

Biotube[®] ProPak[™] Design Criteria

System Description and Effluent Quality

Orenco's Biotube[®] ProPak[™] pumping systems are fully integrated pumping packages, designed to transport filtered effluent from single- and dual-compartment septic tanks (septic/dosing tanks), as well as from pump tanks, to dispersal systems or secondary treatment. Because all of its components are designed to work together, ProPak reduces installation time and errors.

The ProPak pump vault includes a Biotube filter cartridge for filtering solids from the effluent pumped out of the tank's clear zone. Filtering solids from the effluent reduces loading and clogging of downstream components. In turn, this extends the life of drainfields, secondary treatment systems, and other downstream components. When an Orenco Biotube ProPak pumping system is used in a properly sized, structurally sound, water-tight septic/dosing tank, it can be reliably expected to reduce Total Suspended Solids (TSS) by an average of more than 60%.

This document provides Orenco's design recommendations for using the ProPak pumping system to pump out of a single septic/dosing tank. Before using these design recommendations, please verify that they will meet or exceed applicable regulatory requirements in your area. Specific areas for consideration when designing with the ProPak are tank reserve volume, tank minimum liquid level, and minimum dose volume.

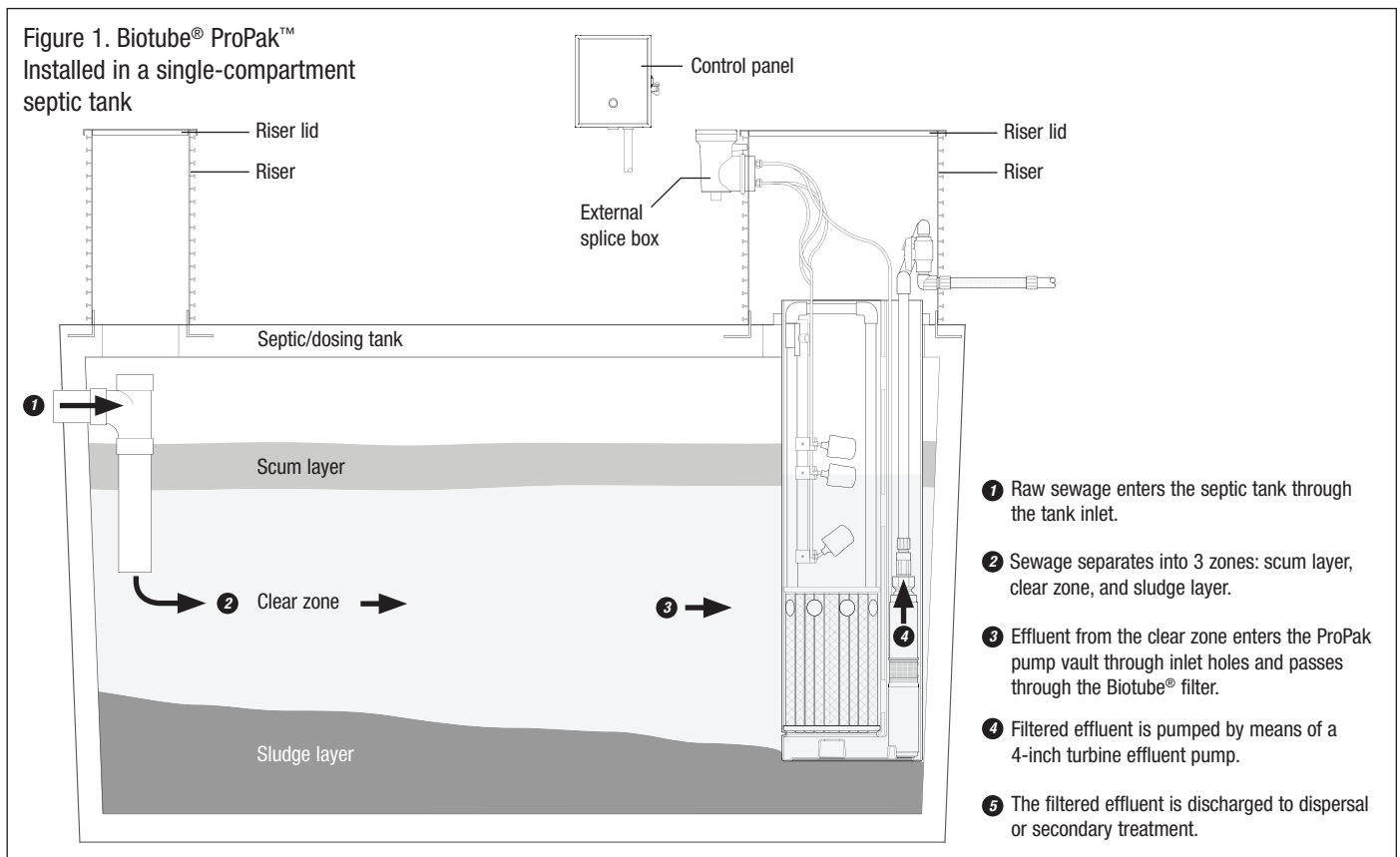


Figure 1 shows a typical single-family system with a ProPak in a single-compartment septic/dosing tank. Raw sewage enters the septic/dosing tank and separates into three distinct zones: a scum layer, a sludge layer, and a clear zone. The ProPak pump package draws effluent from the clear zone and filters it before pumping it to a drainfield, secondary treatment system, or other downstream termination point. In effect, the ProPak effectively acts as a separate dosing tank inside of the septic tank; eliminating the need for additional dosing tankage outside of the septic tank.

An Orenco ProPak ensures high quality effluent by baffling and screening large solids that could otherwise escape the septic/dosing tank. The Biotube Pump Vault's closed bottom and vertical inlet holes help to retain sludge, scum, and other gross solids in the tank — even when biological agitation (bulking) of the tank's contents occurs. Thus, Orenco's Biotube Pump Vault Technology provides sludge, scum and gas baffling.

Pumping System

Figure 2 shows the components of a ProPak pumping system:

1. **Control panel** – The control panel governs pump operation and should be mounted within sight of the pump system. (See Appendix 2.)
2. **External splice box** – In the electrical splice box, wires from the control panel are spliced with the cords from the pump and float switches.
3. **Riser, lid, and adapter** – The riser and lid (ordered separately from the ProPak package) provide a structurally sound, watertight method for accessing the pumping system.
4. **Biotube Pump Vault** – Orenco's patented Biotube pump vault houses the float switch assembly, Biotube filter, turbine effluent pump, and discharge plumbing assembly.
5. **Float switch assembly** – Float switches affixed via float collars to a quick disconnect float stem are mounted onto the Biotube filter to monitor and control the liquid level inside the tank.
6. **Biotube filter** – Effluent filter with 1/8-in. (3.2-mm) mesh that removes approximately two-thirds of suspended solids. Filters with 1/16-in. (1.6-mm) mesh are also available. The Biotube filter can be removed for cleaning without the need to remove the pump or pump vault.
7. **Orenco 4-in. (100-mm) turbine effluent pump** – The turbine pump moves the filtered effluent to the distribution point. (See Appendix 1.)
8. **Discharge plumbing assembly** — A discharge plumbing assembly connects the pump to the transport line.

Accessory Equipment

The following products may be required to complete the system:

- Access risers with fiberglass lids
- Riser tank adapters with bolt-down kits
- Adhesive
- Grommets

See *Orenco's General Onsite Products Catalog (ACT-GOP-1)* to order these products.

Pumping System Requirements: Septic Tank

Because septic tanks provide the initial treatment for any septic system, it is critical that the septic/dosing tanks used with ProPak pumping systems are properly designed, structurally sound, and watertight. The ProPak can pump effluent from a single- or dual-compartment septic/dosing tank.

ProPak Pumping Systems are designed to take in effluent from the clear zone of the septic/dosing tank. Care must be taken that the ProPak vault's inlet holes are positioned at 70% (\pm 10%) of the minimum liquid level in the tank — approximately at the center of the clear zone — to assure that effluent from the clear zone is being filtered.

For pump flows less than 40 gallons per minute (< 2.52 liters per second):

Single-compartment septic/dosing tanks can be used. The drawdown in a septic/dosing tank with a single compartment should also be minimized to ensure that sufficient retention and settling time are provided in the tank; this equates to sustaining a liquid volume of about 90% of tank capacity.

Figure 2.
Biotube® ProPak™ Components

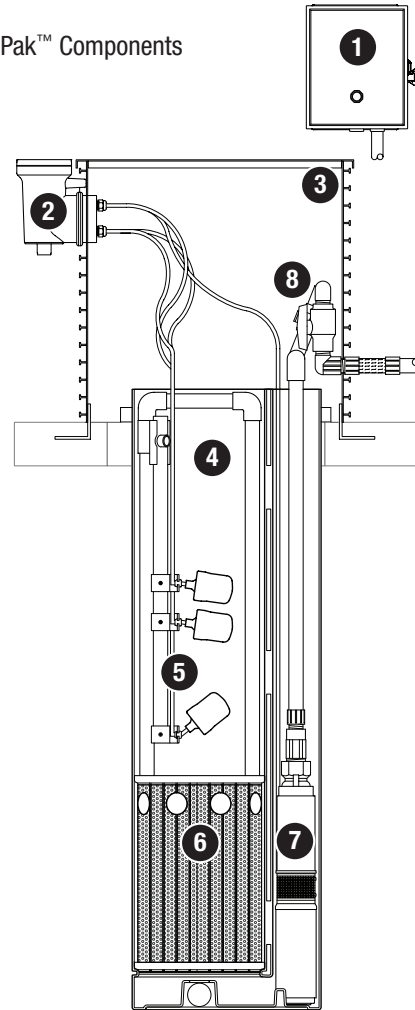
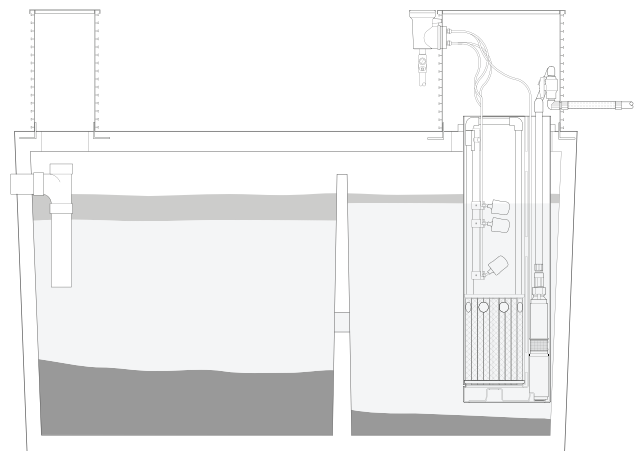


Figure 3.
Dual-Compartment Septic/Dosing Tank
With Shared Liquid Level



For pump flows greater than 40 gallons per minute (> 2.52 liters per second):

Because pump flows exceeding 40 gpm may pull the floating scum layer into the inlet holes of the pump vault in a single-compartment tank, a septic/dosing tank with dual compartments is recommended. Additionally, the liquid level in dual-compartment septic tanks should be kept as high as possible to maintain effluent quality. Scum and sludge layers develop in the secondary compartment — though less rapidly than in the primary compartment — so it is best to maintain surge and reserve volumes by using a dual-compartment tank with a shared liquid level. (See Figure 3.)

Pumping System Settings: Pump Vault Placement

The inlet holes in the Biotube Pump Vault should be located at about 70% (\pm 10%) of the distance up from the the bottom of the tank to the lowest operating liquid level (“Off” float or “Timer off” float). (See Figures 4 and 5.) This location allows the ProPak to draw effluent from the middle of the clear zone in the tank. As the accumulation of scum and sludge occurs in the tank, the location of the inlet holes ensures that the highest quality effluent is being filtered and transported out of the septic/dosing tank.

Pumping System Settings: Float Switch Settings

Several factors affect the operation of the system and the location of the float switches. These factors may include, but aren’t limited to, dose method; downstream components; and local, municipal, county, or state regulations. Information provided in this section is intended to be used as a guideline.

The portion of the septic/dosing tank between the level of the “Off” float and the level of the “On” float (for demand-dose systems) or the “High level alarm” float (for timed-dose systems) is called the operating zone.

Demand-dose systems are typically used to pump effluent to a gravity drainfield or downstream treatment system. For demand-dose systems, the operating zone should be as small as possible. The small operating zone allows more scum and sludge to be stored in the tank. It also minimizes the disturbance of the scum layer during pumping cycles. The minimum achievable operating zone for a ProPak system is 2 inches (50 mm). This is the closest that the “On” and an “Off” floats can be physically placed to one another.

Timed-dose systems are typically used to pump effluent to soil, sand, and media filters for additional treatment. For timed-dose systems, the operating zone should be sized as small as possible while allowing for 24 hours’ worth of estimated daily flow storage. To balance the need for a small operating zone with the need for flow storage capacity, we recommend using single-compartment tanks or tanks with shared liquid levels for timed-dose applications.

Float settings for both types of dosing systems also need to account for reserve volume in the septic/dosing tank. The reserve volume is the portion of the tank from the soffit of the tank to the invert of the tank inlet (“High level alarm” float setting). Reserve volumes should be capable of storing 24-48 hours’ of estimated daily flows.

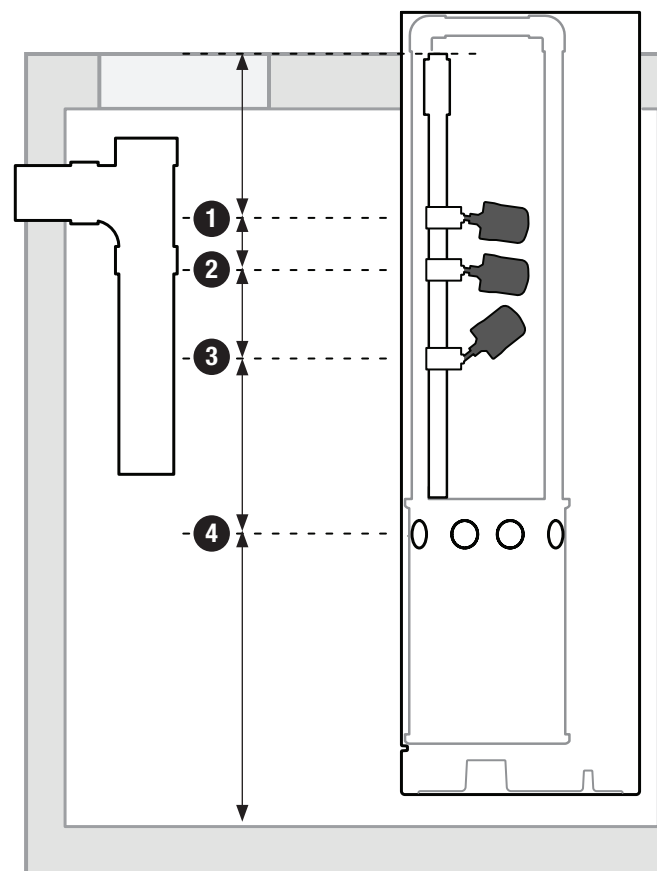
Demand-dose float settings :

Float settings for demand-dose ProPak applications are typically set to maximize the volume in the septic/dosing tank by utilizing a small operating zone. Figure 4 shows general guidelines for float placement. Standard settings for demand-dose are as follows ...

- “High level alarm” float: At the invert of the inlet of septic/dosing tank, as measured from the outside top of the tank.
- “On” float: 2 inches (50 mm) below the high level alarm float
- “Off” float: 2-4 inches (50-100 mm) below the “On” float. The amount of space between the “On” and “Off” float will determine dose volume.

NOTE: The on/off function may be controlled by one float. In this case, dose volume will be constrained by the drawdown of the “On/Off” float.

Figure 4.
Standard Settings: Three-Float, Demand-Dose System (not to scale)



- 1 “High level alarm” float location
(Invert of the tank inlet as measured from the outside top of the tank)
- 2 “On” float location, 2 inches (50 mm) below “High level alarm”
- 3 “Off” float location, about 3 inches (75 mm) below “On” float
- 4 Pump vault inlet hole location, about 70% of the distance between the tank bottom and the lowest operating liquid level (“Off” float)

Timed-dose float settings:

For a single-family dwelling, wastewater flows typically range from 40 to 60 gallons per capita per day (gpcd) or 150 to 227 liters per capita per day (Lpcd). A design parameter of 50 gpcd (190 Lpcd) is commonly used in determining estimated flows from a dwelling. Estimated flows are determined by multiplying the number of occupants in the dwelling by 50 gpcd (190 Lpcd). Figure 5 shows general guidelines for float placement.

- **“High level alarm/override” float:** At the invert of the inlet in the septic/dosing tank, as measured from the outside top of the tank. The “High level alarm” function is combined with the “Override” function. (Some jurisdictions require separate floats for high level alarm and override functions. When a single-function float switch is used for the “Override” function, it is typically set at 2 inches or 50 mm below the “High level alarm” float.)
- **“Timer off” float:** This float is set at a distance below the “High level alarm” float or the “Override” float, equal to the estimated flows for the system. (Example: a home with 4-person occupancy would be set for estimated flows of 200 gallons per day (757 liters per day) or $50 \text{ gpcd} \times 4$ ($190 \text{ Lpcd} \times 4$).

“Redundant off” float settings:

A “Redundant off” float may be used with both demand-dose and timed-dose systems. The “Redundant off” float is placed 2-3 inches below the “Off” float in demand-dose systems, or the “Timer off” float in timed-dose systems.

Drainfield Considerations

When designing the pump system for any type of low-pressure dispersal system (sand filters, pressure drainfields, mounds, etc.), it is important to note that the best design practices address not only the issue of supplying frequent, small doses for dispersal, but also equal distribution. Equal distribution of frequent, small doses maintains the oxygen supply to microbes and promotes the best possible aerobic treatment. Using small-diameter laterals (typically 1-inch) and orifices (typically 1/8-inch) helps to ensure equal distribution of effluent in a dispersal system.

Package Selection

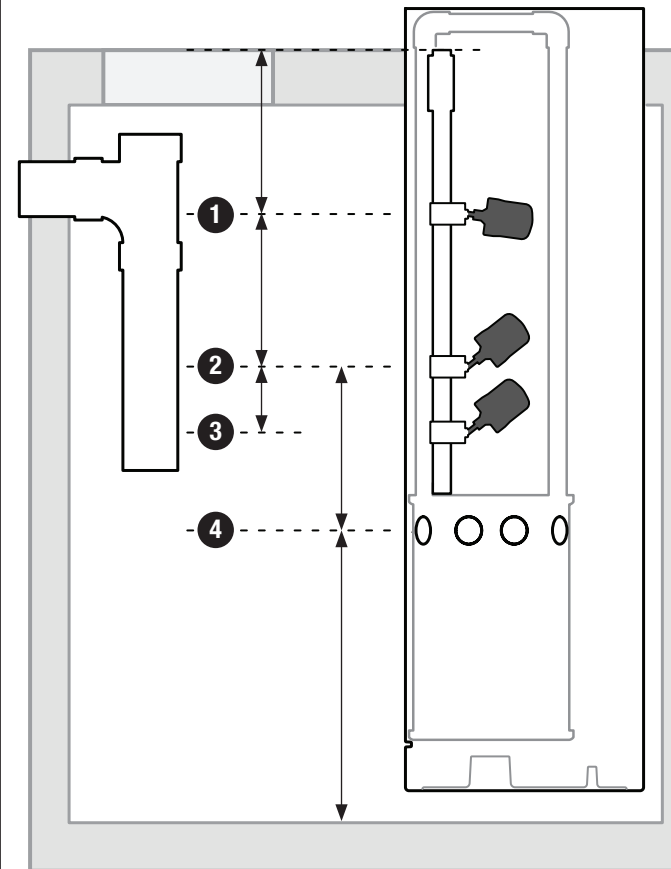
All ProPak pump packages are available for both demand-dose and timed-dose applications, with 15, 20, 30, and 50 gpm (0.95-, 1.6-, 2.5-, and 4.1 L/sec) flow options. There are two basic packages:

1. **Demand-dose** – The BPP15DD accommodates flows up to 20 gpm (1.3 L/sec) and is used to pump to gravity drainfields (distribution boxes, hydro-splitters, etc.). BPP20DD, BPP30DD and BPP50DD systems are available for demand-dose applications that require flow rates greater than 20 gpm.
2. **Timed-dose** – The BPP30TDD accommodates flows up to 40 gpm (2.5 L/sec) and can be used for pumping to a pressurized final dispersal system (drainfield, secondary treatment system, etc.). BPP30TDD systems are available for timed-dose applications for small pressurized dispersal systems (e.g. sand filters, mounds). BPP50TDD systems are available for timed-dose applications that require flows between 40-65 gpm (2.5-4.1 L/sec), such as large pressurized drainfields or mounds.

Design Tools

The ProPak Design Aid CD-ROM includes a ProPak Select™ software program that allows system designers and specifiers to select the correct ProPak package for their application. When project-specific parameters are entered into the appropriate fields in ProPak Select, minimum pump requirements are automatically calculated (e.g. total dynamic head and flow rate) and the appropriate ProPak model is selected for your application.

Figure 5. Standard Settings: Three-Float, Timed-Dose System (not to scale)



- 1 “High level alarm/override” float location (Invert of the tank inlet as measured from the outside top of the tank)
- 2 “Timer off” float location, distance below “High level alarm/override” float equal to “estimated daily flow”
- 3 “Redundant off” float, 3 in. (75 mm) below “Timer off” float
- 4 Pump vault inlet hole location, about 70% of the distance between the tank bottom and the lowest operating point (“Timer off” float)

ProPak Pump Packages and Applications

Tables 1a and 1b below provide recommendations for selecting the correct ProPak pumping systems based on application. Other ProPak models are available. Contact your Distributor or Orenco for more information.

Table 1a. Pumping to Hydrosplitters, Distribution Boxes, and Gravity Drainfields

Pump System Type	Model Code*	Maximum Flow Rate, gpm (L/sec)
Demand-dose	BPP15DD	20 gpm (1.3 L/sec)
Demand-dose	BPP20DD	25 gpm (1.6 L/sec)

Table 1b. Pumping to Pressure Distribution Systems (Soil, Sand, and Media Filters, Mounds, Low-Pressure Pipe Systems, etc.)

Pump System Type	Model Code*	Maximum Flow Rate, gpm (L/sec)
Demand-dose	BPP30DD	40 gpm (2.5 L/sec)
Demand-dose	BPP50DD	65 gpm (4.1 L/sec)
Timed-dose	BPP30TDA	40 gpm (2.5 L/sec)
Timed-dose	BPP30TDD	40 gpm (2.5 L/sec)
Timed-dose	BPP50TDA	65 gpm (4.1 L/sec)
Timed-dose	BPP50TDD	65 gpm (4.1 L/sec)

* ProPak systems come standard with 57-inch pump vault units (PVU). For 68-inch pump vault units, add "-68" to the end of the product code

Appendix 1:

Orenco-Designed 4-in. (100-mm) Turbine Effluent Pumps

In onsite wastewater and pressure distribution systems, Orenco's 4-in. (100-mm) turbine effluent pumps are commonly used because of several advantages they offer compared with other pumps on the market:

1. **High cycle life** – Orenco's 4-in. (100-mm) turbine pumps regularly reach lifetime cycle counts of more than one million.
2. **Scouring velocity** – Orenco's 4-in. (100-mm) turbine effluent pumps provide more than sufficient energy to flush laterals and help keep orifices clear.
3. **Pump run-dry** – Orenco's 4-in. (100-mm) turbine effluent pumps have 24-hr run-dry capability with no deterioration in pump life or performance.
4. **Ease of maintenance** – Orenco's ½-hp (0.37 kW) turbine pumps weigh approximately 25 lbs (11.4 kg) and can be removed by one person for maintenance or repairs without the need for a lifting mechanism. Additionally, because the pump is in a separate chamber from the Biotube filter, there is no need to remove the pump or the pump vault when filter cleaning is required.
5. **Excellent abrasion- and corrosion-resistance** – Orenco's 4-in. turbine effluent pumps are constructed of 300-series stainless steel and thermoplastics.
6. **Warranty period** – Orenco provides a 5-year warranty on its 4-in. (100-mm) turbine effluent pumps.

Appendix 2:

Orenco Simplex Control Panels

Orenco's Biotube ProPak Simplex Control Panels provide pump control based on dose method. Demand-dose panels are specifically engineered for pumping to non-secondary treatment systems (e.g. lift stations, drainfields, manholes, etc.). Timed-dose panels are specifically engineered for applications that require programmable timers, such as pressurized drainfields and secondary treatment systems.

Both panels include the following shared features:

- Motor-start contactor for increased system life.
- 20A Auto/Off/Manual toggle switch for easy troubleshooting and maintenance.
- Resettable control circuit breaker that negates the need for easily lost or forgotten fuses.
- Discrete, touch-safe terminal locations for simple, intuitive pump and float wiring.
- Fiberglass enclosure, for increased durability over plastic.
- Easily accessed external "Push to Silence" button, for homeowner control over audible alarms.

Demand-dose panels include the following features:

- Audible and visual alarms to signal high-level conditions.
- Audible alarm silence relay keeps the audible alarm off until the next alarm condition (or the power is removed and then restored). The visual alarm light remains on until the alarm condition is alleviated.

Timed-dose panels include the following features:

- Choice of digital or analog timers.
- Digital timing is accurate to within 1%.
- Digital timer panels can accommodate multiple timer settings for normal and peak flow conditions.
- Timer settings are field-adjustable without the need of a portable computer.
- Digital timer panels include built-in elapsed time meters and counters (optional on analog timer panels).
- Digital timer panels differentiate between high- and low-level alarm conditions, thereby facilitating troubleshooting.
- Silenced alarms automatically reactivate after 12-hours if condition is not corrected (specific to digital timer panels).
- Timed delays on float inputs to prevent rapid cycling (specific to digital timer panels).
- Visual indicators of float position.