

# AdvanTex<sup>®</sup> Design Criteria

## For Residential Applications — International\*

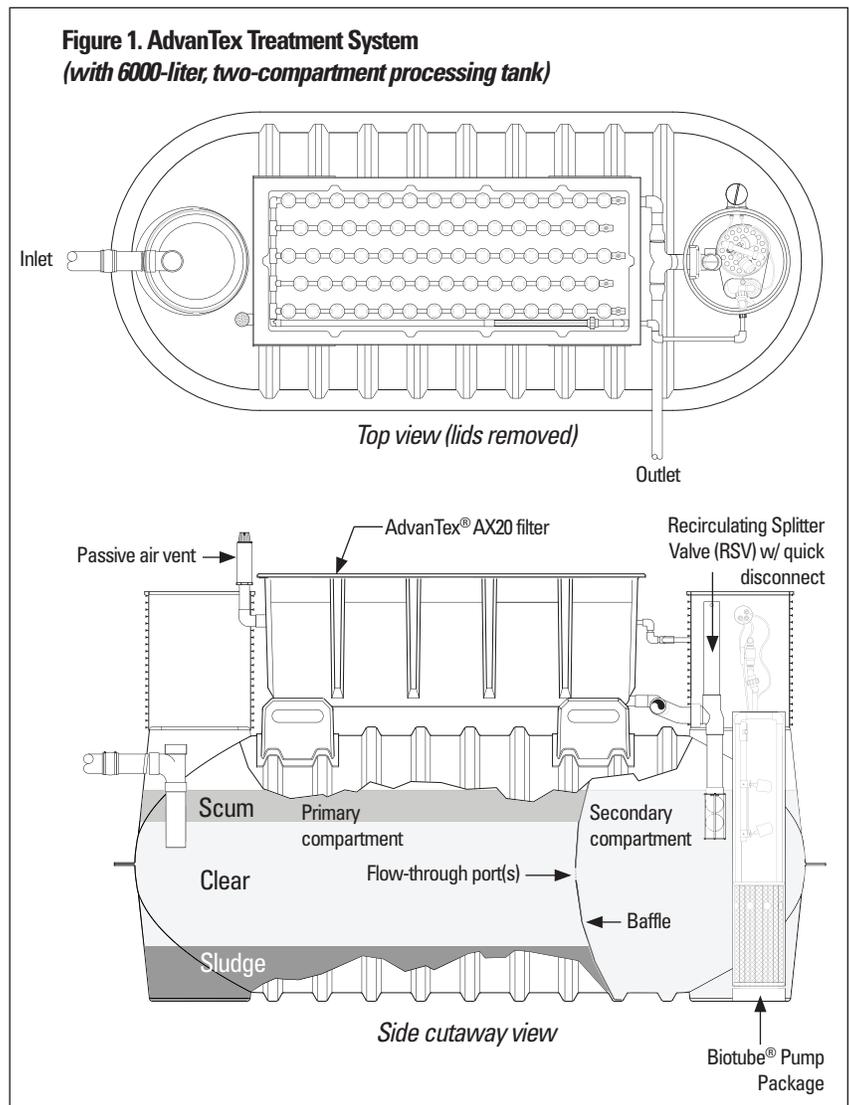
### System Description and Treatment Process

The AdvanTex<sup>®</sup> Treatment System is a multiple-pass, packed-bed aerobic wastewater treatment system specifically designed and engineered for long-term processing of residential strength wastewater. The treatment media is an engineered textile, which has an extremely high void capacity, moisture-holding capacity, and surface area per unit volume. Consequently, AdvanTex Treatment Systems are capable of processing residential strength wastewater to better than “secondary standards” (see Figure 3, page 4).

Here’s how it works in our standard configuration (see Figure 1). 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 clear layer, and a sludge layer. A flow-through port or ports in the tank’s baffle wall allows effluent from the clear layer to flow into the second compartment of the tank. The Biotube<sup>®</sup> 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, which 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 percent of the treated filtrate effluent is returned to the processing tank. Residential AdvanTex filters have a passive vent system and do not require the use of a fan.

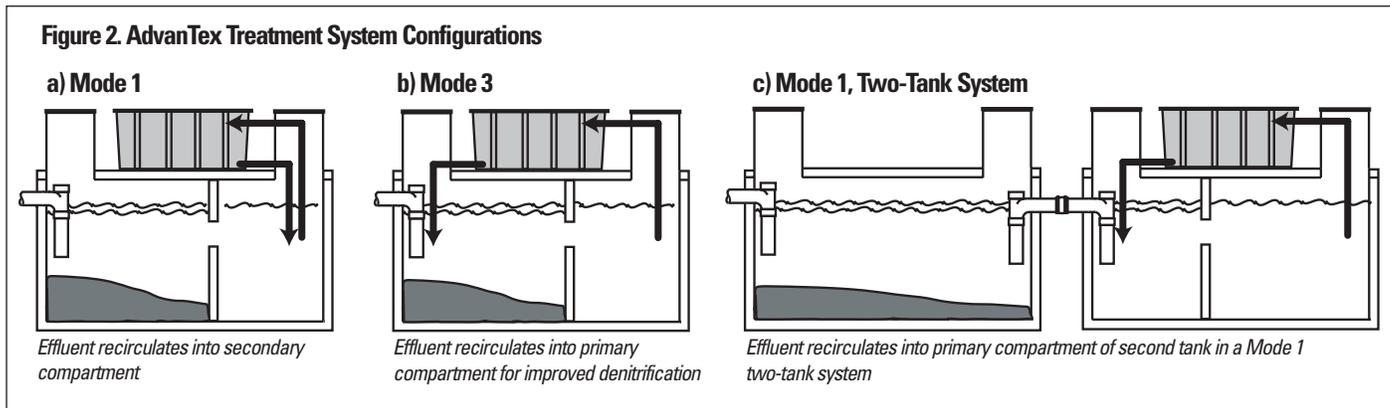
### System Selection: Models and Configurations

Typically, residential-sized AdvanTex Treatment Systems include one or two AdvanTex AX20 filter pods. The AdvanTex Treatment System can be configured in several modes (See Figure 2). Mode 1 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 portion or all of the filtrate may be recirculated through the primary chamber of the tank to enhance nutrient removal.



\* This document is for residential applications only. For commercial applications, call Oreco’s Engineered Systems Department.

Some of the systems in Mode 1 incorporate 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 (see Figure 2, example c). Refer to the AdvanTex Treatment System drawings in the Design/Engineering Package for Residential Applications Binder for further details on mode and discharge options.



### System Requirements: Residential Strength Wastewater

Residential wastewater must meet the criteria in Table 1, below. Consult Orenco or your AdvanTex Dealer for larger system designs.

**Table 1. Residential Strength Wastewater (Influent Characteristics)<sup>1</sup>**

Characteristic	Average (mg/L)	Weekly Peak (mg/L)	Rarely Exceed (mg/L)
CBOD <sub>5</sub>	130	200	300
TSS	40	60	150
TKN	65	75	150
G&O	20	25	25

<sup>1</sup> AdvanTex® Treatment Systems are typically expected to receive residential-strength wastewater from typical primary septic tanks. Residential-strength wastewater is defined as primary sewage effluent from a septic tank that does not exceed the parameters in this table.

### System Requirements: Processing Tank

Homes with four or fewer bedrooms require a minimum two-compartment, 6000-liter (nominal) tank with a flow through port or ports equaling a minimum flow-through area of not less than 77 cm<sup>2</sup> (12 in<sup>2</sup>) at 60 to 70 percent of the lowest normal liquid level (see “Appendix 3: RSV and Float Level Diagram” in the *Residential AX Installation Manual*, NIM-ATX-AX-1, for typical liquid level positions). In larger residential systems, the first compartment should be sized at approximately 2/3 to 3/4 of the total processing tank volume.

All tank designs must be approved by Orenco before use. Each tank must meet Orenco’s minimum structural and configuration requirements. In addition, each tank will be required to pass a 24-hr in-ground watertight test (including the riser/tank connection), and be covered under a written warranty.

Table 2 defines the minimum required tankage for residential AdvanTex applications (unless otherwise approved by both Orenco and the local regulatory body).

**Table 2. ecommended Tankage: Single and Dual Tank Configurations**

Number of Bedrooms <sup>1</sup>		Processing Tank <sup>2</sup>	or	Septic Tank	Recirculation Tank <sup>3</sup>
4 (or fewer)	=	6000 L		4000 L	4000 L
5		10000 L		6000 L	4000 L
6		12000 L		8000 L	4000 L

<sup>1</sup> In jurisdictions where the calculated peak hydraulic loading rate does not exceed 2000 L/day (500 gpd) nominal, a 6000-liter tank may be used as long as the system's anticipated treatment levels (see Figure 3) meet local requirements. For homes with more than six bedrooms or homes that are larger than 500 m<sup>2</sup> (5380 ft<sup>2</sup>), contact Orenco Systems, Inc

<sup>2</sup> Processing tank = a single, two-compartment tank that includes a primary (septic) and a secondary (recirculation) compartment (see Figure 2, examples a and b).

<sup>3</sup> The 4000 liter minimum is due to float settings and reserve requirements.

**System Requirements: Filter Units**

Orenco's suggested design loading rates are based on typical per capita flow rates — 190 to 230 L/day per person (50 to 60 gpd/person) — and average strength characteristics expected from residential type installations, as shown in Table 1. Orenco's requirements assume that peak daily flows (Q<sub>p</sub>) from a residence are typically twice the average daily flows (Q<sub>a</sub>). System design must meet local regulations governing flow-to-bedroom ratios.

Performance is a function of the expected hydraulic and organic loads, with periodic weekly peaks. Typically, the daily mass loading is based on the expected daily flows and actual strength. Figure 3 shows periodic peak loading capacity at a 95 percent confidence level. If the loading rate (or mass load) needs to be reduced to meet discharge limits, it's a simple matter of adding additional treatment units.

Because calculated flows can vary greatly between jurisdictions, Table 3 can be used to determine the recommended number of units per bedroom.

**Table 3. Recommended Number of Treatment Units<sup>1</sup>**

Number of Bedrooms	AX Units Recommended
4 (or fewer)	1 (AX20)
5	2 (AX20)
6	2 (AX20)

<sup>1</sup> The hydraulic loading rate for all residential AX units is 1184 L/m<sup>2</sup>/day (29.1 gpd/ft<sup>2</sup>). The nominal hydraulic application rate is 1017 L/m<sup>2</sup>/ day (25 gpd/ft<sup>2</sup>). In jurisdictions where the calculated peak hydraulic loading rate does not exceed 2000 L/day (500 gpd) nominal, a single AX20 pod may be used as long as the system's anticipated treatment levels (see Figure 3) meet local requirements. For homes with more than six bedrooms or homes that are larger than 500 m<sup>2</sup> (5380 ft<sup>2</sup>), contact Orenco Systems, Inc

### Typical Effluent Quality

Effluent quality is dependent on a number of factors, including influent characteristics and loading rates. Figures 3a and 3b below show third party, NSF/ANSI Standard 40 testing results. The results demonstrate that low-to-moderate loading rates typically produce cBOD and TSS of <5 mg/L, while higher loading rates produce cBOD and TSS in the range of 15-25 mg/L. Field testing of systems in real-world conditions shows similar results, with cBOD and TSS of <10 mg/L. (See *AX Performance Summary*, AHO-ATX-PERF-1.)

Nitrogen reduction in Mode 1 will typically exceed 60 percent, with total nitrogen in the filtrate ranging between approximately 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<sub>3</sub> is needed to nitrify 1 mg/L of NH<sub>4</sub><sup>+</sup>.

### Pumping Equipment: Recirculation Pump

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

### Residual Head Pressures

A residual pressure of 1.5 m (5 ft) is used to determine the initial timed-dosing settings. (Residual pressure may vary depending on system hydraulics and/or special treatment requirements.) Consulting with Orenco is required when the residual pressure dosing falls outside the typical range of 0.9 to 1.8 meters (3 to 6 feet).

### Recirculation Ratios and Timer Settings

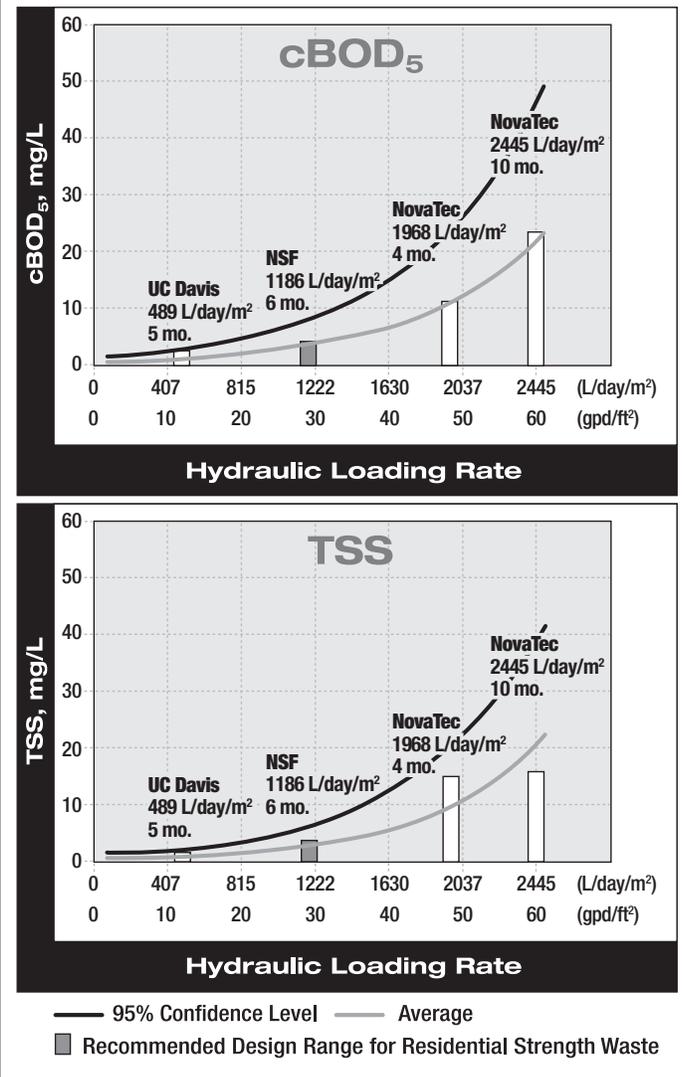
The AdvanTex Treatment System's initial timer settings should be established based on the expected average daily flow and a 4:1 recirculation ratio (filter recirculation ratio). If flows vary significantly from expected flows, timer settings can easily be recalculated and adjusted. See "Appendix 1: AX20 Timer Settings Worksheet" in the *Residential AX Installation Manual*, NIM-ATX-AX-1, for more information.

### AdvanTex Control Systems

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. Orenco offers two timed-dose control panels with the AdvanTex Treatment System.

**Figure 3. Effluent Quality vs. Hydraulic Loading Rates**

Third Party, NSA/ANSI Standard 40 Testing Results



Orenco's MVP (Most Versatile Panel) series control panels include an easy-to-use programmable logic unit that incorporates many timing and logic functions. The units have built-in screens that show time and date, elapsed pump run times, pump cycle counts, high-level alarm and override cycle counts, and low-level alarm counts, as well as power fault information and operating hours. In addition, there are separate screens that show the status of the panel's digital inputs and outputs. These features give operators and maintenance providers the ability to monitor individual systems on site. Alarm events activate the panel's audible and visual alarms.

In some markets, Orenco offers our VeriComm® (VCOM) remote telemetry control panels as alternatives to the MVP series panels. Orenco's VCOM control panels give 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. VCOM panels also provide additional alert and alarm functions to notify the operator/designer in the event that trend data indicate potential problem conditions (e.g., high flows or frequent alarms).

### **Surge Volume**

For most residential applications, the recommended surge volume is approximately 570 to 950 L (150 to 250 gallons). The actual surge volume used should be approximately 50 to 100 percent of the actual average daily flow. The surge volume is the volume between the normal low liquid level and the override timer float. The normal low liquid level is the level at which 100 percent of the filtrate returns to the tank. For most residential installations, the low liquid level will be approximately 130 to 150 mm (5 to 6 inches) below the top of the RSV cage. Refer to the *Residential AX Installation Manual*, NIM-ATX-AX-1, for more information.

### **AdvanTex Control Systems**

for details.

### **Reserve Volume**

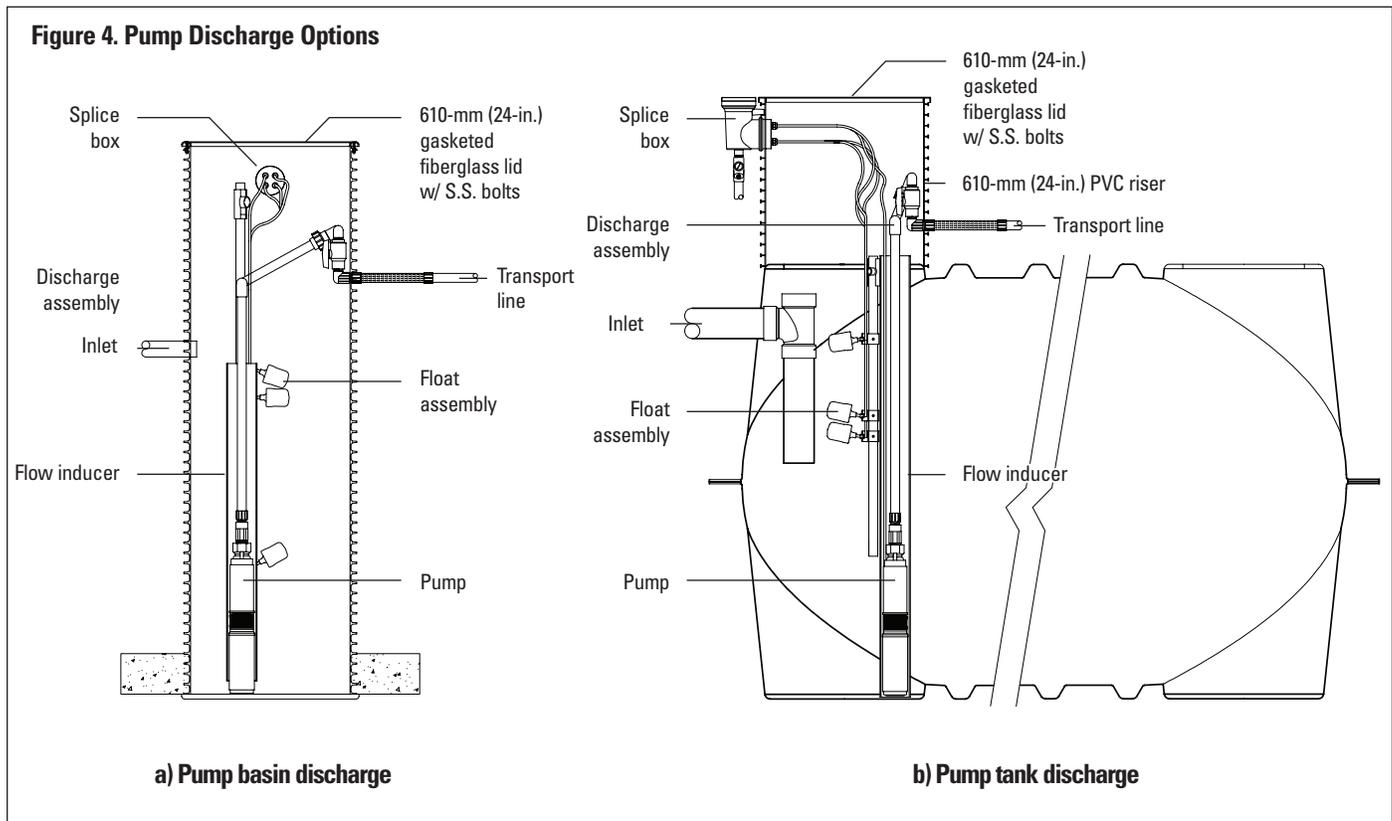
A typical AdvanTex Treatment System on a four-bedroom home has a 6000-L processing tank. There are about 1,500 L (400 gallons) of emergency storage between the normal operating liquid level and the inside top of the tank. Assuming that the average home produces about 950 L/day (250 gpd), the emergency storage volume in an AdvanTex system is sufficient for 1.5 days.

*Power outage:* During a power outage, water usage will be significantly reduced because water heaters, dishwashers, and laundry equipment will not be used. Under these conditions, it is realistic to estimate that water usage will be reduced by 50 percent to around 473 L/day (125 gpd). Therefore, in a power outage, the emergency storage capacity available in an AdvanTex system increases to approximately three days' worth. Because power outages typically last no more than one day, the emergency storage of an AdvanTex system is adequate.

*Mechanical component failure:* Failure of a pump or electrical component may cause the system to stop operating, requiring some amount of emergency storage volume. For MVP Series control panels, once an alarm level is detected, the MVP Series panel will immediately activate the local audible and visual alarms. For VCOM control panels, the VeriComm Monitoring System immediately notifies the Service Provider of the alarm condition and indicates the cause of the alarm. This helps Service Providers bring the right replacement components. In most cases, no more than 950 L (250 gallons), or one day's worth of reserve, would be needed for the Service Provider to respond and get the system running again.

## Discharge Equipment

There are two discharge options: gravity and pump. When discharging by pump, an Orenco pump basin (Figure 4, example a)



can be used. Alternatively, some designs may call for pumping out of a tank (Figure 4, example b).

All tanks must meet Orenco's 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, NDA-DG-SPEC-1, and tank specifications checklist in Orenco's Concrete Tank Questionnaire, NCL-TNK-TNK-1.

## Cold Weather Considerations

AX units are available with 25-mm (1-in.) insulation attached to the bottom of the lid. Installing insulation around the sides of the filter pods themselves is optional and is done on site 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 back-filling risers with pea gravel if frost-heave is a concern. The filter vent may need to be extended above the highest level of the snowpack during winter months. Consult Orenco if supplementary options need to be considered.