access lid secure to the riser at all times. If bolts are lost or damaged, call Orenco Systems immediately for replacement: 1-800-348-9843.

DON'T enter your tank. Any work to the tank should be done from the outside. Gases that can be generated in the tank and/or oxygen depletion can be fatal.

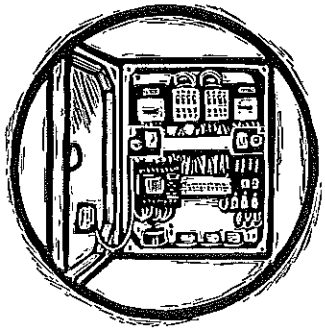
OUTSIDE THE HOUSE

DO make arrangements with a reliable service person to provide regular monitoring and maintenance. Place the service person's phone number on or in your control panel!

DO keep a file copy of your service provider's sludge and scum monitoring report and pumpout schedule. This information will be beneficial for real estate transactions or regulatory visits.

DO keep an "as built" system diagram in a safe place for reference.

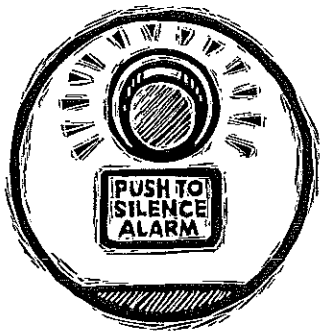
AT THE CONTROL PANEL



DO locate your electrical control panel where it will be protected from potential vandalism and have unobstructed access.

DO familiarize yourself with the location of your wastewater treatment system and electrical control panel. Refer to the panel's model number (on the back of this booklet) when reporting a malfunction in the system.

DO take immediate action to correct the problem in the event of an alarm condition. Call your system operator or maintenance company immediately whenever an alarm comes on; it sounds like a smoke alarm.



DO remember that the audible alarm can be silenced by pushing the lighted button located directly above the "Push to Silence" label on the front of the electrical control panel. With normal use, the tank has a reserve storage capacity good for 24-48 hours.

DON'T turn off the main circuit breaker to the wastewater pumps when going on vacation. If there is any infiltration or inflow into the system, the pumps will need to handle it.

Important! Caution!

Only a qualified electrician or authorized installer/operato should work on your control pane Before anyone does any work on either the wiring the level control floats and pumps in the vault or on the control panel itself, it is imperc tive to first switcl the isolation fuse/breaker and the circuit breake in the panel to th "Off" positions, then switch "Off" the power to the system at the ma breaker!

DO'S AND DON'TS FOR OUTSIDE THE HOUSE

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Service Contract (Sample)

Orenco Systems® Incorporated
1-800-348-9843

Parties:
(Contractor)

NAME _____
ADDRESS _____
CITY, STATE _____
ZIP CODE _____
TELEPHONE _____

And:
(Customer)

NAME _____
ADDRESS _____
CITY, STATE _____
ZIP CODE _____
TELEPHONE _____

Date: _____

NOW, THEREFORE, in consideration of the terms, provisions, covenants and conditions contained herein, the parties hereto agree as follows:

1.0 Performance of Services

1.1 The local AdvanTex® Treatment System Dealer, or an Operating and Maintenance agent of Dealer, shall perform the following services that are marked:

1. Monitoring _____
2. Periodic Maintenance and Testing _____
3. Reporting to _____ _____
4. Alarm Response Program _____

1.2 Standard Monitoring, Maintenance, Testing, and Reporting shall be performed during normal business hours Monday through Friday (excluding national holidays) on a pre-scheduled basis and as the local AdvanTex® Treatment System Dealer deems necessary or advisable. The Service Provider will affix a "For Service, Call _____" label near the control panel's failure signal and fill in his or her phone number. Each time the System is serviced, effluent quality will be evaluated in accordance with the instructions in the System's O&M Manual.

1.3 Performance of the periodic Monitoring, Testing, and Maintenance may include repair, replacement or addition of parts used in the system. The Operating and Maintenance agent of the local AdvanTex® Treatment System Dealer shall determine in its sole discretion the maintenance required to render the treatment system operational and in compliance with local effluent standards.

1.4 The local AdvanTex® Dealer or Dealer's agent may, but shall not be required to, provide services hereunder if the Customer:

1.4.1 makes alterations or modifications to the System, or
1.4.2 misuses the System, or
1.4.3 attaches devices to it not supplied by its original supplier, or
1.4.4 performs or attempts to perform any type of Maintenance services on the system or any portion thereof.

1.5 During the term hereof, Customer shall provide the Operating and Maintenance representative of the local AdvanTex® Dealer with access to the System. Access includes electrical controls & disconnects, and sufficient workspace to perform the necessary maintenance services.

2.0 Definitions

For purposes of this Agreement, the following definitions shall apply:

2.1 "Dealer" shall mean an Orenco AdvanTex® Treatment System Dealer.

2.2 "Periodic Monitoring" shall mean the collecting and processing of data by telemetry for operating parameters of the treatment system, including alarm notification.

2.3 "System" shall mean only AdvanTex® wastewater treatment system described on the attached Exhibit A.

2.4 "Periodic Testing and Maintenance" and "Testing" shall mean the testing and maintenance Services described in the AdvanTex® O & M Manual and on Exhibit B, attached hereto, and by this reference specifically made a part hereof to be performed by the local AdvanTex® Dealer or Dealer's agent on and with respect to the System.

2.5 "Reporting" shall mean preparing periodic data summary sheets or special reports for oversight agencies.

2.6 "Alarm Response Program" shall mean a program to allow AdvanTex® Dealer or his agent 24-hour access to monitoring database.

2.7 "Additional Services" shall mean any services provided by AdvanTex® Dealer or Dealer's agent to Customer in addition to Periodic Maintenance and Monitoring, Testing and Reporting as

required by any regulatory agencies. Additional Services shall also include any Services performed by AdvanTex® Dealer or Dealer's agent under the Alarm Response Program.

2.8 "Effective Date" shall mean the date of this Agreement as written above.

3.0 Term of Agreement

This Agreement shall be for the period of _____ months, unless otherwise terminated or canceled by either party as provided herein.

4.0 Charges

The charges which the Customer shall pay AdvanTex® Dealer or Dealer's agent for the performance of Services shall be as described in Schedule A. Dealer or Dealer's agent may increase all or any of the charges for those Services described in Schedule A by giving the Customer written notice at least thirty (30) days before each yearly anniversary of the Effective Date of this Agreement.

4.1 In addition to the charges set forth on Schedule A, Customer shall pay Dealer or Dealer's agent for all supplies and parts furnished by Orenco and utilized by Dealer in the performance of Services or Additional Services hereunder. The charges for such supplies and parts shall be at Orenco's list price at the time Dealer delivers such supplies and parts to the Customer.

4.2 All charges shall be due and payable within thirty (30) days of the Customer's receipt of Dealer's invoice. The Customer shall pay Dealer a late payment charge of 1.5% per month, or the maximum rate permitted by applicable law, whichever is less, on any unpaid amount for each calendar month or fraction thereof that any payment to Dealer is in arrears.

5.0 Certification of System

The Customer shall permit AdvanTex® Dealer or Dealer's agent to inspect the System to determine if it is in good working order. Based on such inspection, AdvanTex® Dealer or Dealer's agent may, in its sole discretion, either (i) require the Customer to perform such maintenance on the System as AdvanTex® Dealer or Dealer's agent may deem necessary, or (ii) perform such maintenance on the System itself. Any such maintenance services provided by Orenco under this Section 5 shall be billed by AdvanTex® Dealer or Dealer's agent to the Customer at AdvanTex® Dealer or Dealer's agent's standard rates for time, materials and travel.

6.0 Warranty

AdvanTex® Dealer warrants that all Services shall be performed in a good and workmanlike manner and that Dealer will correct any System errors, malfunctions, or defects directly caused by Dealer's failure to perform the Services and Additional Services in such manner. Neither Orenco or AdvanTex® Dealer warrant that the System will meet the Customer's needs or be free of failure, errors, malfunctions or defects or that the Customer's use of the System will be uninterrupted. Nor does Orenco or AdvanTex® Dealer make any warranty that the AdvanTex® Treatment Systems will meet any new or pending effluent standard levels which may emerge as a result of new or more demanding requirements for any component of the discharged

wastewater. Except and to the extent expressly provided otherwise in this Agreement, and in lieu of all other warranties, there are no warranties of any kind, either expressed, implied or statutory, including but not limited to warranties of quality, performance, non-infringement, merchantability or fitness for a particular purpose, nor are there any warranties created by course of dealing, course of performance or trade usage. The foregoing exclusions and disclaimers are an essential part of this Agreement.

7.0 Limitation of Liability

The sole liability of AdvanTex® Dealer under this agreement shall be to correct any errors, malfunctions or defects in the system directly caused by AdvanTex® Dealer's failure to perform any services in a good and workmanlike manner pursuant to Section 6 above; provided, however, in no event shall AdvanTex® Dealer's liability to the Customer hereunder exceed the total of the amounts paid to AdvanTex® Dealer hereunder by the Customer. In no event shall AdvanTex® Dealer be liable to the Customer or any third-party claimant for any indirect, special, punitive, consequential or incidental damages or lost profits arising out of or related to this Agreement or the performance or breach thereof, whether based upon a claim or action of contract, warranty, negligence or strict liability or other tort, breach of any statutory duty, indemnity, or contribution or otherwise, even if Dealer has been advised of the possibility of such damages.

8.0 Indemnity

The Customer agrees to indemnify and hold Orenco and AdvanTex® Dealer free and harmless from and against any and all claims, demands, liabilities, actions, losses, and damages of whatsoever kind or nature arising out of or relating to Dealer's performance of services or additional Services under this Agreement.

9.0 Termination/Cancellation

9.1 This Agreement may be terminated or cancelled in the following circumstances:

9.1.1 By either party at any time and for any or no reason upon ten (10) days prior notice from one party to the other.

9.1.2 Upon written notice by one party effective as of the effective date thereof if the other party is in default of any provision of this Agreement and such default is not cured by the defaulting party within fifteen (15) days after the effective date of said notice from the non-defaulting party.

9.1.3 Upon written notice by one party effective as of the date of the voluntary filing by the other party or, if not dismissed within ninety (90) days, the filing against the other party, of a petition in bankruptcy or a petition for reorganization, any assignment by such other party for the benefit of creditors, the appointment of a receiver or a trustee for such other party, or the placement of such other party's assets in the hands of a trustee or receiver.

9.1.4 By AdvanTex® Dealer or Orenco immediately and without notice in the event that any permit, license or certificate required by law or regulation to be held by the Customer is for any reason denied, revoked, or not renewed.

9.1.5 Upon failure of the Customer to make any required renewal fee payment per conditions in the System Owner Agreement.

9.2 In the event of any termination or cancellation of this agreement by Orenco or the local AdvanTex® Dealer, Orenco shall have the right to:

a. Declare all amounts owed to Orenco or the local AdvanTex® Dealer to be immediately due and payable;
b. Enter the Customer's premises and repossess all materials, parts, and all other items owned by Orenco or the local AdvanTex® Dealer;
c. Cease performance of all services and additional services without liability to the Customer.

9.3 In the event of any termination or cancellation of this agreement by the Customer, the Customer shall have the right to:

a. Deny Orenco or the local AdvanTex® Dealer access to its premises and to the system, except that Orenco or the local Orenco Dealer shall have the right to enter the Customer's premises to repossess all materials, parts and other items owned by Orenco or the local AdvanTex® Dealer; and
b. Discontinue utilizing Orenco or the local AdvanTex® Dealer for the performance of services and additional services.

9.4 The foregoing rights and remedies shall be cumulative and in addition to all other rights and remedies provided a party at law or in equity.

10.0 Miscellaneous Provisions

10.1 This Agreement is personal in nature and may not be delegated, assigned or transferred by either party without the prior written consent of the other party.

10.2 This Agreement terminates and supersedes all other agreements between the parties and constitutes the entire understanding between them. This agreement cannot be changed, modified, or varied except by written instrument duly executed by both parties, except that Orenco or the local AdvanTex® Dealer may increase the charges for Services without execution of a written instrument as provided in Section 4.1 above.

10.3 The failure of either party to insist on strict performance of this agreement by the other shall not be construed as a waiver of the right to insist on such performance and no waiver by either party to any breach by the other of any provision hereof shall be deemed a waiver of any other prior or subsequent breach.

10.4 The laws of the State of _____ shall govern this Agreement.

10.5 If any suit or action is filed by any party to enforce this Agreement or otherwise with respect to the subject matter of this Agreement, the prevailing party shall be entitled to recover reasonable attorney fees incurred in preparation or in prosecution or defense of such suit or action as fixed by the trial court, and if any appeal is taken from the decision of the trial court, reasonable attorney fees as fixed by the appellate court.

10.6 This Agreement shall be binding upon and inure to the benefit of the successors and assigns of Orenco, the local AdvanTex® Dealer and Dealer's agents, and the Customer.

10.7 Time is of the essence for each and every provision of this Agreement.

10.8 The exhibits referenced in this Agreement are a part of this agreement as if fully set forth in this Agreement.

10.9 Any notice or other communication required or permitted to be given under this Agreement shall be in writing and shall be mailed by certified mail, return receipt requested, postage prepaid, addressed to the parties at the addresses shown on the first page of this Agreement. Any notice or other communication shall be deemed given at the expiration of the second day after the date of deposit in the United States mail. The addresses to which notice or other communications shall be mailed may be changed from time to time by giving written notice to the other party as provided in this Section 10.9.

	AdvanTex® Dealer	Customer(s)
Name:	_____	_____
Address:	_____	_____
	_____	_____
Telephone:	_____	_____
Facsimile:	_____	_____
e-mail:	_____	_____
By:	_____	_____
Its:	_____	_____

Exhibit A: Listed Products

AdvanTex® packages are listed below:

1. AdvanTex® AX Series Treatment Systems for single or multiple unit installations

2. AdvanTex® RX Series Treatment Systems for single or multiple unit installations

3. Other textile filter products that are developed in future to extend the AdvanTex® Treatment System product line.

Exhibit B: Testing, Maintenance, and "Additional Services"

Orenco requires periodic testing and maintenance of AdvanTex® Treatment Systems as described in the AdvanTex® O & M Manual.

Following is a list of any additional testing & maintenance activities required:

Following is a list of any special reporting requirements:

Part 2: AdvanTex® Dealer Policy Manual

Section 2-A: Business Relationship of Orenco and AdvanTex System Dealers

A. Business Vision

1. Orenco will manufacture and sell AdvanTex Treatment Systems through a network of Dealers. These Dealers will sell AdvanTex Treatment Systems directly to end-users, or Installers. Dealers will assume responsibility for insuring that the installation and maintenance is done to Orenco standards by Authorized Installers and/or Authorized Service Providers. The Dealer may also choose to become an Authorized Installer and/or Authorized Service Provider.

B. What is Different

1. AdvanTex Treatment Systems are unique proprietary products that provide very high levels of BOD, TSS, and nitrogen removal from wastewater in a compact unit. This allows onsite wastewater systems to be used in many new and retrofit situations where alternatives are not acceptable. Examples include regulatory requirements for better contaminant removal, soil with poor characteristics, or land area that is too small for alternatives.

2 Monitoring electronics can be built into every Treatment System by equipping the System with a VeriComm® Control Panel to enable key operating data to be transmitted via telephone line to the Dealer or an Authorized Service Provider.

3. AdvanTex Treatment Systems must be operated under an annual maintenance contract with the Dealer or Authorized Service Provider in order to keep the warranty active. This contract must cover the three-year warranty period.

C. The Business Model

1. Dealer Commitments as Orenco Dealers

   a. Work with legislators to gain approval for the AdvanTex Treatment Systems in designated state, county, or other political jurisdictions for regulation of wastewater treatment systems.
   b. Sell AdvanTex Treatment Systems to end-users or to Installers in Dealer's designated market territory.
   c. Install or oversee installation to ensure compliance with Orenco installation requirements. Take photographs and collect other appropriate evidence to document satisfactory installation as required in the installation instructions.
   d. Maintain file copies of required documents and photographs for each installed AdvanTex system.
   e. Obtain a signed maintenance agreement for every installation.
   f. Bill for and collect annual fees for contracted maintenance of AdvanTex Treatment Systems.
   g. Ensure that maintenance is done by an Orenco Authorized Service Provider for all systems under maintenance contracts, based on the terms of the annual maintenance agreements with Customers.
   h. Ensure a prompt response to every alarm notification from Orenco for AdvanTex installations that are under a monitoring and maintenance contract. Alarms will be sent to Dealer and/or Dealer's Service Provider by Orenco or Orenco's third party monitoring Service Provider.

i. Train Installers and Service Providers so they are qualified to install and/or maintain all systems in their area, based on the terms of the maintenance agreement in place.

2. Orenco Commitments to Our Dealers

a. Dealers will normally operate within a non-exclusive territory. Orenco does not plan or expect to establish additional Dealers within a Dealer's agreed upon territory but reserves the legal right to do so, at the sole discretion of Orenco. Any Dealer may sell into the geographic area of another Dealer. Under this agreement, every Dealer recognizes that Dealer's territory is nonexclusive, and that Orenco has the right to establish additional Dealers covering all or part of any Dealer's territory at the sole discretion of Orenco. Orenco will not expect or encourage Dealers to sell into other Dealers' Territories, but recognizes the right of Dealers to sell into other Dealers' Territories.
b. Orenco will prepare supporting documentation and presentations to gain regulatory support. These materials will be used by Orenco or by AdvanTex Dealers seeking regulatory approvals by state or local regulatory authorities.
c. Orenco will provide complete AdvanTex systems, ready for installation, delivered within 30 days anywhere in the USA.
d. Engineering support for the design of any AdvanTex Treatment System will be provided when needed. While most engineering support will be provided at no cost, Orenco reserves the right to charge the Dealer for engineering services as agreed to between Orenco and the Dealer before the work is started.
e. Training on, design, installation, and/or maintenance of AdvanTex Treatment Systems for Dealer's staff, Installers, and Service Providers in a Dealer's Territory may be provided by Orenco or by the Dealer. In either case, Orenco will develop, maintain, and provide the required training materials for Dealers, including manuals, presentations, handouts, videos, or other appropriate training materials. One full and updated set of training materials will be provided to each Dealer. Orenco reserves the right to charge a nominal fee to cover the costs of additional sets of training materials.
f. Initial training on maintenance of AdvanTex Treatment Systems for Dealers and/or their Service Provider will be provided at no cost to the Dealer or their Service Provider. Subsequent training sessions are subject to mutually agreed upon reimbursement of Orenco material, time, and travel costs.
g. Marketing support will be provided through technical publications, literature, and any other written materials needed by Dealers to support their business with their customers.
h. Orenco provides a three-year limited warranty on all AdvanTex systems. The three-year warranty requires the AdvanTex Treatment System to be covered by a maintenance contract.

D. Financial Expectations and Agreements

1. Revenue to Dealers

   a. Dealers will purchase AdvanTex Treatment Systems from Orenco at the agreed upon Dealer price. Dealers will sell these systems at the price appropriate to their market. Orenco will set an MSRP for guidance to Dealers in setting their selling prices.
   b. Dealers will collect annual monitoring and maintenance fees from each of their installations directly or through third parties. A portion of this fee will be paid to Orenco for the monitoring and alarm notification service Orenco will establish on treatment systems which are equipped with telemetry control panels, and for extension of AX series and RX series warranties.

2. Costs to AdvanTex Dealers

   a. AdvanTex Treatment Systems packages will be sold to all Dealers at a Dealer price, fob Orenco. Dealer is subject to payment terms covered in the Dealer Agreement.
   b. Replacement parts and other AdvanTex Treatment Systems components and accessories will be sold to Dealers under standard Orenco terms.
   c. Parts provided under our Orenco three-year warranty will be provided to Dealers under the terms of that warranty.
   d. A fixed annual monitoring and alarm notification fee per AdvanTex Treatment System equipped with monitoring telemetry and covered by a monitoring contract will be due and payable to Orenco annually within 30 days of the due date. In the event of nonpayment of the monitoring fee to Orenco, all monitoring shall be terminated, and any and all Orenco warranties shall become null and void.

Section 2-B: Dealer Oversight Requirements

A. Prior to final sale and installation of an AdvanTex system, the Dealer should ensure that the following actions have been completed:

1. Obtain a permit from the agency that regulates onsite wastewater installations and ensure that a copy of that permit is retained in Dealer's files.

2. Complete the System Questionnaire, before installation, and retain it in Dealer's files. (Document included in Appendix I.)

3. Obtain a signed System Owner Testing and Maintenance Agreement and retain it in Dealer's files. (Copy provided in Appendix II-A.)

4. Obtain a signed System Owner Monitoring Agreement for any AdvanTex Treatment System equipped with a VeriComm Panel. Retain a copy in Dealer's files and return original to Orenco at the address in Section 7 below. (Copy provided in Appendix II-B.)

5. Follow Orenco Installation Instructions per installation manuals and take and retain photographs and other documentary evidence that the system has been installed to meet Orenco Installation Instructions and requirements.

6. Have the End-User purchase a Service Contract from the Orenco Dealer's Service Provider and sign it. Services under this contract must be performed by the AdvanTex Dealer, or Authorized Service Provider. The Service Provider will perform sampling to monitor and maintain the system, any required testing of samples, and maintenance. Dealer will maintain testing, monitoring, and maintenance data and records for each system installed.

7. Send one copy of the System Owner Testing and Maintenance Agreement to: Systems Engineering, Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, OR 97479. The telephone number for questions or assistance is: 1-800-348-9843.

Section 2-C: Installation and Construction Requirements

A. General Conditions

1. As a condition of warranty, customers must adhere to Orenco's AdvanTex Treatment System Installation Instructions. The Installer is encouraged to provide photographs, copies of approval documents, and other appropriate documentation that those instructions have been followed. The Dealer will retain documentation returned by the Installer in Dealer files.

2. As soon as practicable before completion of construction, the permit holder (normally the Installer) for the system being installed shall be responsible for arranging a final joint inspection for the appropriate approval agency or agencies, the contractor, designer, and owner. During this inspection, all components, controls, monitoring apparatus, operation and maintenance procedures shall be reviewed and agreement reached on the completion and operation of the system.

B. Installation Instructions

1. The system shall be constructed in accordance with the approved plans and specifications. Prior to placing the new system into operation, the permit holder shall be responsible for arranging the opportunity for the appropriate approval agency or its designated agent and the vendor to verify the following:

   a. All individual treatment units, septic tanks, access covers, tank risers, dosing tanks, and the collection system were properly constructed, vented, and tested to ensure there is no leakage and/or groundwater or surface water infiltration;
   b. Each component of the system has been installed where designed on the approved plans and specifications;
   c. Dosing tank cycle controls, as well as alarm controls, have been properly installed, tested and calibrated, and are fully operational;
   d. All necessary plumbing and electrical permits have been obtained from the appropriate agency, and the components have been inspected and approved by the appropriate agent;
   e. All disposal fields have been installed within the approved area, at the proper depth, on natural contours, with minimal disturbance of vegetation, and at a grade not to exceed one inch;
   f. The drainfield area shall be permanently protected from vehicle traffic, compaction, surface water runoff, irrigation, and roof drains after the trenches are backfilled.

2. Where appropriate, the project engineer is encouraged to certify in writing that 1-a through 1-f have been accomplished. When a system is certified by a project engineer, a copy of that certification (accompanied by an as-built plan, photographs, or other evidence of satisfactory completion of the AdvanTex installation) shall be retained by the Dealer in Dealer's files.

3. Complete installation manuals are available. They include configuration options and photographs to assist Installers.

Section 2-D: Monitoring

A. Monitoring by Telemetry

Orenco Systems has developed VeriComm remote telemetry control panel products as an optional technology for all AdvanTex Treatment Systems. Remote telemetry monitors the operation of system components, such as the pumps, water levels, pumping cycle duration and frequency, and daily system flows.

The data is transmitted to a central server via the regular telephone located at the installed system site and data transmission is invisible to the site owner. The VeriComm Panel is equipped with software and hardware that allows it to connect to the central server. Data is transmitted at a time when the telephone is not likely to be used by the site owner. The data is processed and retained for use by the system owner and person or organization responsible for maintaining the treatment system under the maintenance contract. This monitoring is done through software and hardware services provided by Orenco.

Failure or deterioration of any system component triggers an alarm or a programmed corrective action by the VeriComm Panel. This alarm is communicated to the Dealer or Authorized Service Provider responsible for maintaining that particular system. The Service Provider will contact the site owner (if necessary) and arrange for a maintenance visit to the site at the earliest possible time to correct any system problems identified by the alarm, unless the programmed corrective action has resolved the problem.

B. Monitoring by Maintenance Visits

In addition to the monitoring by remote telemetry, there are several things that should be checked periodically, regardless of whether any alarm has been sounded. These items should be part of an annual inspection and maintenance visit. (See AdvanTex O&M Manual.) One copy of the maintenance checklist should be retained by Dealer.

Parameters that can or should be measured when appropriate to ensure that the wastewater treatment system is producing effluent to the required standards are also documented and discussed in the O&M Manual.

Section 2-E: Maintenance Schedule and Procedures

As a condition of warranty, Orenco requires regular annual inspection and maintenance of AdvanTex Treatment Systems. This service must be performed by a Service Provider who is qualified and approved by Orenco and the local AdvanTex Dealer.

As a result of the VeriComm telemetry monitoring capability Orenco has available for AdvanTex Treatment Systems, an alarm notification may be sent to the system Service Provider from systems equipped with VeriComm panels. It is also possible that monitoring data might indicate that there is a problem with an operating component of the treatment system. In either of these cases, the AdvanTex Dealer will ensure that a Service Provider conducts the necessary maintenance of the AdvanTex Treatment System. However, replacement of parts that are not under warranty shall be the responsibility of the owner of the treatment system.

Copies of inspection and maintenance reports, along with any additional documentation, must be retained by the Dealer. A Required Maintenance Checklist and sample reporting forms are provided in the AdvanTex O&M Manual. A sample "Service Contract" is provided in Appendix III.

Section 2-F: Testing

There are many parameters that can be tested to ensure that the AdvanTex Treatment System is operating efficiently and discharging effluent that fully meets the permit requirements. In the absence of any alarms or identified system problems, testing may be more limited.

The AdvanTex O&M Manual describes required and recommended tests and test procedures.

Appendix I: AdvanTex® Questionnaire

Project Name	Start-up Date		Orenco Contact	
Address	**City**	**State**	**Zip**	**County**

Contact Name	Phone/Fax/E-mail
Property Owner:	
Engineer/Designer:	
Service Provider:	
Installer/Company:	
Regulator/Dept:	
Distributor:	

Project Description

Number of bedrooms

Number of occupants

System age _____ yrs

Design Flow

☐ Single-family residence _____ gpd

☐ Multifamily residence _____ gpd

☐ Commercial _____ gpd

Tankage

Septic volume _____ gal

No. of tanks _____

Compartment ☐ Single ☐ Double

Recirc volume _____ gal

System Type

☐ AX10 ☐ AX20

System Mode ☐ A ☐ B

☐ 1 ☐ 2 ☐ 3 ☐ 4

Filter type _____

Media type _____ Size _____

Dispersal

☐ Drainfield _____ ft

☐ Other _____

Details _____

Discharge rate _____

Soil type _____

Please provide basic schematic drawing here *(Use reverse side if needed)*

Comments: _____

_____

Appendix II-A: AdvanTex® Treatment System Owner Testing and Maintenance Agreement

Acknowledgement of Understanding

I/we, as owners of an Orenco Systems®, Inc., AdvanTex Treatment System, understand that I/we have purchased from Orenco Dealer or Dealer's agent an onsite wastewater treatment system that uses proprietary advanced wastewater treatment technology. I/we agree to purchase and maintain a service contract for Testing and Maintenance of this system from our AdvanTex Dealer or from Dealer's agent.

This Testing and Maintenance contract will be for a period of not less than 3 and not more than 5 years at a cost of $_____per year, payable annually on or before _____or payable for the duration of the contract at the discounted cost of $ _____for the period from _____ to _____.

I/we also understand that I/we are obligated to disclose this information and this service contract requirement to subsequent property buyers. I/we also acknowledge that I/we have received a Homeowner's Manual (for preventative maintenance) and that I/we are obligated to pass this Homeowner's Manual on to subsequent property owners.

I/we also understand that this Testing and Maintenance contract must be maintained. Failure to pay any renewal fee within 30 days of the due date shall result in termination of all Maintenance of our AdvanTex Treatment System.

I/we also understand that failure to pay any renewal fee within 30 days of the due date will void the AdvanTex Treatment System warranty.

I/we also understand that failure to pay any renewal fee within 30 days of the due date shall render all Orenco warranties on any component of the AdvanTex Treatment System null and void.

Site Address _____
(Street/PO Box) (City) (State) (Zip Code)

_____ _____
(Printed Name) (Printed Name)

_____ _____
(Signature) (Signature)

_____ _____
(Date) (Date)

Appendix II-B: System Owner Monitoring Agreement
(For AdvanTex® Treatment Systems equipped with a VeriComm® Panel)

Acknowledgment of Understanding

I/we, as owners of an Orenco Systems®, Inc., AdvanTex Treatment System, understand that I/we have purchased from Orenco Dealer or Dealer's agent an onsite wastewater treatment system that uses proprietary advanced wastewater treatment technology and a VeriComm telemetry control panel. I/we agree to purchase and maintain a Monitoring contract for the monitoring of this system from Orenco.

This Monitoring contract will be for a period of not less than 3-years and not more than 5 years at a cost of _____ per year, payable annually on or before _____ or payable for the duration of the contract at the discounted cost of _____ for the 3-year period from _____ to _____, or _____ for the 5-year period from _____ to _____.

I/we also understand that I/we are obligated to disclose this information and this Monitoring contract requirement to subsequent property buyers. I/we also acknowledge that I/we have received a Homeowner' Manual (for preventative maintenance) and the I/we are obligated to pass this Homeowner's Manual on to subsequent property owners.

I/we also understand that this Monitoring contract must be maintained. Failure to pay any renewal fee within 30 days of the due date shall result in termination of all Monitoring by Orenco or its authorized monitoring Service Provider, and termination of regular maintenance of our AdvanTex Treatment System.

I/we also understand that failure to pay any renewal fee within 30 days of the due date shall render all Orenco warranties on any component of the AdvanTex Treatment System null and void.

Site Address _____
(Street/PO Box) (City) (State) (Zip Code)

_____	_____
(Printed Name)	(Printed Name)
_____	_____
(Signature)	(Signature)
_____	_____
(Date)	(Date)

Appendix III: Sample Service Contract

Parties:	NAME	_____
(Contractor)	ADDRESS	_____
	CITY, STATE	_____
	ZIP CODE	_____
	TELEPHONE	_____
And:		
(Customer)	NAME	_____
	ADDRESS	_____
	CITY, STATE	_____
	ZIP CODE	_____
	TELEPHONE	_____

Date: _____

NOW, THEREFORE, in consideration of the terms, provisions, covenants, and conditions contained herein, the Parties hereto agree as follows:

1.0 Performance of Services

1.1 The local AdvanTex Treatment System Dealer or an Orenco Authorized Service Provider shall perform the following services that are marked:

1. Monitoring _____
2. Periodic Maintenance and Testing _____
3. Reporting to _____ _____
4. Alarm Response Program _____

1.2 Standard Monitoring, Maintenance, Testing, and Reporting shall be performed during normal business hours Monday through Friday (excluding national holidays) on a prescheduled basis and as the local AdvanTex Treatment System Dealer deems necessary or advisable.

1.3 Performance of the periodic Monitoring, Testing, and Maintenance may include repair, replacement or addition of parts used in the system. The Authorized Service Provider shall determine in its sole discretion the maintenance required to render the treatment system operational and in compliance with local effluent standards.

1.4 The local AdvanTex Dealer or Dealer's agent may, but shall not be required to, provide services hereunder if the Customer:

1.4.1 makes alterations or modifications to the System, or
1.4.2 misuses the System, or
1.4.3 attaches devices to it not supplied by its original supplier, or
1.4.4 performs or attempts to perform any type of Maintenance services on the system or any portion thereof.

1.5 During the term hereof, Customer shall provide the Operating and Maintenance representative of the local AdvanTex Dealer with access to the System. Access includes electrical controls and disconnects, and sufficient workspace to perform the necessary maintenance services.

2.0 Definitions

For purposes of this Agreement, the following definitions shall apply:

2.1 "Dealer" shall mean an Orenco AdvanTex Treatment System Dealer.

2.2 "Customer" shall mean the owner of the installed AdvanTex Treatment System.

2.3 "Party" shall mean AdvanTex Dealer or Dealer's agent or Customer and "Parties" shall mean AdvanTex Dealer or Dealer's agent and Customer.

2.4 "Periodic Monitoring" shall mean the collecting and processing of data by telemetry for operating parameters of the treatment system, including alarm notification.

2.5 "System" shall mean only AdvanTex wastewater treatment system described on the attached Exhibit A.

2.6 "Periodic Testing and Maintenance" and "Testing" shall mean the testing and maintenance Services described in the AdvanTex O&M Manual and on Exhibit B, attached hereto, and by this reference specifically made a part hereof to be performed by the local AdvanTex Dealer or Dealer's agent on and with respect to the System.

2.7 "Reporting" shall mean preparing periodic data summary sheets or special reports for oversight agencies.

2.8 "Alarm Response Program" shall mean a program to allow AdvanTex Dealer or his agent 24-hour access to monitoring database.

2.9 "Additional Services" shall mean any services provided by AdvanTex Dealer or Dealer's agent to Customer in addition to Periodic Maintenance and Monitoring, Testing and Reporting as required by any regulatory agencies. Additional Services shall also include any Services performed by AdvanTex Dealer or Dealer's agent under the Alarm Response Program.

2.10 "Effective Date" shall mean the date of this Agreement as written above.

3.0 Term of Agreement

This Agreement shall be for the period of _____ months, unless otherwise terminated or canceled by either Party as provided herein.

4.0 Charges

The charges which the Customer shall pay AdvanTex Dealer or Dealer's agent for the performance of Services shall be as described in Schedule A. Dealer or Dealer's agent may increase all or any of the charges for those Services described in Schedule A by giving the Customer written notice at least thirty (30) days before each yearly anniversary of the Effective Date of this Agreement.

4.1 In addition to the charges set forth on Schedule A, Customer shall pay Dealer or Dealer's agent for all supplies and parts furnished by Orenco and utilized by Dealer in the performance of Services or Additional Services hereunder. The charges for such supplies and parts shall be at Orenco's list price at the time Dealer delivers such supplies and parts to the Customer.

4.2 All charges shall be due and payable within thirty (30) days of the Customer's receipt of Dealer's invoice. The Customer shall pay Dealer a late payment charge of 1.5% per month, or the maximum rate permitted by applicable law, whichever is less, on any unpaid amount for each calendar month or fraction thereof that any payment to Dealer is in arrears.

5.0 Certification of System

The Customer shall permit AdvanTex Dealer or Dealer's agent to inspect the System to determine if it is in good working order. Based on such inspection, AdvanTex Dealer or Dealer's agent may, in its sole discretion, either (i) require the Customer to perform such maintenance on the System as AdvanTex Dealer or Dealer's agent may deem necessary, or (ii) perform such maintenance on the System itself. Any such maintenance services provided by Orenco under this Section 5 shall be billed by AdvanTex Dealer or Dealer's agent to the Customer at AdvanTex Dealer or Dealer's agent's standard rates for time, materials and travel.

6.0 Warranty

AdvanTex Dealer warrants that all Services shall be performed in a good and workmanlike manner and that Dealer will correct any System errors, malfunctions, or defects directly caused by Dealer's failure to perform the Services and Additional Services in such manner. Neither Orenco or AdvanTex Dealer warrant that the System will meet the Customer's needs or be free of failure, errors, malfunctions or defects or that the Customer's use of the System will be uninterrupted. Nor does Orenco or AdvanTex Dealer make any warranty that the AdvanTex Treatment Systems will meet any new or pending effluent standard levels which may emerge as a result of new or more demanding requirements for any component of the discharged wastewater. Except and to the extent expressly provided otherwise in this Agreement, and in lieu of all other warranties, there are no warranties of any kind, either express, implied or statutory, including but not limited to warranties of quality, performance, noninfringement, merchantability or fitness for a particular purpose, nor are there any warranties created by course

of dealing, course of performance or trade usage. The foregoing exclusions and disclaimers are an essential part of this Agreement.

7.0 Limitation of Liability

The sole liability of AdvanTex Dealer under this agreement shall be to correct any errors, malfunctions or defects in the system directly caused by AdvanTex Dealer's failure to perform any services in a good and workmanlike manner pursuant to Section 6 above; provided, however, in no event shall AdvanTex Dealer's liability to the Customer hereunder exceed the total of the amounts paid to AdvanTex Dealer hereunder by the Customer. In no event shall AdvanTex Dealer be liable to the Customer or any third-party claimant for any indirect, special, punitive, consequential or incidental damages or lost profits arising out of or related to this Agreement or the performance or breach thereof, whether based upon a claim or action of contract, warranty, negligence or strict liability or other tort, breach of any statutory duty, indemnity, or contribution or otherwise, even if Dealer has been advised of the possibility of such damages.

8.0 Indemnity

The Customer agrees to indemnify and hold Orenco and AdvanTex Dealer free and harmless from and against any and all claims, demands, liabilities, actions, losses, and damages of whatsoever kind or nature arising out of or relating to Dealer's performance of services or additional Services under this Agreement.

9.0 Termination/Cancellation

9.1 This Agreement may be terminated or canceled in the following circumstances:

9.1.1 By either Party at any time and for any or no reason upon ten (10) days prior notice from one Party to the other.

9.1.2 Upon written notice by one Party effective as of the effective date thereof if the other Party is in default of any provision of this Agreement and such default is not cured by the defaulting Party within fifteen (15) days after the effective date of said notice from the nondefaulting Party.

9.1.3 Upon written notice by one Party effective as of the date of the voluntary filing by the other Party or, if not dismissed within ninety (90) days, the filing against the other Party, of a petition in bankruptcy or a petition for reorganization, any assignment by such other Party for the benefit of creditors, the appointment of a receiver or a trustee for such other Party, or the placement of such other Party's assets in the hands of a trustee or receiver.

9.1.4 By AdvanTex Dealer or Orenco immediately and without notice in the event that any permit, license or certificate required by law or regulation to be held by the Customer is for any reason denied, revoked, or not renewed.

9.1.5 Upon failure of the Customer to make any required renewal fee payment per conditions in the System Owner Agreement.

9.2 In the event of any termination or cancellation of this agreement by Orenco or the local AdvanTex Dealer, Orenco shall have the right to:

9.2.1 Declare all amounts owed to Orenco or the local AdvanTex Dealer to be immediately due and payable;
9.2.2 Enter the Customer's premises and repossess all materials, parts, and all other items owned by Orenco or the local AdvanTex Dealer;
9.2.3 Cease performance of all services and additional services without liability to the Customer.

9.3 In the event of any termination or cancellation of this agreement by the Customer, the Customer shall have the right to:

9.3.1 Deny Orenco or the local AdvanTex Dealer access to its premises and to the system, except that Orenco or the local Orenco Dealer shall have the right to enter the Customer's premises to repossess all materials, parts and other items owned by Orenco or the local AdvanTex Dealer; and
9.3.2 Discontinue utilizing Orenco or the local AdvanTex Dealer for the performance of services and additional services.

9.4 The foregoing rights and remedies shall be cumulative and in addition to all other rights and remedies provided a Party at law or in equity.

10.0 Miscellaneous Provisions

10.1 This Agreement is personal in nature and may not be delegated, assigned or transferred by either Party without the prior written consent of the other Party.

10.2 This Agreement terminates and supersedes all other agreements between the Parties and constitutes the entire understanding between them. This agreement cannot be changed, modified, or varied except by written instrument duly executed by both Parties, except that Orenco or the local AdvanTex Dealer may increase the charges for Services without execution of a written instrument as provided in Section 4.1 above.

10.3 The failure of either Party to insist on strict performance of this agreement by the other shall not be construed as a waiver of the right to insist on such performance and no waiver by either Party to any breach by the other of any provision hereof shall be deemed a waiver of any other prior or subsequent breach.

10.4 The laws of the State of Oregon shall govern this Agreement.

10.5 If any suit or action is filed by any Party to enforce this Agreement or otherwise with respect to the subject matter of this Agreement, the prevailing Party shall be entitled to recover reasonable attorney fees incurred in preparation or in prosecution or defense of such suit or action as fixed by the trial court, and if any appeal is taken from the decision of the trial court, reasonable attorney fees as fixed by the appellate court.

10.6 This Agreement shall be binding upon and inure to the benefit of the successors and assigns of Orenco, the local AdvanTex Dealer and Dealer's agents, and the Customer.

10.7 Time is of the essence for each and every provision of this Agreement.

10.8 The exhibits referenced in this Agreement are a part of this agreement as if fully set forth in this Agreement.

10.9 Any notice or other communication required or permitted to be given under this Agreement shall be in writing and shall be mailed by certified mail, return receipt requested, postage prepaid, addressed to the Parties at the addresses shown on the first page of this Agreement. Any notice or other communication shall be deemed given at the expiration of the second day after the date of deposit in the United States mail. The addresses to which notice or other communications shall be mailed may be changed from time to time by giving written notice to the other Party as provided in this Section 10.9.

	AdvanTex Dealer	Customer(s)
Name:	_____	_____
Address:	_____	_____
	_____	_____
Telephone:	_____	_____
Facsimile:	_____	_____
e-mail:	_____	_____
By:	_____	_____
Its:	_____	_____

Appendix IV: Testing, Maintenance, and "Additional Services"

Orenco requires periodic testing and maintenance of AdvanTex Treatment Systems as described in the AdvanTex O&M Manual.

Following is a list of any additional Testing & Maintenance activities required:

Following is a list of any special reporting required:

Appendix V: Typical Fees for Maintenance Activities

Customer:

I. Maintenance and Servicing Minimum Requirements

	*Frequency	Number of Units	Cost per Unit	Total Unit Cost/Yr
A. Test pumps and alarms at each dosing tank		1	$11.00	
Record motor amps				
Record elapsed time meters and event counters				
Activate all alarm floats				
Inspect septic/dosing tank pump screens				
B. Maintain gravel filter		1	$78.00	
Inspect/clean lateral orifices				
Inspect/clean hydrosplitter				
Inspect/clean gravel surface				
C. Inspect drainfield surface		1	$4.00	
Visually inspect surface				
D. Inspect recirculation ball valve		1	$2.00	
Assure cage is secure				
Assure buoy is inflated				
E. Inspect Biotube® filters in recirc. tanks w/EFL-18.33, w/o				

EFI-41.25		1	$18.00	
Clean as needed				
F. Inspect Filter Media		1	$0.00	
Check under several orifices for organic build-up				
G. Inspect floats in recirculation and drainfield dose tanks		1	$4.00	
Check floats for proper operation				
H. Sample System for testing		1	$77.00	
Take physical samples				
Travel costs for (_____) miles, round trip				
I. Measure sludge/scum accumulation in recirculating tank		1	$60.00	
Recommend tank pumping when necessary				
Submit required WPCF permit reports to DEQ (copy to customer)				
Total for Maintenance & Servicing		1		

II. Monitoring & Reporting Minimun Requirements

A. Perform the required WPCF permit lab tests	*Frequency	Number of Units	Cost per Unit	Total Unit Cost/Yr
Biochemical Oxygen Demand		1	$31.00	
Total Suspended Solids		1	$15.00	
Total Kjeldahl Nitrogen		1	$23.00	
Ammonia, Nitrogen		1	$23.00	
Nitrate, Nitrogen		1	$26.00	
Nitrite, Nitrogen		1	$26.00	
Grease and Oils		1	$38.00	
Total for Monitoring & Reporting				
Total for Maintenance & Servicing				

Yearly Total		
Your Monthly Payment		
* A=Annually Q=Quarterly S=Semiannually M=Monthly		

Appendix VI: Orenco Expectations of Partners

Document	Dealer Retain	Orenco Retain	Designer Retain	Installer Retain	Service Provider Retain	Homeowner Retain
Dealer Agreement	original	original				
Acknowledgment of Understanding (Dealer Agreement: Appendix II-B)	original					original
Bill of Sale(s) w/Serial #	original A			original B (if applicable)		copy
3-Year Service Contract	copy				original	copy
Warranty	1 reference copy	original return card				original
Homeowner's Manual	Fill in contact #'s on back page; make 3 copies; retain 1 copy			1 reference copy plus copy of each back page	1 reference copy plus copy of each back page	original
Homeowner's Manual Supplement[2]	1 reference copy[2]			1 reference copy[2]	1 reference copy[2]	original[2]
Project Info (formerly AdvanTex Questionnaire)	online					
Installation Guide	1 reference copy			original	1 reference copy	original[2]
Installation Photographs	online copies (optional)			originals		
O&M Manual	1 reference copy			1 reference copy	1 reference copy	original
Maint. Visit Checklist, Field Reports	copies[1]				original[1]	
Maintenance Test Data	online copies[1] (optional)	demo site data only			original[1]	
Customer Notification of Problems Requiring Subsequent Service Call[2]					copy[2]	original[2]
Authorized Installer Certificate	copy			original		
Authorized Service Provider Certificate	copy				original	
Certified Designer Certificate[3]	copy		original			
NSF Certification Policies for[2] Wastewater Devices	original	original				
	original	original				

AdvanTex® FAQ

Orenco Systems® Incorporated
1-800-348-9843

Q. Since one of your AdvanTex models received NSF approval under the NSF/ANSI Standard 40 testing protocol (which is primarily used for aerobic treatment units), does that mean your product is an ATU?

A. Not in the way the term "ATU" is currently understood. ATU is an acronym for "Aerobic Treatment Unit," but it has evolved into industry shorthand for technologies that use a "suspended growth" treatment process. (This process involves pumping air into a liquid medium, where waste-eating microbes are grown, "suspended" in the liquid). By contrast, AdvanTex Treatment Systems are packed bed filters that use an "attached growth" treatment process. (Attached growth uses physical filtration devices on which waste-eating microbes are grown.)

Since both these treatment processes use oxygen, technically they are both Aerobic Treatment Processes; the differences in performance, however, are significant. Suspended growth processes in residential applications are typically on-demand, gravity-discharge and rely solely on complete mixing and the biochemistry of aeration to treat waste. Any disruption of this delicate biochemical process (peak loads, power outages) can cause untreated waste to gravity right through the unit and into the drainfield.

In contrast, attached growth packed bed filters like AdvanTex are typically time-dosed, pump discharge and use both biochemical AND physical removal treatment processes. So they can handle peak loads reliably and no untreated waste is bypassed under any circumstances. Attached growth packed bed filters have other benefits as well: quick start-ups, low O&M costs, and low power consumption.

Q. Are your AdvanTex textile filters a new technology?

A. Yes, but the textile filter treatment process is based on a proven technology: packed bed filters. At the end of this section, we've included a chapter on "Intermittent and Recirculating Packed Bed Filters" from the definitive textbook on decentralized waster water treatment: *Small and Decentralized Wastewater Management Systems* (Crites and Tchobanoglous, 1998). In that chapter, on page 714, there is a brief summary of the history of packed bed filters: "Early Development and History of Use." We've also included an article that discusses the use of textile media in wastewater treatment: "Performance of Packed Bed Filters," (T. Bounds, E. Ball, H. Ball, 2000). Additional documentation can be provided at your request.

Q. How can you take a 360-square-foot packed bed filter, like a sand or gravel filter, and compress it into just 10 to 30-square-feet?

A. Because of the increased surface area of the textile media, combined with its large void spaces and its water holding capacity. This is a treatment process based on sound science, incorporating fundamental principles of physics (mass loading), chemistry, and biology.

Q. Why does textile have such a bigger surface area and void space than sand or gravel?

A. Because the textile media is fibrous, not solid. With a solid grain of sand or gravel, only the outside surface area is available for the attachment of bacteria. With textile, the surface area around each and every fiber is also available. As a result, the surface area is more than 5 times greater than that of sand media.

Q. According to your research, you're loading your textile filters as high as 60 gpd / ft^2. That's much, much higher than the typical loading rates for intermittent sand filters (1.25 gpd / ft^2) and recirculating sand filters (5 gpd / ft^2). How can you do that?

A. There are a number of reasons why. The **first** reason is the larger surface area of the textile media, as noted in the previous question. The larger surface area gives greater colonies of bacteria an interface for oxygen exchange.

The **second** reason is the greater void space in textile media, which is about 5 times greater than that of sand. Void space does two things; it allows for a free flow of oxygen and provides a larger void for solids accumulation. Free flow of oxygen combined with a large interface for oxygen transfer optimizes bacterial digestion. The SAR (Solids Accumulation Rate) is a measurement of how long a filter will last before it clogs with organic and inorganic particles, as well as grease and oil. The greater the SAR, the longer life a filter will have.

The **third** is the greater water holding capacity of the textile media. An increased water holding capacity equates to a more sustainable environment for bacteria to live in. A poor water holding capacity creates an environment where bacteria dry out and sloughing can occur. Finally, water-holding capacity is important, because high water-holding capacity gives bacteria the time to digest organic waste. Textile media has about five times the water-holding capacity of sand.

It's important to note that these factors combine to allow substantial increases in loading rates. For example, one cubic foot of ISF sand media has about twice as much surface area as one cubic foot of RSF sand media. ISF sand media also has a better water holding capacity. However the loading rate of the RSF sand media is actually five times higher due to the greater void space. If we compare the sand medias, the ISF has more surface area and greater water holding capacity while the RSF has greater void spaces.

To conclude, textile media optimizes treatment with a large surface area, greater void space, and increased water holding capacity, which allows the combination of the best attributes of the ISF and the RSF into one compact, packed bed filter.

Q. How long will the media last?

A. The media should last indefinitely under normal domestic discharge conditions. The synthetic fibers are made of durable and biodegradation-resistant polymers.

Q. Will the media need to be discarded or replaced, and, if so, how frequently?

A. No. The media hang in aligned sheets. This style is built to accommodate solids accumulation, and, under normal conditions, should last indefinitely. It can be easily maintained by cleaning with a hose or pressure washer. We expect the nominal interval between cleanings to be several years, although, as with all biochemical processes, that will depend on the mass loading of the system. Also, the biomat that develops on the media is where treatment occurs, so excessive cleaning does not assure improved performance; maintenance should be done by a knowledgeable and qualified operator.

Q. Occasionally I see references to an "RX Series" textile filter. But most of your material discusses the "AX Series." What's the difference between the AX and the RX?

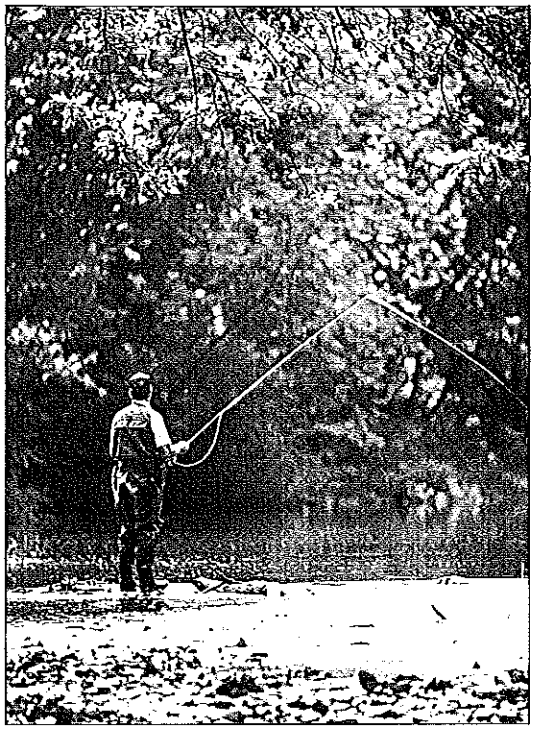
A. The AX Series uses aligned sheets of hanging textile material, while the RX Series – an earlier version of the product – uses random chips (aka "coupons") of textile material. The AX Series is a refinement of the technology and is the one we are now promoting except in regions that have approved the RX Series but have not yet approved the AX Series.

O R E N C O

CASESTUDY

Steamboat, Oregon:

AdvanTex® Treatment System Preserves Protected Waters



The wild and scenic waters around Steamboat, Oregon have become a hot spot for fly-fishermen from around the country. An Orenco AdvanTex® textile filter system at the Steamboat Ranger Station helps to ensure that the waters remain clean and clear for years to come.

The U.S. Forest Service and the Oregon Department of Transportation (ODOT) had a costly wastewater problem. Sewer lines in their 25-year-old treatment plant for the Steamboat Ranger Station were being infiltrated by groundwater, causing daily flows to exceed 18,000 gpd for what should have been, at peak flow, a 5,000 gpd compound.

In addition, the outdated plant was discharging directly into the wild and scenic waters of the North Umpqua River. Consequently, to meet NPDES permit requirements, the system carried a $25,000 annual maintenance contract — a significant financial burden.

Hoping to expand his capacity for housing visiting fly-fishermen during the busy summer months, Jim Van Loan, owner of the nearby Steamboat Inn, began discussions with the agencies about subleasing several houses on the Ranger Station site. Both agencies were interested, but the cost of operating the wastewater treatment plant made it difficult to justify the arrangement.

Van Loan had ten years of good experience with an Orenco-designed wastewater treatment system at the Inn. So he suggested bringing in Orenco Systems® to discuss the merits of a small effluent sewer for the Ranger Station, using a new, AdvanTex® textile filter system for treatment. After several years of planning, "We have a system in place that cost the state about $7,000 in operating expenses the first year, versus $25,000," explains Van Loan.

Because of the system's outstanding effluent quality (monthly BOD_5 and TSS tests have averaged 1.9 mg/L and 1.5 mg/L respectively), the DEQ approved a semiannual, instead of a monthly, testing procedure. As a result, annual operating costs have dropped to $1,455. Says Van Loan, "The capital costs will be paid for in five years."

Once the contractor was selected, all the construction was completed in only seven weeks. Very little disruption to the

(Continued on back)

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ground was required, as the small diameter main lines followed existing sewer line paths. And because of the extremely high quality of effluent being discharged, the DEQ allowed a 50% reduction in the dispersal area.

Since the system has been up and running, there have been no problems. Regular monitoring and maintenance have shown outstanding effluent quality; and an advanced remote telemetry control system monitors daily activity and reports servicing needs, any alarms, or any abnormalities that may occur. Moreover, for a week during the 2002 fire season, daily flows quadrupled and design flows were exceeded by 50-100% when hordes of firefighters were billeted at Steamboat. Nevertheless, an inspection showed no discernible decline in system performance or effluent quality.

Back in the thirties, Zane Grey walked the slippery slopes of the North Umpqua River in search of that perfect steelhead. Today, people come from all over during the summer months to tackle the 31 miles of "fly-fishing only" water. And thanks to the advanced treatment provided by the AdvanTex Treatment System, and the foresight of ODOT, the waters will continue to remain clean and clear, for generations of steelhead to come.

SUMMARY OF SPECIFICATIONS

Steamboat, Oregon Effluent Sewer and AdvanTex® Textile Filter System
Using Orenco Systems Equipment

Installation Date
June 1999

System Engineer
Terry Bounds, P.E., Orenco Systems, Inc.

Contractor
Greensun's Inc., Springfield, Oregon

Total Project Cost
$150,000 (collection and treatment)

Onsite Facilities
16 EDUs, mostly residential

Collection System
Each lot has 1" service lines
2" main lines

Tanks
1,500 gal concrete meander tanks with Biotube® pump vaults

Tanks were tested extensively for watertightness and structural integrity

Pumps
1/2 hp, 10 gpm turbine effluent pumps

Treatment System

Four AdvanTex-RX40 Textile Filters

Design Flows:	4,800 gpd
Average Flows:	2,400 gpd
Actual Average:	1,840 gpd
Peak Day:	7,400 gpd

Tanks
Two 1,500 gal concrete meander recirc. tanks

Tanks were tested extensively for watertightness and structural integrity

Pumps
Two 3/4 hp, 50 gpm turbine effluent pumps

Dispersal
960' of 18" x 36" pressurized drainfield with 60' of shallow gravelless drainfield

Two 3/4 hp, 50 gpm turbine effluent pumps

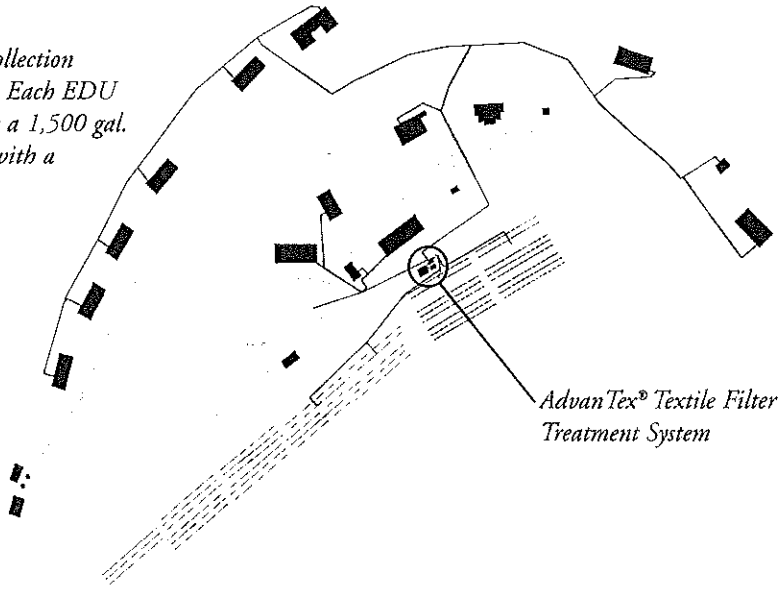
Operation/Maintenance
1 part-time operator for onsite facilities

Per DEQ: first year testing performed monthly. Subsequent years performed semiannually.

Performance

Test	Influent (mg/L)	Effluent (mg/L)
BOD5	150	1.9
TSS	17	1.5

This map shows the effluent collection system at Steamboat, Oregon. Each EDU (equivalent dwelling unit) has a 1,500 gal. concrete meander septic tank with a 1/2 hp pump.



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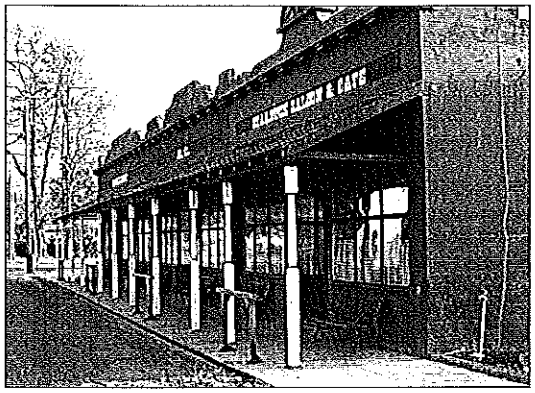
ACS-SL-6
Rev. 2.1, 10/02

O R E N C O

CASESTUDY

Starbuck, Washington:

Community Builds Own Effluent Sewer System, Cuts Cost in Half



The small Eastern Washington town of Starbuck (pop. 165) installed a low-cost, reliable effluent sewer system to serve the community, followed by an AdvanTex® Treatment System.

When the failing septic systems in Starbuck, Washington (pop. 165) threatened to pollute the groundwater and nearby Tucannon River, residents discovered they wouldn't be allowed to rehabilitate or replace them. Their lots didn't meet the state's current minimum size for onsite wastewater systems. But residents figured they couldn't afford a community wastewater system, especially when initial estimates came in at $1.8 million to construct and a monthly fee of $55-$65 per household.

Enter the Washington Department of Ecology's "self-help" program. If Starbuck could eliminate debt from the equation by supplementing grant money with citizen contributions of labor, the town could cut the monthly fee to less than $20. Residents embraced the concept, as well as one of its chief proponents, an engineering firm experienced in self-help projects for small communities. Loomis Austin Inc. had specified Orenco Systems equipment in Texas and knew that effluent sewers were relatively easy to install. Armed with plans for an affordable system from Loomis Austin and grant funding from the State and the US Forest Service, the townspeople took on the challenge of doing the installation themselves.

Loomis Austin recommended an Orenco Effluent Sewer and Orenco AdvanTex® Treatment System. On each property, a 1,500-gallon watertight tank with Biotube® effluent filter was installed, where solids are retained and treated. The filtered effluent from the tanks flows by gravity through small diameter collection lines (mostly 2" and 3") to an 8,000-gallon STEP pumping station, equipped with telemetry controls. The pumping station pumps to a 20,000 gpd AdvanTex® Treatment System (sixteen RX40 textile filters). After treatment, the effluent is so clean it's used to irrigate grazing lands via a drip irrigation system.

Carol Wildman, Starbuck's former clerk/treasurer, oversaw the self-help project. "People here can be stubborn," she said, "so we made hook-ups voluntary." Each household wanting a

(Continued on back)

"I've been in construction all my life and didn't know wastewater, but this is the simplest system to run. So user-friendly — better than Windows 98! And the people at Orenco couldn't have been more helpful. You guys do a great job."

Floyd Wildman
Operator
Starbuck, Washington

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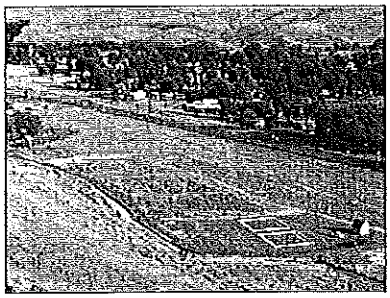
connection to the effluent sewer was expected to donate 80 hours of labor.

Some people laid pipe; others fed the work crews or babysat for crew members. Still others ran errands or did paperwork. Retirees found a new reason to get up in the morning. In the end, virtually everyone in town opted to hook up. After nine months, installation was complete and Starbuck had accomplished what amounted to a modern-day barn-raising on an amazing scale.



Aerial view of Starbuck, Washington and its AdvanTex® Treatment System.

The collection system — 2.5 miles of pipe and 90 hook-ups, including a school and a restaurant — cost $325,000. Treatment facilities added $414,000 and professional fees another $124,000. Grant funds covered that $863,000 total. But grant administration, housing and meals for engineers, meals for volunteers, and approximately 7,500 hours of volunteer labor were contributed by the community! Residents pay a base monthly fee of $16, plus one dollar per thousand gallons of water used (averaged from winter monthly consumption).

The system has been performing beautifully since the January 2000 start-up: lab sampling shows average BOD and TSS under 2 mg/L and total nitrogen of 13.3 mg/L. The system operator — Wildman's husband Floyd — spends about ten hours a month on O&M, excluding the drip irrigation equipment.

"When you design a self-help project, the goal is constructability," says engineer Andy Hollon of Loomis Austin. So forget the big pipes, deep trenches, mammoth construction equipment, and special expertise! For the town of Starbuck, Orenco's effluent sewer and AdvanTex® Treatment System fit the bill.

"A self-help project is no picnic," says Carol Wildman. "It requires hard work and sacrifice. But look at what we accomplished. Our wastewater system is completely debt-free. It was definitely worth it!"

SUMMARY OF SPECIFICATIONS

Starbuck, Washington Effluent Sewer and AdvanTex® Treatment System with Denitrifying Upflow Filters Using Orenco Systems Equipment, plus Dispersal by Drip Irrigation

Installation Date
1999. Completed in 9 months

Start-Up Date
January 2000

System Engineer
Loomis Austin, Inc.; Austin, Texas

Project Cost Excluding Donated Labor
$863,000

Donated Labor
7,500 hours

Fees
$16 per month base charge plus $1 per 1,000-gal winter avg. water use

Onsite Facilities
90 connections, all STEG
Residential tanks by Willamette Graystone, Portland, OR: 1,500-gal* one-piece concrete construction, single compartment, fitted with Orenco Biotube® Effluent Filters

Collection System
2.5 miles of PVC pipe, mostly 2" and 3", some 4".

One 8,000 gal STEP pumping station with two 3/4 hp pumps and VeriComm® telemetry controls

Treatment System
16 AdvanTex®-RX40 Textile Filters
2 denitrifying upflow filters—1 day HRT (peak flow)
2 flow-splitter basins set for 50/50 filtrate split

Design flow = 20,000 gpd
Average actual flow = 7,330 gpd

Recirculation rate: start-up—5:1, after one year—4:1

** Although 1,000-gal tanks would have been adequate, 1,500-gal tanks were selected for reduced septage pumping frequency, from every 8 - 12 years (for a 1,000-gal tank) to every 12 - 20 years.*

Tanks
20,000-gal-blend tank; (2) 10,000-gal recirculation tanks

Pumps
Four 3/4 hp pumps in each recirc tank

Dispersal
20,000 gal surge/dose tank
50,000 lineal feet of drip irrigation line (4 acres)

Operation/Maintenance
Maintenance of tanks, collection system, AdvanTex® Treatment System, and upflow filters – Avg. 10 hrs/mo

Performance

Test	Influent (mg/L)	Effluent (mg/L)
BOD_5	130	<1
TSS	34	1.8
TN	46	13.3

Cost Comparison

Gravity Sewer

Effluent Sewer

"Self-Help" Effluent Sewer

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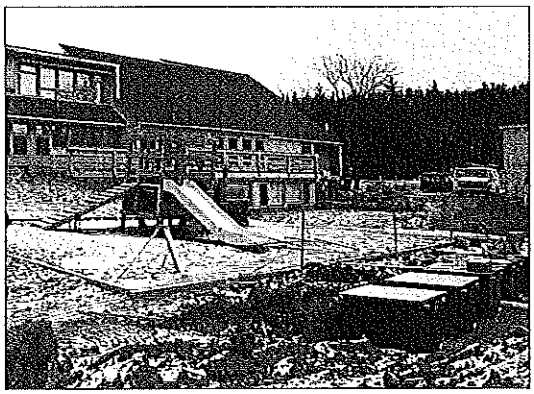
ACS-SL-7
Rev. 2.0, 7/02

O R E N C O

CASESTUDY

Warren, Vermont:

Award-Winning AdvanTex® System Provides Superior Treatment in a Small Footprint



The Warren Elementary School playground sits less than ten feet from a row of AdvanTex® AX10 pods. Orenco's highly efficient AdvanTex Treatment System allows children at the school to play without fear of health or safety hazards.

"We live in a cold environment, but I've had no wintertime problems with this system. Just really good smokin' numbers. AdvanTex gets BOD and TSS down to five [mg/L]. You can't beat that!"

Mike Mayo
Sewage Officer
Town of Warren

In the fall of 1999, the town of Warren, Vermont discovered problems in the elementary school's water supply. The culprit was the school's failing leach field, which was ponding and causing a public health hazard.

Clearly, the septic system had to be replaced. However, there was not enough land — far enough away from the well — for a conventional leach field. The town's consulting engineers recognized that they needed a compact but high-performing wastewater treatment and dispersal system . . . at a price the town could afford. After an intensive lifecycle cost analysis of several systems, they chose Orenco's AdvanTex® Treatment System with a pressurized, shallow, narrow drainfield.

Fitting into less than half the area of conventional systems, the AdvanTex system became fully operational by the end of the school's winter break. Within two days of installation (supervised by Orenco distributor Dave Cotton of WTI), effluent testing showed considerable reduction in biochemical oxygen demand. Warmer weather brought increased biological activity in the system and BOD/TSS reductions of up to 90%, with BOD_5 at 7.5 mg/L and TSS at 5.9 mg/L.

Recognizing the system's superior design and performance, the American Consulting Engineers Council awarded its Vermont Engineering Grand Award for Water Resource Projects to the system's design engineers, the town's environmental consulting firm, and the regional planning commission.

Since the system has been operational, there have been no problems. An advanced remote telemetry control system sends information on treatment system functions via modem to a computer in the town offices. If a problem occurs, the control panel pages the town's sewage officer. School staff no longer need to worry about another septic system failure.

Warren Elementary School is an EPA National Demonstration System — a model approach to solving onsite wastewater treatment and dispersal problems faced across the country.

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Incorporated
800/348-9843
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SUMMARY OF SPECIFICATIONS

Warren, Vermont Commercial AdvanTex® Treatment System
Using Orenco Systems Equipment

Installation Date
January 2001

Project Costs

Treatment System

$60,000

Total Project

$150,000 (includes all engineering costs; removal of old system; and installation of new force main, new drainfield, new tanks, and new treatment system)

Environmental Consultant
Stone Environmental, Inc.

System Engineer
Forcier Aldrich & Associates

Contractor
New England Water Systems

Distributor
Wastewater Technologies, Inc.

Design Flow
4,600 gpd

Collection System
Existing 4,000-gallon septic tank
New 3,000-gallon dosing pump station

Treatment System
New 3,000-gallon septic tank with effluent filter
New 5,000-gallon recirc/blend tank with pumps
12 AdvanTex-AX10 textile filters
Remote telemetry control panel

Effluent Quality
Effluent BOD averages are 7.5 mg/L;
TSS averages are 5.9 mg/L.

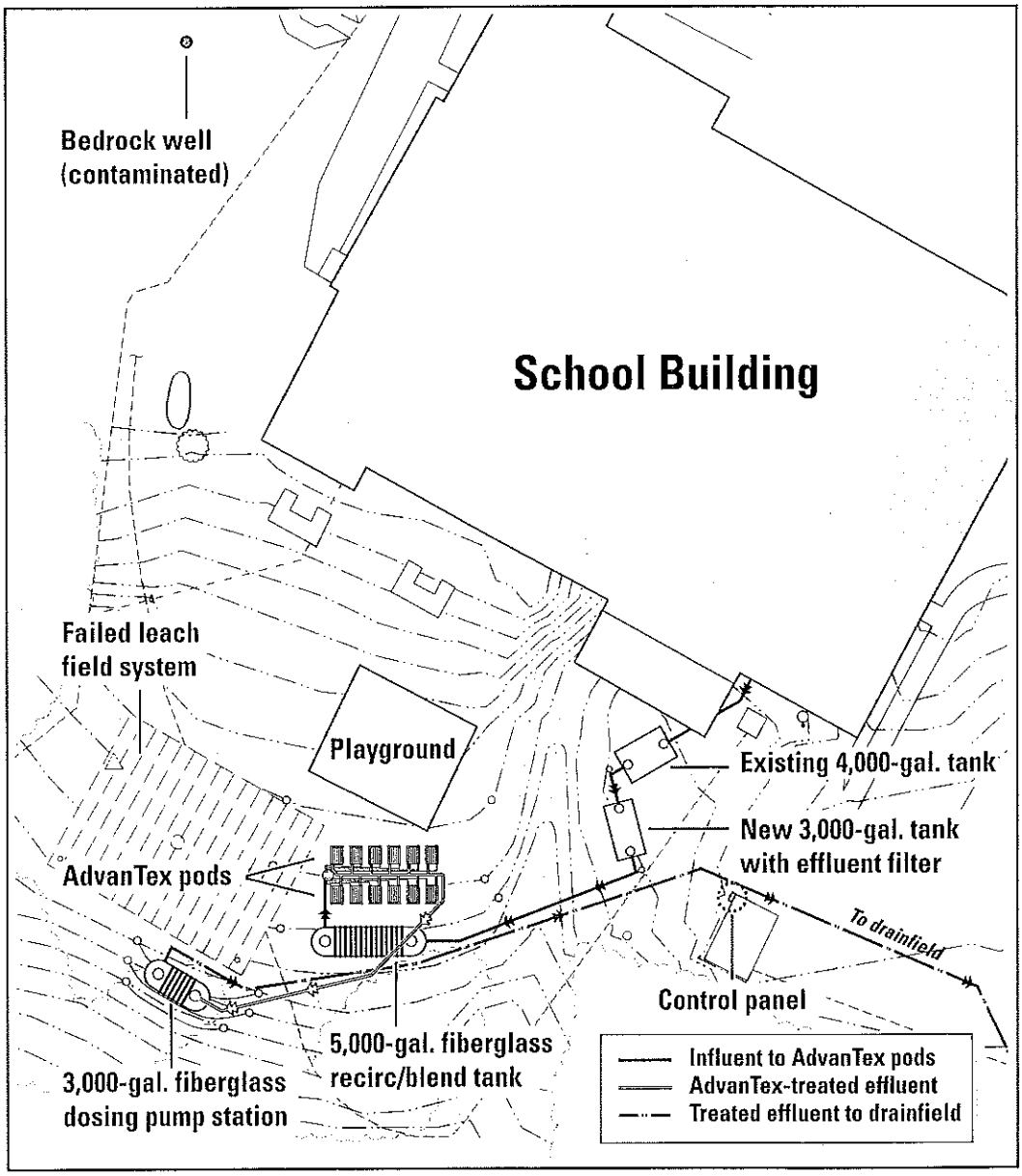
Dispersal
Pressurized, shallow, narrow drainfield

Operation/Maintenance Costs (Annual)

Onsite facilities

Electrical	$80
Engineering Inspection	$250
Operator labor	$1,000
Telemetry/paging (telephone charges)	$650
Annual cost	$1,980

Per EPA/DEC, quarterly influent/effluent quality testing was required for the first two years of operation.



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