# ECOLOGICAL TANKS, INC.

*Makers of*

AQUA SAFE® *and* AQUA AIRE®

**Advanced Wastewater Treatment Systems**

# SUBSURFACE EFFLUENT DRIP DISTRIBUTION SYSTEMS

## Design, Installation, and Maintenance Manual



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ABBREVIATIONS:
fps = feet per second; ft = feet; $ft^2$ = square feet; gpd = gallons per day; gph = gallons per hour, gpm = gallons per minute; HP = Horse Power; in = inch; LF = linear feet; min/in = minutes per inch; psi = pounds per square inch.

# INTRODUCTION

Ecological Tanks, Inc. assembles subsurface drip distribution (dispersal) systems for use with highly treated wastewater using Geoflow, Inc.'s WASTEFLOW® dripline and Netafim USA's BIOLINE® dripline. ETI's Drip Distribution Systems are subsurface onsite sewage disposal systems designed for use with the Aqua Safe® and Aqua Aire ® aerobic treatment systems, or other wastewater treatment systems with similar effluent quality. The heart of the system consists of small diameter tubing with evenly spaced emitters for micro-dosing the effluent disposal field. Small doses of effluent are dispersed in the root zone at regular intervals during the day. The system employs uniform distribution, dosing and resting cycles, shallow placement in the soil, and vegetation for evapo-transpiration. These features optimize soil absorption of treated wastewater and minimize soil saturation between doses. Drip distribution systems are effective over a wide range of soil and site conditions, and landscape positions.

Advantages of drip distribution systems for the disposal of treated wastewater include:

- Minimal lot excavation and soil disturbance for drip field installation.
- Reduced human or animal contact and associated health risks.
- Reduced ponding and run-off potential of treated wastewater.
- Water re-use for landscape irrigation.
- Tackles high water tables, tight soils, steep slopes, obstacles, and other limitations.
- Nutrient uptake by vegetation and reduced pollution.
- Warranty protection and maintenance agreement.
- Logically controlled for consistent, reliable operation.

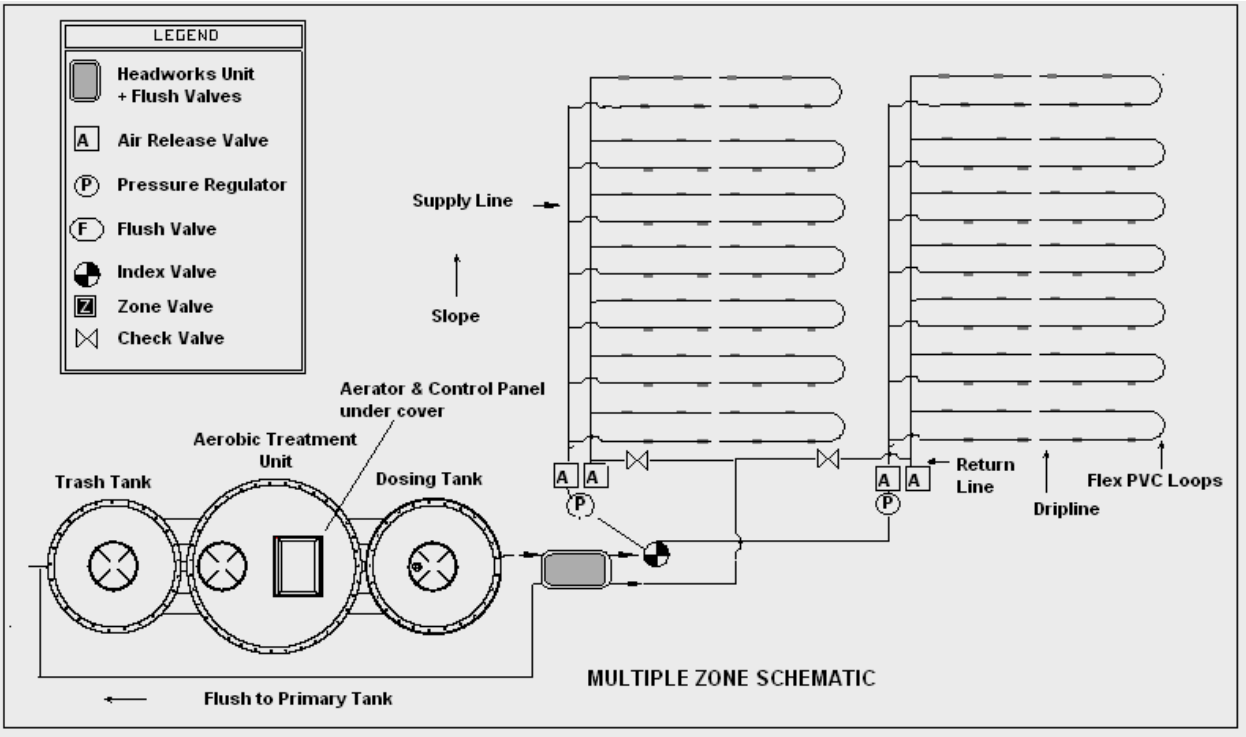
To assist designers, regulators, and installers, a package of pre-engineered drip distribution systems is included in this manual. Designers may use these pre-engineered systems to save time, or custom design a drip distribution system for specific soil and site conditions. The pre-engineered systems may facilitate easier local approval for a range of conditions that are detailed on page 18. The pre-engineered drip zones are to be used without modification and replicated to meet minimum area requirements of state or local regulations. A complete set of supporting calculations is available for inspection.

This manual and the pre-engineered drip distribution systems contained herein were developed with the aid of guidance presented in "Wastewater Subsurface Drip Distribution: Peer Reviewed Guidelines for Design, Operation, and Maintenance, EPRI, Palo Alto, CA, and Tennessee Valley Authority, Chattanooga, TN: 2004. 1007406."

NOTES

- WASTEFLOW® is a registered trademark of A. I. Innovations.
- BIOLINE is a registered trademark of Netafim USA
- Always follow your State and Local Regulations for onsite wastewater disposal.

DIAGRAM 1: TYPICAL DRIPFIELD LAYOUT




Subsurface Drip Distribution System for Onsite Wastewater Reuse and Dispersal

## A. SYSTEM COMPONENTS

ETI subsurface drip distribution systems contain the following components (See Diagram 1 above):

**1. ETI DRIPLINES** (See Appendix 1 for details)

Four types of dripline are provided by Ecological Tanks, Inc. under this manual, as follows:

ETI DRIPLINE 130 is a non-pressure compensating dripline with turbulent-flow emitters rated at 1.30 gph at 20 psi, manufactured by Geoflow, Inc. as WASTEFLOW Classic;

ETI DRIPLINE 102 is a pressure compensating dripline with turbulent-flow emitters, rated at 1.02 gph, and manufactured by Geoflow, Inc. as WASTEFLOW PC 1.02;

ETI DRIPLINE 62 is a pressure-compensating dripline with self-flushing, filtered emitters rated at 0.62 gph, and manufactured by Netafim USA as BIOLINE Dripper Line; and

ETI DRIPLINE 53 is a pressure-compensating dripline with turbulent-flow emitters, rated at 0.53 gph, manufactured by Geoflow, Inc. as WASTEFLOW PC 0.53;

All four driplines are ½-inch flexible tubing with evenly-spaced emitters which disperse effluent uniformly throughout the effluent disposal field. They are connected to PVC supply and return lines with special fittings. Standard emitter and line spacing is 24-inches. Other spacings may be necessary for soils with very low or high permeability. A single dripline, from supply to return line, is called a lateral. A lateral may be looped to form multiple 'runs' to fit in the available space. Driplines have no joints that may pull apart during installation and are ideal for tractor mounted burying machines. It is sold in 500 and 1,000-foot rolls. It is protected against root intrusion and bacterial growth for maximum longevity.

**2. DRIP LOGIC® CONTROL PANEL** (See Appendix 5)

The Model 218 Drip Logic Control Panel is designed to control and monitor the aerobic treatment unit, the pump and floats, and the drip distribution system in all modes of operation. Model 217 is similar to that described above, but is used for manual control of flushing functions, where approved.

**3. PUMPS AND PUMP TANKS** (See Appendix 11 for details)

ETI supplies the pump for each drip distribution system. Recommended pump tank capacity is at least one day's sewage flow above the high water float. Check your state or local regulations.

**4. FILTERS** (See Appendix 3 for details)

ETI drip distribution systems use specially-sized Screen (Spin Clean) Filters or Disc Filters in the headworks units to remove solids 100 microns or larger from the treated effluent. Screen filters are flushed at set intervals to remove buildup.

**5. SUPPLY AND RETURN LINES** (supplied locally)

The supply line carries treated effluent from the dosing tank to the drip field. Rigid PVC Schedule 40 pipe is sized to achieve recommended flushing velocities between 2 and 5 feet per second (fps). Pipe sizes may vary as a result. The ends of the dripline are connected to PVC supply & return lines with special lockslip fittings. Return lines are needed to flush each drip zone at regular intervals. The return line is directed to the pretreatment tank through the headworks unit. A check valve must be placed on the return line of each zone (2 or more) to prevent water from one zone entering another during the flush cycle.

**6. PRESSURE REGULATOR** (See Appendix 8 for details)

Pressure regulators fix the inlet pressure at a given rate and immediately precede each drip zone. Under normal operating conditions, pressure in the drip lines must be between 10 and 45 psi. For ETI Dripline130 the inlet pressure is set with a 20 psi regulator. A 40 psi pressure regulator is used for all pressure-compensating driplines to protect the emitters.

**7. AIR RELEASE VALVE** (See Appendix 6 for details)

Air release valves are used at the highest points of each drip zone, on the supply and return lines, to prevent back siphoning or a vacuum. They allow the system to depressurize and drain after each dosing and flushing cycle. Air release valves are fitted with Schrader valves.

**8. ZONE VALVES** (See Appendix 7 for details)

Automated multiple-zone dosing is done using mechanical index valves plumbed sequentially to 2-6 zones, or by a solenoid valve on each supply line, wired to the control panel, for 2 or more zones. Index valves must be installed higher than the supply line and headworks unit for proper operation. Individual zone solenoid valves should be used when the number of zones exceeds six (6).

**9. CHECK VALVES** (See Appendix 10 for details)

Check valves are placed on the return line of each zone (2 or more) for individual zone flushing and to separate zones during the dosing cycle. When slope exceeds 5%, check valves may be required on the supply lines to minimize drain back or accumulation at lower elevations. Check your state or local regulations.

**10. ETI HEADWORKS UNIT** (See Appendix 2 for details)

The ETI Headworks Units are pre-assembled for installation into the riser of the pump tank supplied by ETI, or in a separate cover box. Automatic and manual models are available; check your state or local regulations for use. Headworks units are placed within 30 feet of the pump and ahead of the zone valve.

### 11. VEGETATIVE COVER

A good vegetative cover is essential for evapotranspiration of soil moisture and to reduce soil erosion. Each installation must be seeded and mulched, or sodded, after construction, unless the existing grass cover is undisturbed.

## B. SYSTEM DESIGN

### 1. SELECT DISPOSAL FIELD AREA

A thorough soil and site evaluation must be performed by a professional soil classifier, professional engineer, or other qualified professional in accordance to local regulations. Soils that have not been disturbed or modified offer the best potential for infiltration in to the soil. The site evaluation should identify areas unsuitable for effluent disposal, including wetland areas, hydric soils, excessive slopes, fractured rock, Kharst geology, embankments, drainage ways, flood plains, flood prone areas, etc. The evaluation must provide accurate information on soil texture, structure, and percolation rate; depth to restrictive layers, seasonally high watertable, and other limiting factors; and the soil hydraulic loading rate, as prescribed by your state or local regulations. Select fill soil should be similarly evaluated. All surface water run-off, roof drainage, French drains, etc. must be directed away from the tanks and the drip field area.

### 2. EFFLUENT QUALITY

Drip distribution systems in this manual are designed for use with the Aqua Safe® and Aqua Aire® aerobic treatment systems, or with advanced treatments systems that meet the limits in TABLE 1 below, as determined in the test results for ANSI/NSF Standard 40 certification, or equivalent.

TABLE 1. EFFLUENT QUALITY PRECEDING THE DRIP DISTRIBUTION SYSTEM

| PARAMETER | MAXIMUM |
|---|---|
| CBOD (30-day max.) | 20 mg/l |
| TSS (30-day max.) | 20 mg/l |

### 3. SOIL APPLICATION

Always follow your state or local regulations. Applicable soil loading rates must be applied to the most restrictive soil horizon **within 24 inches** of the dripline elevation. When dripline is placed in fill soil, the minimum footprint of the fill must be based on the texture, structure, and permeability of the native soil. When calculating the total length of dripline needed, always round up to the next full drip lateral length, and ensure that drip zones are of equal size. Always choose the longest lateral and run lengths that can fit in the available space, especially for sloping sites and for tight soils.

### 4. DEPTH AND SPACING

Standard ETI Dripline has emitters every 2 feet and is installed on 2-foot (600 mm) centers; each emitter wets 4ft$^2$ of soil area. Lines are placed 6-12 inches below grade (check local regulations). Closer spacings may be needed in tight soils and coarse sands, since lateral water movement is reduced. Closer spacings require more dripline. Wider line spacings will not reduce the total length of

dripline needed, but may limit zone sizes due to elevation differences. PC Dripline tolerates greater elevation differences and is preferred on steep slopes.

## 5. SOIL LAYERS AND TYPES

Shallow installation is best for drip distribution systems. Topsoil is usually the most biologically active and permeable soil for accepting water. It dries faster after rain and usually has higher absorption rates. The quality and condition of the soil is critical. Soil that is undisturbed or in its native state will perform better than if graded, compacted by traffic, or otherwise modified. If soil is not prepared well, or if it contains construction debris, rocks, or mixed soils, uniform distribution will be difficult to achieve. The goal should be to insert the dripline into the drip field area with the minimum of soil disturbance. For select fill soils, extra care must be taken when handling the soil, to maximize infiltration and to minimize soil compaction.

## 6. ADDING FILL TO THE DISPOSAL FIELD

Some sites require additional fill to meet separation distances from restrictive layers. Restrictive layers may reduce downward movement of water or lead to surfacing of effluent during the year. Soils with high water tables are of particular concern. ETI Dripline may be placed in select fill soil above natural grade. Effective infiltration into the native soil is essential. The minimum area of fill needed must be based on the infiltration rate of the native soil to prevent hydraulic overload. Check your state or local regulations.

If fill material is used, it must be compatible with the native soil, in terms of texture and percolation. The area to receive fill must have all vegetation removed and be scarified. An initial layer of fill soil must be mixed with the native soil to form a good transition between the two soils, while avoiding compaction. Compaction can be minimized using light-weight equipment and by keeping equipment off the fill as much as possible. The remainder of the fill soil must be placed in lifts per design specifications. The fill soil should be crowned from the center to shed rain. All surface water run-off must be diverted away from the drip field area. A uniform permanent vegetative cover is required over the drip field for evapo-transpiration. If possible, fill should be allowed to settle for seven days or more before installing the dripline. The dripline should be inserted using a vibratory plow or similar equipment, after the mound/controlled fill has been prepared. If backfilling is used, care must be taken not to create an artificial barrier to the downward movement of water and to keep the drip lines from shifting.

## 7. BACKFLOW PREVENTION

A problem can occur after pump-shut off, leading to backflow through the supply line, or accumulation of water at lower elevations. For this reason drip fields should be equipped as follows:

a. Drip lines laid level along the contour;
b. Air release valves at the highest points on supply and return lines in each zone;
c. Check valve on the return line, each zone (2 or more)(may be required on supply line if slope ≥ 5%)
d. Driplines dosed to the bottom and flushed from the top; and
e. Driplines connected to supply and return lines over a 3” soil berm (optional).

## 8. HILLY SITES

ETI Driplines should be stretched to the maximum length possible in the space available, along the contour, as shown below left. For slopes over 20%, driplines should be spaced at least 36 inches apart. Check your state or local regulations. Wider spacing will not reduce the length of dripline required, but may limit zone size due to elevation differences. PC dripline is better on steep slopes.

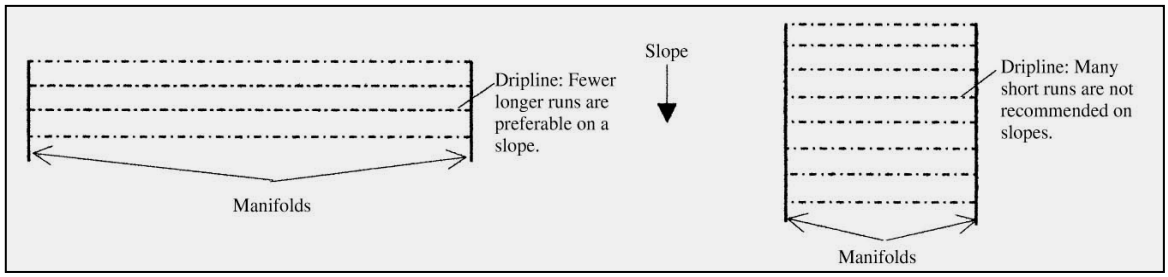



DIAGRAM 2. OPTIMUM DRIP FIELD LAYOUT

## 9. MULTIPLE ZONES

Dividing drip fields into zones is done to minimize pressures needed for dosing and flushing; to enhance soil absorption with frequent rest periods; to reduce low head drainage; and to minimize dosing and flushing volumes. Mechanical index valves are often used for 2 to 6 drip zones. Alternatively, a solenoid valve may be used on each supply line for 2 or more zones, and wired to the control panel. Table 2 below gives specifications for zones based on 24-inch spacing for driplines and emitters. Consult Ecological Tanks, Inc. for wider or narrower spacings. Drip laterals may be looped to form two or more runs as indicated. Choose the longest lateral and run lengths for the available space. A single Headworks Unit is used to dose and flush each zone. Each zone requires a check valve on its return line to isolate it from the other zones during flushing. A complete drip design requires calculation of the flow rates, friction losses, and total dynamic head for dosing and flushing phases, with specified sizes of pipes and other components, for a hydraulically balanced system, which meets minimum velocities and other standards. Contact ETI for the design spreadsheet and assistance.

TABLE 2. DRIP ZONE CONFIGURATION.

| ETI DRIPLINE | MAXIMUM LATERAL LENGTH **(LF)** | MAXIMUM NUMBER OF ZONES* | PRESSURE REGULATOR **(psi)** | MAXIMUM ELEVATION DIFFERENCE **(ft./per zone)** |
|---|---|---|---|---|
| **130** **(Non-PC 1.3 gph)** | 210 | 6 | 20 | 6 |
| **102** **(PC 1.02 gph)** | 210 | 6 | 40 | 20 |
| **62** **(PC 0.62 gph)** | 400 | 6 | 40 | 20 |
| **53** **(PC 0.53 gph)** | 300 | 6 | 40 | 20 |

*Use individual solenoid zone valves for more than six zones.

## 10. INSTANTANEOUS LOADING RATE

In some states it is necessary to determine the amount of water that can be applied to the soil, taking into account evapotranspiration, soil percolation, and rainfall. The result may reduce the soil loading rate and increase the size of the drip field, for the most critical month for rainfall and evapotranspiration. Please consult Ecological Tanks, Inc. for assistance, if needed.

The instantaneous water loading rate is derived from the following:

$$\text{Instantaneous Loading Rate (min/in)} = \frac{[231 \times \text{emitter flow rate (gph)}] \div 60}{\text{emitter spacing (in)} \times \text{line spacing (in)}}$$

**11. CHECKLIST:**

A sample checklist is provided on page 20-21, covering system design and installation. It is designed to assist the designer, regulator, and installer. Use the checklist to guide design steps and documentation required for permit application. Submit a copy to the regulator with the permit application and for subsequent use by the installer. A copy of the checklist completed by the installer should be given to the owner, regulator, and designer. Contact Ecological Tanks, Inc. for printed or electronic copies of the checklist.

## C. SYSTEM INSTALLATION

### 1. INSTALLATION GUIDELINES

All ETI drip distribution systems require:

a. Advanced wastewater treatment
b. Pump tank & pump matching operating conditions
c. A headworks unit containing:
    i. Screen or Disc filters
    ii. Field & Filter flush valves
    iii. Pressure gauge & flow meter (optional)
d. Zone indexing valve for two or more zones
e. Supply & return lines of Schedule 40 PVC
f. Pressure regulator for each zone
g. Air valve at highest point on supply and return lines
h. Check valve on return line for each zone

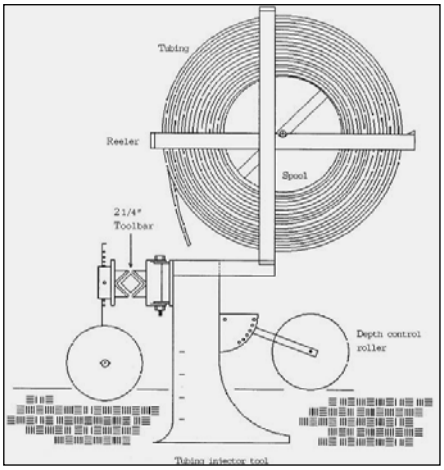



DIAGRAM 3. DRIPLINE INSTALLATION TOOL

Handle the dripline and other components with care. Avoid extreme temperatures. Store the dripline away from direct sunlight in a cool place.

1. All drip field construction shall meet state or local rules and regulations.
2. No utilities, cable wire, lawn irrigation systems, storm drains, etc. in the drip field area.
3. Fence off or flag entire drip field area for protection until installation begins.
4. Do not install drip system when the ground is wet or frozen. Do not smear or compact soil.
5. Divert all downspouts, surface waters, French drains, etc. away from drip field area.
6. Excavating and grading should be minimized and finished before installing the dripline.
7. Have all parts & components onsite before installation begins. Pre-assemble components before installation. Riser units should be pre-assembled; supply and return lines with tees may also be pre-assembled and used to mark the beginning and end of the drip lines.
8. Mark the four corners of the field. The top two corners should be at the same elevation and likewise for the bottom two corners.
9. Install a watertight pump tank with watertight riser. Fill with water.
10. For freezing conditions all components should drain to pump or pretreatment tank.
11. Supply and return lines must be of the sizes specified by designer and be Schedule 40 PVC.
12. Install the PVC supply line from pump tank & Headworks unit through one lower and one upper corner stake of the drip field.
13. Mark dripline spacing at beginning & end of each run/lateral.
14. Insert full length of dripline from the supply line to return line, + 2' each end, 6″ to 12″ deep. Use Flex PVC Loops (solid tube) to connect runs. Tape the ends. Continue for all lines. Depth of the dripline must be uniform along the contour. Keep dirt out of driplines.
15. Install the supply manifold and connect to bottom run of driplines, if looped.
16. **Do not glue the dripline.** Using Lockslip fittings (See Appendix 1 for directions):
    a. Hold the fitting in one hand and position the tubing with the other hand.
    b. Move the sleeve back, and push the tubing onto the exposed stem as far as possible.
    c. Push the sleeve out over the tubing and thread the sleeve onto tubing, as though tightening a nut to a bolt. Hand tighten only. **Do not use tools.**
    d. Test the connection to make sure the sleeve threads have gripped the tubing tightly.
16. Dig return line ditch & install return line to drain to pre-treatment tank through Headworks unit.

Install check valve on the each return line for 2 or more zones.

17. Install air release valves at the highest points on supply and return lines. Use Teflon tape.
18. Install the Headworks Unit in pump tank riser or within 30 feet of pump tank. **Check for approval.**
19. For 2 or more zones, install index zone valve (check model number, # outlets = # zones), or individual solenoid valve for each zone, on supply line after the Headworks unit. Index zone valves must be higher than drip zones and Headworks Unit for proper function.
20. Install pressure regulator on the supply line for each drip zone with valve cover box. May be placed before zone valves in some situations; check with ETI.
21. Install Control Panel & follow wiring directions. Wire pump, floats, aerator, solenoid valves, etc. to panel. Set program as specified for: dose-on time; dose-off time; filter flush time; field flush time, field flush frequency, etc. See Appendix 5.
22. Remove duct tape from dripline ends. Turn pump on. Flush each zone for 5 minutes. Shut pump off. Connect driplines with Lockslip fittings to return line. **Do not kink the dripline.**
23. Open the field flush valve. Turn on pump. Close valve and check each zone for leaks.
24. Turn off. Turn on. Check and record all pressure readings & compare to design specs.

TABLE 3. SUBSURFACE DRIP INSTALLATION METHODS

| INSERTION METHOD | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| a) Hand Trenching | • Handles severe slopes and confined areas | • Slow<br>• Labor intensive<br>• Disturbs existing turf and ground<br>• Back fill required |
| b) Oscillating or vibrating plow. Use top-feed method to prevent stretching of drip tube. | • Fast in small to medium installations<br>• Minimal ground disturbance<br>• No need to back fill the trench | • Depth has to be monitored closely<br>• Not for slopes over 20%<br>• Requires practice to set and operate adequately |
| c) Trenching machine<br><br>**• Not for clayey/silty soils** | • Faster than hand trenching • May use the 1″ blade for most installations<br>• Uniform depth | • Slower, requires labor<br>• Disrupts existing turf<br>• Back fill required |
| d) Tractor with dripline insertion tool - see diagram 3. above. Use top-feed method to prevent stretching of drip tube. | • Fast<br>• Less damage to existing turf<br>• Minimal ground disturbance<br>• Does not stretch drip line<br>• Adaptable to any tractor | • The installation tool is designed specifically for this purpose.<br>• Equipment not readily available |
| e) Tractor mounted 3-point hitch insertion implement | • Fastest.<br>• Rolls soil over drip line | • Suitable for large installations |
| f) Other Method as approved | | |

NOTE: Excessive handling affects soil structure and permeability. Keep to a minimum for best results.

## 2. WINTERIZATION

Buried drip systems are not prone to frost damage if allowed to drain rapidly after each dose through the use of air release valves, and other features. ETI Dripline is made of polyethylene and is not susceptible to freezing. It drains through the emitters so will not be full of water after pumps are turned off. In colder climates, with extended freezes, use the following precautions:

a) Supply lines and return lines must be sloped back to the dosing or pre-treatment tanks. Lines must drain rapidly. Return and supply lines may be insulated or buried below frost-line. The system must drain completely after dosing & flushing cycles.
b) Remove the check valve at the pump. Be sure zones can self-drain rapidly.
c) Check supply and return pipe sizes to ensure rapid drain back.
d) Insulate equipment (Headworks Unit, valve boxes, zone valve, pressure regulator, and vacuum relief valves) with Perlite, heat tape, small heater, or by other means.

e) The top of air release valves must be no higher than soil surface.
f) Keep good cover crop over the dripfield; add hay or straw to insulate, if necessary.
g) Mark the valve boxes with metal pins for locating under snow cover.
h) If using manual flush valves, they should be left cracked open while avoiding excessive pressure loss.
i) Fields dosed with relatively small quantities of effluent are more likely to freeze. If winter use is less than summer use, use fewer zones to maintain water application rates.

## 3. PARTS LIST

TABLE 4. ETI DRIP DISTRIBUTION SYSTEM PARTS LIST

| PART NAME | PART NUMBER(S) | PART NAME | PART NUMBER(S) |
|---|---|---|---|
| ETI Dripline 130 | WFNPC13024, 13018, & 13012 | Zone Index Valve | 6402, 6403, 6404, 6605, 6606 |
| ETI Dripline 102 | WFPC10224, 10218, & 10212 | Pressure Regulator | PMR-20LF, PMR-40LF, PMR-20MF, PMR-40MF, PMR-20HF, PMR-40HF |
| ETI Dripline 62 | BLPC 6224, 6218, & 6212 | Solenoid Zone Valve | SVLV100, SVLV150 |
| ETI Dripline 53 | WFPC 5324, 5318, & 5312 | Drip Logic Control Panel | 218, 218-2, 218-6, 218-6D 217 |
| Headworks Unit (Screen Filters) | DHWA075/DHWM075 DHWA100/DHWM100 DHWA150/DHWM150 | Headworks Unit (Disc Filters) | DHWM075D DHWM100D DHWM150D |
| Screen Filter | AP4E075, AP4E100, AP4E150 | Disc Filters | AKD075, AKD100, AKD100S, AKD150, AKD15S, AKD200 |
| Pumps | See Table in Appendix 11 | Floats | FL1 Jr. Super Single, FL2 Mini Sensor, FL3 Super Single |
| Pressure Gauge | 450818 60psi ¼" NPT LM | Air Release Valve | APVBK-1 |
| Filter Flush Valve | SVLV100, SVLV150 | Field Flush Valve | SVLV100, SVLV150 |
| Check Valve | NIBCOCKV ¾", 1", 1¼", 1½" | Flow Meters | MM⅝, MM¾, MM1, MM1½, MM2 |
| Drip Field Fittings | LTC600, LTslip600, LTTee600, LTMPT600 | Drip Field Fittings (for Dripline 62 only) | TLCOUP,TLCROS, TLEL, TL075FT, TL050MA, TL075MA, TLT, TLSOV, TL8 |

## D. SYSTEM MAINTENANCE

To ensure years of trouble free service from a drip distribution system it must receive regular maintenance. Drip distribution systems are designed to receive treated wastewater from an Aqua Safe® or Aqua Aire® aerobic treatment unit, or equivalent, for which regular maintenance is required every six (6) months, by a licensed, trained, and authorized service provider.

### ROUTINE AND PREVENTATIVE MAINTENANCE

- ☐ Check control panel and all functions of advanced treatment system.
- ☐ Clean or replace filter. Should not exceed 5 psi pressure drop. The filter cartridge should be cleaned to remove all debris. If buildup is severe, soak in detergent, 50% bleach bath, or similar.
- ☐ Open the field flush valve and flush the field for 5 minutes by activating the pump in "manual" mode. Close the flush valve. On solenoid valves the manual bleed lever should be left in the 'Off' position and the dial on top should be free spinning. Clockwise rotation closes the valve.
- ☐ With the pump in the "manual" mode, check pressures in the drip field and Headworks Unit using a Schrader valve located on the air vent or by reading the pressure gauges provided. The pressure should agree with initial installation readings. On systems with manual flush valves, close the field flush valve completely and then open slightly while avoiding excessive pressure loss or until design pressure is achieved. This will allow the field to drain after each dose.
- ☐ Check air release valves for proper operation. They should seal completely after the pump is activated. If water is ponded or leaking, remove the valve cap, press down on ball, & clear away debris. Use latex gloves. Check flush valves.
- ☐ Check zone indexing valve (or individual zone valves) to ensure that all ports are operative and that the valve is self-draining. Zones are designed to be dosed in sequence.
- ☐ Turn off the pump and reset the control panel to "auto" mode.
- ☐ Visually check and report the condition of the drip field for wet spots.
- ☐ Effluent samples may be collected for periodic testing of effluent quality. Consult laboratory for proper sampling techniques.
- ☐ Record the pump counter, flow meter, pressure gauge readings, field conditions, parts replaced or repaired, and other work performed, below. Compare with original readings. Adjustments should be made to restore all features to design specifications.

**DRIP SYSTEM FIELD MEASUREMENTS**

Pressure (psi) Dose - Filter___; Headworks unit ___; Zone 1___; Zone 2___; Zone 3___; Zone 4___; Zone 5___; Zone 6 ___

Flush - Filter___; Headworks unit ___; Zone 1___; Zone 2___; Zone 3___; Zone 4___; Zone 5___; Zone 6___

Flow Meter (g) _____(record all digits) Date:_____

List parts replaced, repaired, & observations:_____
_____
_____
_____
_____
_____
_____

**Owner's Name**_____ **Address**_____
**City**_____ **State**_____ **Zip** _____ **Serial #**_____ **Model #**_____
**Service Provider**_____ **Contract#** _____ **Phone #**_____ **License#**_____
**Company Name**_____ **Service Date**_____ **Next Service**_____ **Signed**_____

# HOME OWNER'S GUIDE FOR MAINTAINING A DRIP DISTRIBUTION SYSTEM

A drip distribution system is installed on your property for dispersal of treated wastewater. The system uses 1/2" diameter drip tubing installed 6-12 inches below grade. It is designed to carefully dispose of the effluent into the root zone of your lawn. The system will work for many years if regular maintenance is done twice a year, along with the following:

## Do

- ☐ Continue the maintenance contract for semi-annual inspections and maintenance by a licensed service provider trained and authorized by Ecological Tanks, Inc.
- ☐ Maintain all plumbing fixtures to prevent excess water from entering the system. Add a drop of food coloring to your commode tank. If color appears in the bowl, repair the leak.
- ☐ Divert all downspouts, roof water, or run-off from up slope away from all tanks and the drip field.
- ☐ Maintain healthy grass cover over the drip field to enhance evapotranspiration, and to minimize soil erosion.
- ☐ Contact your service company if a high water alarm or other malfunction should occur. In the event of a high water alarm, reduce your water consumption where possible until the problem is corrected.
- ☐ Have your tanks pumped when recommended by the service provider.
- ☐ Contact your service provider if you notice wet areas over the drip field. In most cases, this may be caused by a loose fitting and can be easily repaired.
- ☐ Keep good records of all service calls, repairs, tank pumpings, or other work performed on your system, together with the permit, and engineering plans.

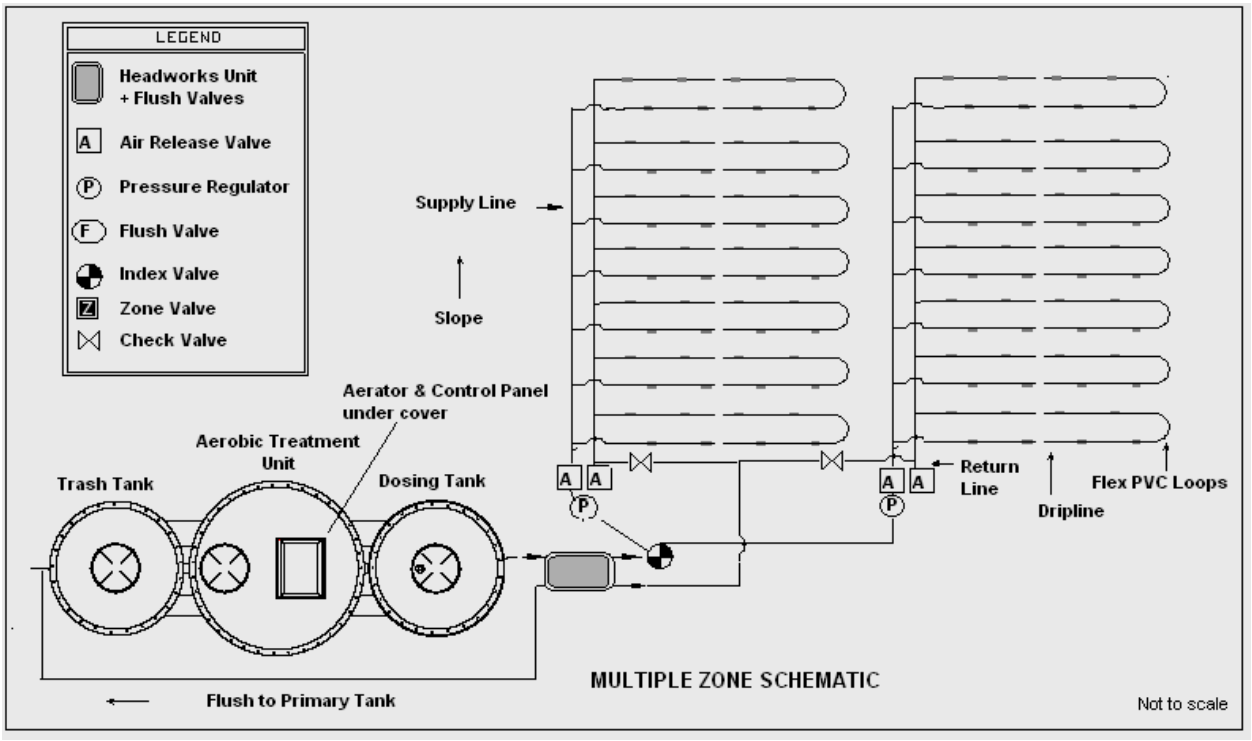
## Don't

- ☐ Allow utility lines, cables, lawn irrigation systems, storm drains, French drains, swimming pool, or similar items to be installed near the drip field or other parts of the system. (Check engineering plans approved for your system).
- ☐ Drive cars, trucks, or other equipment heavier than conventional lawn mowers over the drip field area, or over any tanks or valve boxes.
- ☐ Dig, excavate, pave, or disturb the soil or lawn over the drip field or tanks.
- ☐ Dispose of paints, cleaners, solvents, motor oil, bleach, prescription drugs, additives or enzymes, grease, or similar materials through your house plumbing system.
- ☐ Use additives of any kind which may disrupt the chemistry of the advanced treatment system installed with your drip field.

| | TROUBLE SHOOTING GUIDE: |
|---|---|
| **Symptom:** | High water alarm activates periodically (1-2 times/week). During other times the water level in the pump chamber is at a normal level. |
| Possible cause: | Peak water usage (frequently laundry day) causing temporary high water. |
| Remedy 1: | Space out wash loads evenly over a 7-day period. |
| Remedy 2: | Set timer to activate the pump more frequently. Be sure to not exceed the total design flow. To avoid this, reduce the duration of each dose. |
| Remedy 3: | Provide a larger pump tank to accommodate the peak flow periods. |
| **Symptom:** | High water alarm activates during or shortly after periods of heavy rainfall. |
| Possible cause: | Infiltration of ground/surface water into system. |
| Remedy: | Identify sources of infiltration (tank seams, pipe connections, risers, etc). Repair. |
| **Symptom:** | High water alarm activates intermittently, including times when it is not raining or when laundry is not being done. |
| Possible cause: | A toilet or other plumbing fixture may be leaking sporadically but not continuously. Check water meter readings for 1-2 weeks to determine if water usage is unusually high for the number of occupants and their lifestyle. Also determine if water usage is within design range. |
| Remedy: | Identify and repair all leaking fixtures. |
| **Symptom:** | High water alarm activates continuously on a new installation (less than 3 months of operation). Inspection of the filter indicates it is plugged with a gray colored growth. Water usage is normal. |
| Possible cause: | Slow start-up of treatment plant with increased nutrient in effluent causing a biological growth on the filter. This is typical of lightly loaded treatment plants that receive a high percentage of gray water (i.e., from showers and laundry). |
| Remedy: | Remove and clean filter cartridge in a bleach solution. Advise owner of proper loading and waste strength for advanced treatment system. |
| **Symptom:** | Water surfaces continuously in isolated spots, each one foot or more in diameter. |
| Possible cause: | Damaged drip line or a loose connection is allowing water be discharged under pressure and therefore at a much greater volume than intended. |
| Remedy: | Dig up drip line. Activate pump and locate leak. Repair as required. |
| Possible cause: | If water is at base of slope, can be caused by low-head drainage. |
| Remedy: | Install check valves and air vents in the manifolds to redistribute water in the system after pump is turned off. This is not advised for freezing climates where manifold drainage is required. |
| Possible cause: | Area of drip field was inadequately sized and is too small. |
| Remedy: | Provide additional soil analysis to verify sizing and enlarge as required. |
| **Symptom:** | A portion of the drip field closest to the supply line is saturated while the rest of the field is dry. |
| Possible cause: | Insufficient pump pressure. Check pressure at the return line for 10 psi or 15psi for PC. |
| Remedy 1: | Check filter and pump intake for build up & clean as required. |
| Remedy 2: | Leaks in the system may result in a loss of pressure. Check for water leaks in connections and fittings or wet spots in the field. Also check air vents to insure they are closing properly. Repair as necessary. |

| | TROUBLE SHOOTING GUIDE: Continued |
|---|---|
| Remedy 3: | Pump is worn or improperly sized. Pressure at supply line is less than design. Verify pressure requirements of system and replace pump if undersized. As an alternative, the drip field may need to be divided into two or more zones. |
| Possible cause: | The duration of each dose is too short to allow the drip field to pressurize before the pump shuts off (or runs for only a brief time before turning off). |
| Remedy: | Increase the pump run time and decrease the frequency of doses. Always calculate (or observe during field operation) how long the system takes to fully pressurize and add this time to the design Dose-On time. |
| Possible cause: | Air release valves not fully closed after pump is activated. Ball may be stuck, or debris may be preventing complete seal. |
| Remedy: | Open & check air release air release valves; remove any debris or buildup; ensure ball is free and clear. Reactivate pump to ensure proper function. |
| **Symptom:** | High water alarm begins to activate continuously after a long period (1-2 years) of normal operation. Inspection of the filter indicates it is plugged with a heavy accumulation of sludge. |
| Possible cause: | A buildup of solids in the pump tank carried over from the treatment plant. |
| Remedy: | Replace the filter cartridge with a clean cartridge. Check the pump tank and if an accumulation of solids is noted, pump the tanks. Also, check the operation of the treatment plant to insure it is operating properly. |
| **Symptom:** | Water surfaces at several spots in drip field during dosing. Installation is recent, less than 6 months, and the soil is a moderate to heavy clay. |
| Possible cause: | Smearing of the soil may have occurred during installation of drip line. Also, the “cut” resulting from the installation may allow a path for the water to surface during dosing. |
| Remedy: | In most cases the sod will compact naturally around the drip line and surfacing will diminish and ultimately cease. To help, compress soil lightly over driplines; reduce the duration of each dose and increase the number of doses/day. Also, it will help to seed the area to encourage the development of a good root zone. |
| **Symptom:** | Entire area of drip field is wet, soft and spongy & appears totally saturated with water. Situation occurs during dry season when there is little rainfall. |
| Possible cause: | Water being discharged to drip field exceeds design. Excess water may be a result of infiltration, plumbing leaks or excessive water usage. |
| Remedy: | Check water meter, flow meter, & control panel to determine water usage. Check for leaks or infiltration & repair required. Reduce water usage by installing water saving fixtures, or enlarge drip field. |
| **Symptom:** | Valve will not open manually |
| Remedy: | Check water supply and master or gate valves to insure they are open. Check that the valve is installed with the arrow pointing downstream. Check that the flow control is fully open, counterclockwise. Turn off water supply. Remove the solenoid and check for debris blocking the exhaust port. Remove the cover. Check diaphragm for damage and replace, if necessary. |
| **Symptom:** | Valve will not close |
| Remedy: | Insure the manual bleed lever is in the Off/Closed position. Check for leaks around the flow control, solenoid or between the valve cover and body. Turn off the water supply. Remove the solenoid and check for debris or damage to the exhaust port. Remove valve cover and inspect for debris under diaphragm or debris in diaphragm ports. |
| **Symptom:** | Slow leak |
| Remedy: | Check for dirt or gravel embedded in the diaphragm seat.<br>Check actuator and exhaust fitting for proper seating. |
| **Symptom:** | One drip zone is soggy or over saturated, others are dry; run-off may be visible. |
| Cause: | Index valve may not be rotating to dose each zone. |
| Remedy: | Check to ensure index valve is able to de-pressurize after pump shut off; open index valve to ensure that inner cam can rotate freely; remove any debris or build-up. |

# PRE-ENGINEERED DRIP DISTRIBUTION SYSTEMS




For fast, reliable, and straightforward application of drip distribution technology, Ecological Tanks, Inc. has prepared a package of pre-engineered drip distribution zones for use with the Aqua Safe® and Aqua Aire® Aerobic Treatment Systems for a range of soil and site conditions, specified in TABLE 5, below. Each drip distribution zone in TABLE 6 below has been pre-engineered to facilitate local review and approval of drip distribution systems. The designer may use these pre-engineered drip distribution zones, or custom-design an installation for specific soil and site conditions.

TABLE 5. STANDARD PROVISIONS FOR PRE-ENGINEERED DRIP ZONES

| PARAMETER | SPECIFICATION |
|---|---|
| Soil Texture Range | Loamy Sand to Clay (non-shrink swell) |
| Soil Hydraulic Loading Rate ($g/ft^2/d$) | 0.5-0.05 |
| Maximum Slope (%) | 20 |
| Maximum Elevation (pump to drip line) (ft) | 30 |
| Maximum Distance, Pump to Headworks (ft) | 30 |
| Maximum Supply Line Length (headworks to drip line) (ft) | 200 |
| Maximum Return Line Length (drip line to headworks) (ft) | 200 |
| Maximum Return Line Length (headworks to pre-tank) (ft) | 30 |
| Drip Line Spacing (in) | 24 |
| Drip Emitter Spacing (in) | 24 |
| Minimum Operating Pressure (psi) | 20 for Non-PC; 10 for PC |
| Standard Field Flush Frequency | 1/30 (31 even zones) doses |
| Standard Filter Flush Frequency | 1/dose |

TABLE 6. PRE-ENGINEERED DRIP ZONES FOR ETI DRIPLINES.

| ETI Dripline | 130* | | 102* | | 62♪ | | 53* | |
|---|---|---|---|---|---|---|---|---|
| Zone Area, $ft^2$ | 1260 | 2520 | 1680 | 2940 | 2400 | 4000 | 3000 | 4800 |
| Zone Length, LF [c] | **630** | **1260** | **840** | **1470** | **1200** | **2100** | **1500** | **2400** |
| Lateral Length, LF | 210 | 210 | 210 | 210 | 300 | 300 | 300 | 300 |
| Minimum Run Length, ft | 30 | 30 | 30 | 52 | 30 | 50 | 50 | 50 |
| Laterals/Zone (see note below) | 3 | 6 | 4 | 7 | 4 | 7 | 5 | 8 |
| Pressure Regulator, psi | 20 | 20 | 40 | 40 | 40 | 40 | 40 | 40 |
| Average Emitter Rate (gph) | 1.39 | 1.38 | 1.02 | 1.02 | 0.62 | 0.62 | 0.53 | 0.53 |
| Filter Size, in | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Supply Line Size, in | 1.50 | 2.00 | 1.50 | 2.00 | 1.50 | 2.00 | 1.50 | 2.00 |
| Return Line Size, in | 0.75 | 1.25 | 1.00 | 1.25 | 1.00 | 1.50 | 1.00 | 1.50 |
| Pump Size, HP | ½ | 1 | ½ | 1 | ½ | 1 | ½ | 1 |
| Dosing Rate, gpm | 7.30 | 14.49 | 7.14 | 12.50 | 6.20 | 10.85 | 6.63 | 10.60 |
| Flushing Rate, gpm | 4.44 | 8.89 | 5.92 | 10.36 | 6.36 | 11.13 | 7.40 | 11.84 |
| Total Flow, gpm + 5% | **12.32** | **24.56** | **13.71** | **24.00** | **12.56** | **23.08** | **14.73** | **23.56** |
| Total Dynamic Head, ft | **135.04** | **136.54** | **112.61** | **111.33** | **111.49** | **132.40** | **136.57** | **135.97** |
| Pump Selection | **A** | **B** | **A** | **B** | **A** | **B** | **A** | **B** |
| Time to Pressurize, min. | **1.08** | **1.09** | **1.45** | **2.79** | **2.57** | **2.79** | **2.79** | **2.79** |

* Geoflow Classic 1.30 gph, PC 1.02 gph, & PC 0.53 gph, respectively; ♪ Netafim Bioline PC 0.62 gph.

Each column above contains specifications calculated to ensure a hydraulically balanced drip distribution system with minimum flushing velocities, and minimum dosing and flushing rates to match the pumps supplied by ETI. The figures were calculated to provide sufficient hydraulic head, dose volume, and pump capacity to handle the range of conditions listed in TABLE 5. As a result, the following features have been pre-engineered and fixed:

| | | | |
|---|---|---|---|
| Zone Size | Min. Run Length | Filter Size | Supply Line Size Return |
| Line Size | Pump Size | Dosing Flow | Flushing Flow |
| Total Flow | Total Dynamic Head | | |

ETI supplies two pumps selected to match the hydraulic requirements of the drip distribution systems shown above. The pumps are as follows (See pump curves in Appendix 11):

A. 20EB05 20 gpm ½ HP 1 Phase 115 V
B. 20EB10 20 gpm 1 HP 1 Phase 230 V

The selected pre-engineered zone from TABLE 6 must be replicated a sufficient number of times to achieve the minimum drip field area required by state or local regulations, for a specific daily sewage flow and soil application rate. Once a selection is made, the specifications in the relevant column must be incorporated without modification into the plot plan and design drawings required for the permit application. Supporting calculations for each pre-engineered drip distribution zone are available for inspection upon request. All drip distribution systems, whether pre-engineered or custom-designed, require a minimum flushing velocity of 2 feet per second.

If soil or site conditions fall outside the limits shown in TABLE 5, a custom design will be necessary. For these situations ETI will supply the design spreadsheet to assist the designer. Such custom designs may involve steeper slopes, narrower or wider dripline spacing, and other modifications.
**Note:** Drip laterals in the pre-engineered drip zones above may be looped multiple times to fit in the available space. While TABLE 6 specifies a minimum length of 'run' for each zone design, it is best to maximize the length of run to the extent possible, especially on slopes. The longest possible run lengths should be used in the space available.

## Calculating the Minimum Number of Zones

The following steps should be used to determine the minimum number of pre-engineered drip zones for a site:

| STEP | PARAMETER | RESULT (example) |
|---|---|---|
| 1. Determine | A. Daily Sewage Flow (gpd) | ____ ( 900) |
| 2. Determine | B. Soil Loading Rate (gpd/ft$^2$)* | ____ ( 0.4) |
| 3. Calculate | C. Minimum Drip Field Area (ft$^2$) | A/B____ ( 2250) |
| 4. Calculate | D. Minimum Length of Drip Line (LF) | C/2____ ( 1125) |
| 5. Select | E. Pre-Engineered Drip Zone Length (LF) | ____ ( 840) |
| 6. Calculate | F. Number of Zones for Drip System | D/E____ (1.34 **2**)† |

* Derived from state/local regulations & site evaluation.

† Round up to the next whole number.

## Programming the Control Panel

It will be necessary to calculate the following settings for the Drip Logic Control Panel:

A. Number of Zones = ___

B. Doses/Zone*= ___ 3 ___4 ___5 ___6 ___Other = ___
*(The minimum number of doses per day for a drip distribution system should not be less than 6)

C. Dose Volume = $\frac{\text{Daily Sewage Flow}}{\text{A x B}}$ = ___ g

D. Dose-On Time = (0-30 min) C ÷ Dosing Rate, gpm + Time to Pressurize = ___ min.

E. Dose-Off Time (Absorption) = (0-4 hrs) $\frac{\text{1440 min.s} - \text{D}}{\text{A x B}}$ = ___ min.

F. Filter Flush Time (0-60 sec)(for Screen Filters) = 10 sec.

G. Field Flush Time (0-15 min)(standard setting) = 5 min.

H. Field Drain Time (0-15 min)(standard setting) = 15 min.

I. Doses/Field Flush (matched to number of zones) (standard setting) = 30 (31 even)

It is recommended that a copy of the "ETI Drip Distribution System Checklist," included in this manual, be used and submitted with the permit application, design drawings, and other documents, for the regulatory review. All the specifications should be entered in Part B of the checklist, including the program settings D, E, F, G, H, and I. A copy of the prepared checklist and approved design should also be passed along to the installer to guide the installation. Upon completion and approval of the installation, the installer should provide a copy of the completed checklist to the owner, regulator, and designer.

Project Name:_____ New ___ Repair __ Street: _____
S/D, Development:_____ Res. ___ Comm.__ City: _____ Zip:_____
Designer: _____ Single ___ Cluster__ County: _____ Date:_____
**Dwellings**: ____ **Bedrooms**:_____ **Peak Flow**:_____ g/d **BOD:**_____ mg/l **Perc. Rate**: _____ min/in **Restrictive Layer**: ____ in **Soil Text.**: _____

# ETI DRIP DISTRIBUTION SYSTEM CHECKLIST, Part A

Sample

Designer:_____ (copy to regulator) Regulator:_____ (copy to installer) Installer:_____ (copy to designer & regulator)

**DOCUMENTS** (for designer)

**___ 1. Permit Application, including:** **√= yes x=no**

**___ (a) Vicinity map of property. ___ (b) Legal description ___ (c) Plot plan to scale, with:**

**LOT FEATURES** (for designer)

___ 1. Lot dimensions.
___ 2. Location of proposed dwelling and driveway.
___ 3. Any existing or proposed cut or fill area.
___ 4. Proposed location of all tanks.
___ 5. Proposed location of the drip field and layout.
___ 6. Proposed location of drip field duplication area.
___ 7. Relative elevations of the lot and slope (contours).
___ 8. Location of drainage features and direction of flow.
___ 9. Results & locations of soil tests performed
___10. Location of all underground utility lines.
___11. Location of other structures.
___12. Location of all surface waters, flood zones, wetlands, etc.

**OSS SETBACKS***

Treatment System: _____

(a) ____ feet - dwelling.
(b) ____ feet - property line.
(c) ____ feet - potable water line.
(d) ____ feet- in-ground pool.
(e) ____ feet -drainage feature
(f) ____ feet -surface waters.
(g) ____ feet - tanks to potable water source.
(h) ____ feet- EDF to potable water source.
(i) _____feet - public water well
(j) _____ feet - a sinkhole
(k) _____inches – restrictive layer

* Follow state or local setback requirements.

**DRIP SYSTEM FEATURES** (for designer)

___ 1. Location of advanced treatment system, & related components.
___ 2. Location of pump tank, control panel, & electrical conduit, with 14-gauge wire, from power source.
___ 3. Location of headworks unit, zone valve (s) (2 or more zones), & all supply & return lines.
___ 4. Layout of all zones showing line spacing, connections to supply & return lines, pressure regulators, check valves, air release valves, & other features.
___ 5. Spot elevations for key components of OSS, including:-
___ 6. All zones & lines level, & parallel to contour.
___ 7. Pipe sizes shown (supply, return, pump discharge, etc.)
___ 8. Supply line dosing to bottom of laterals.
___ 9. Return line flusing from top laterals.
___ 10. Zone valve elevated higher than headworks & supply lines.
___ 11. Other details necessary to guide the installation.

ft.
a. ___ High water alarm float.
b. ___ Peak override float
c. ___ Pump enable float.
d. ___ Low water cut-off.
e. ___ Highest drip line.
f. ___ Lowest drip line.
g. ___ Pre-treatment tank inlet.

ft.
h. ___ Zone valve
i. ___ Headworks
j. ___ Other _____
k. ___ Other _____
l. ___ Other _____
m. ___ Other _____

**___ (d) Construction plan** (for designer)

___ 1.- Profile drawing of the entire onsite sewage system, including pump tank, to scale and with elevations.
___ - Sectional drawing of the effluent disposal field, to scale and with elevations.
___ - **D**epth__", **L**ength__', & **W**idth__' of drip lines/field.
___ - Trench construction details and layout. **(EDF needs _____ ft$^2$ for _____ gpd; has _____ft$^2$)**
___ - Specifications for materials to be used in the effluent disposal field.
___2. Plans for diversion of surface water away from all tanks and the effluent disposal field.
___3. Plan view drawing showing layout of OSS in greater detail, effluent disposal field, and landscape features.
___4. Specifications for pump, floats, and controls to be used.
___5. All plot plans & construction plans certified by designer's seal, signature, & date.

___ 2. Limited warranty - copy to regulator & Ecological Tanks, Inc.
___ 3. Owner's maintenance contract – copy to regulator & Ecological Tanks, Inc.'s authorized distributor.
___ 4. Written comments from ETI, if required.

Standard Package: Soil Texture: LS-C; HLR: 0.5-0.05 gpd/ft$^2$; Slope ≤20%; Elev. Head ≤ 30 ft; Supply Line ≤200 ft; Return Line ≤230 ft; Line Spacing = 24 in.; Emitter Spacing = 24 in.; Op. Press = 20 psi for Classic (10 for PC)

# ETI DRIP DISTRIBUTION SYSTEM CHECKLIST, Part B

## DRIP SYSTEM DETAILS (for designer)

♪ = Control panel settings

**DESIGN SPECIFICATIONS** (enter specific details) **Hydraulic Loading Rate: ____ g/ft$^2$ (for soil 24" below drip)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Zones | _____; | Zone Size | _____; LF | Lateral Length | _____; LF | Runs/Lateral | _____; |
| Supply Line | _____; in | Return Line | _____; in | Filter Size | _____; in | Pump | _____; |
| Press. Reg. | _____; psi | Zone Valve # | _____; | Filter Type | _____; | Doses/day | _____; |
| Dose Rate | _____; gpm | Flush Rate | _____; gpm | Backflush Rate* | _____; gpm | Dose On-time♪ | _____; min |
| Filter Flush♪ | _____; sec | Field Flush♪ | _____; min | Field Drain♪ | _____; min | Dose Off-Time♪ | _____; min |
| Check Valves | _____; | Dripline Type | _____; gph | Dripline Depth | _____; in. | Dose Volume | _____g: |
| TDH | _____; ft | Op. Press | _____; psi | Control Panel # (* Disc filters only) | _____; | Doses/Field Flush♪ | _____; |

**DESIGN LAYOUT**

___ 1. Zone length maximized based on available space. All drip lines & zones run parallel with contour.
___ 3. Drip field size based on most restrictive soil horizon within 24 inches of the drip tubing.
___ 4. Elevation difference ≤ 6' for Non-PC, ≤ 20' for PC drip line: A __, B__, C __ , D__, E __, F __ ft.
___ 5. Line Spacing: 12 __ 24 __, or, other ___ inches; Emitter Spacing: 12 __ 24 __, or other ___ inches
___ 6. Drip line level between 6 & 12 inches below finished grade.
___ 7. Check valve on return line for each zone; air release valve at highest point on all supply & return lines.
___ 8. Dosing to bottom of each drip lateral; flushing from top of each drip lateral.
___ 9. Fill approved by designer; compatible with native soil; placed in lifts; all vegetation removed.
___ 10. Mound long & narrow, runs with contour, & shoulder extends 3 feet beyond drip line + 3:1 side slopes.
___ 11. Pump tank size _____ g; reserve capacity above high water alarm float _____ g.
___ 12. Uniform vegetation over entire drip field, around tanks, and other disturbed areas.

## DRIP SYSTEM INSTALLATION (for installer)

___ 1. No utility lines, cables, phone lines, French drains, or similar features near drip field.
___ 2. Installation protected from grading, heavy machinery, or modification before construction.
___ 3. Installation conducted to control soil erosion & silting of surface waters; ground not wet or frozen.
___ 4. All downspouts, roof drainage, surface run-off, etc. diverted away from tanks and drip field.
___ 5. If used, fill placed after removing all vegetation, scarifying foot print area, & mixing with native soil.
___ 6. Corners zones staked; ground marked for drip lines, supply lines, return lines, & other components.
___ 7. Drip line inserted level along contour at specified depth.
___ 8. Drip line not stretched or kinked; looped with non perforated pipe; & duct-taped.
___ 9. Drip line inserted with vibrating plow or cable installer; soil smearing and compaction avoided.
___ 10. Supply line installed with tees glued; dripline connected with lockslip fittings, hand tightened.
___ 11. Return line installed with tees glued; dripline connected with lockslip fittings, hand tightened.
___ 12. Pressure regulator on supply line before each zone; check valve on each return line for 2 or more zones.
___ 13. Zone index valve elevated above headworks unit & supply lines; or field flush valves for each zone.
___ 14. Air release valves at highest elevation on supply & return lines, each zone, in valve cover box.
___ 15. Headworks unit plumbed to supply lines (zone valve), common return line, & pump discharge assembly.
___ 16. Check valve on each return line for 2 or more zones; (may be required on supply lines if slope >5%).
___ 17. Pump & float tree set per design specifications; access risers to grade, secure, & watertight.
___ 18. Electrical wiring to control panel in electrical conduit for protection; all wiring protected from moisture.
___ 19. Air compressor, pump, floats, & all solenoid valves wired to panel; alarm wired separately.
___ 20. System activated to flush out debris; field settings entered into control panel; power turned off & on.
___ 21. Flow meter & pressure readings recorded at the headworks unit, air release valves, etc.
___ 22. Good grass cover over entire drip field area, tanks, and disturbed areas.

## DRIP SYSTEM FIELD MEASUREMENTS

Pressure(psi) Dose - Filter___; Headworks unit ___; Zone 1___; Zone 2___; Zone 3___; Zone 4___; Zone 5___; Zone 6___

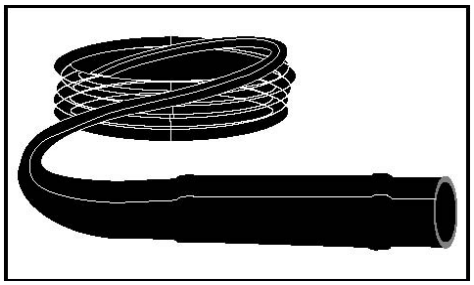
Flush - Filter___; Headworks unit ___; Zone 1___; Zone 2___; Zone 3___; Zone 4___; Zone 5___; Zone 6___

Flow Meter (g) _____(record all digits) Date:_____

# APPENDISES

# APPENDIX 1

## ETI DRIPLINES



### DESCRIPTION

ETI Driplines 130, 102, & 53 are flexible 1/2" polyethylene WASTEFLOW dripline manufactured by Geoflow, Inc. with emitters regularly spaced in the line. The tubing is black with a purple stripe. At 6 (8) inches below ground, effluent is dispersed slowly and uniformly, reducing ponding, even in difficult soils and hilly terrain. WASTEFLOW dripline is built to last. It is guaranteed to be free from root intrusion with built-in ROOTGUARD® protection. The dripline wall is protected from slime growth with a bactericide lining. Emitters have a Coefficient of variation (Cv) of less than .05. Different flow rates, diameters, and emitter spacings can be ordered. Use 600 series compression adapters or lockslip fittings to connect the driplines to the PVC pipe.

ETI Dripline 62 is low-volume 1/2" polyethylene Bioline dripperline manufactures by Netafim USA with regularly spaced emitters for slow, even dispersal of treated effluent. The tubing is purple. Emitters are equipped with self-flushing diaphragms and individual filter, and are impregnated with Vinyzene ® to prevent slime growth and emitter clogging.

### ROOTGUARD® AND BACTERICIDE

ETI Driplines 130, 102, & 53 (WASTEFLOW) use patented ROOTGUARD® technology to prevent roots from clogging the emitters. Pre-emergent Treflan® is bound into emitters when molded to divert roots from growing into the tubing. The system is guaranteed against root intrusion for 10 years. Ultra-Fresh DM50 is bound to the inner lining and emitters of WASTEFLOW driplines to prevent bacterial growth and slime build-up. It is a tin based formula that defeats the energy system of microbial cells.

ETI Dripline 62 (BIOLINE) is treated with Vinyzene® to prevent attachment of microbial slime and emitter clogging. The design of the dripper (emitter) and the presence of trifluralin also ensures that roots cannot penetrate into the dripline to clog emitters.

### WHEN TO USE PC VS. NON-PC DRIPLINE

| | |
|---|---|
| a) | Very long runs. |
| b) | Steep slopes. Systems should be designed for the dripline lateral to follow the contour. The extra cost of pressure regulators required for NON PC dripline would likely be less than the incremental cost of PC dripline. |
| c) | Rolling terrain. If the difference in height from trough to peak exceeds six feet then PC dripline should be used. Vacuum breakers must be placed at the top of each rise. |

PC and NON-PC dripline can be interchanged to meet filter and zone flow requirements.

- WASTEFLOW is manufactured under US Patents 5332160, 5116 414 and Foreign equivalents.
- WASTEFLOW is a registered trademark of A.I.Innovations.
- TREFLAN is a registered trademark of Dow Agro Chemicals.
- BIOLINE is a product of Netafim USA.
- Vinyzene® is a product of the Roam and Haas Company

## ETI DRIPLINE 130 (WFNPC 13024, 13018, & 13012)

**WASTEFLOW Classic**
Available in 2 standard models:

WF16-4-24 WASTEFLOW Classic 24"/1.3gph
WF16-4-12 WASTEFLOW Classic 12"/ 1.3 gph

Alternative flow rates & spacings available

| Pressure | Head | WFPC 16-4-24 | WFPC 16-4-12 |
|---|---|---|---|
| 10 psi | 23.10 ft. | 0.90 gph | 0.90 gph |
| 15 psi | 34.65 ft. | 1.13 gph | 1.13 gph |
| 20 psi | 46.20 ft. | 1.20 gph | 1.20 gph |
| 25 psi | 57.75 ft. | 1.47 gph | 1.47 gph |
| 30 psi | 69.30 ft. | 1.62 gph | 1.62 gph |
| 35 psi | 80.85 ft. | 1.76 gph | 1.76 gph |
| 45 psi | 103.95 ft. | 1.89 gph | 1.89 gph |

**ETI Dripline 130 Specifications** **Flow Rate vs. Pressure (+/- 5%)** NON-PC Dripline

ETI Dripline 130 shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.053″ x 0.053″ square. The tubing shall have an outside diameter (O.D.) of approximately 0.64 inches and an inside diameter of approximately 0.55-inches. The tubing shall consist of three layers; the inside layer shall be a bactericide protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24″ (or 12″) apart. The turbulent flow emitters shall be molded from virgin polyethylene resin. Turbulent flow emitters shall have nominal discharge rates of 1.30 gallons per hour at 20 psi. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. ETI Dripline 130 shall be Geoflow model number WF16-4-24 (WF16-4-18 or WF16-4-12).

**Maximum Length of Run vs. Pressure**
WASTEFLOW Classic
Flow variation ± 5%
Total loss taken in dripline. No allowance for loss in manifold.

| Pressure | Head | WFNPC13024 (WF16-4-24) | WFNPN13018 (WF16-4-18) | WFNPC13012 (WF16-4-12) |
|---|---|---|---|---|
| 10-45 psi | 23 - 104 ft. | 210 ft. | 208 ft. | 120 ft. |

Always allow 25% loss in manifold.

| Pressure | Head | WFNPC13024 (WF16-4-24) | WFNPN13018 (WF16-4-18) | WFNPC13012 (WF16-4-12) |
|---|---|---|---|---|
| 10-45 psi | 23 - 104 ft. | 170 ft. | 165 ft. | 100 ft. |

Kd = 0.9

Minimum Flushing Flow (gpm) = 1.48 per dripline lateral (@2 feet per second)

## ETI DRIPLINE 53 (WFPC 5324, 5318, & 5312)

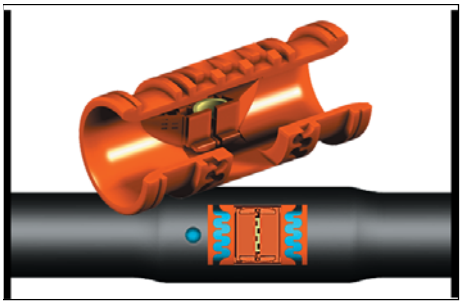
**WASTEFLOW PC 0.53**
Available in 3 standard models:

WFPC16-2-24 WASTEFLOW PC 24″ / .53gph

WFPC16-2-18 WASTEFLOW PC 18″ / .53gph

WFPC16-2-12 WASTEFLOW PC 12″ / .53gph

Alternative spacing, flow rates and diameters available upon request



PC 0.53 Emitter

### ETI Dripline 53 Specification

ETI Dripline 53 shall consist of nominally sized ½-inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032″ x 0.045″ square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a bactericide protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced at 24″ (or 18″ or 12″). The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm.

The pressure discharge rates shall be 0.53 gph Emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. ETI Dripline 53, a pressure compensating dripline, shall be Geoflow model number WFPC16-2-24 (or WFPC16-2-18 or WFPC16-2-12)

Minimum Flushing Flow (gpm) = 1.48 per dripline lateral (@2 feet per second) Kd = 2.07

### ETI DRIPLINE 53 Emitter Rate

| Pressure | Head | WFPC5324<br>WFPC5318<br>WFPC5312 |
|---|---|---|
| 10-45 psi | 23 - 104 ft. | 0.53 gph |

### Maximum Length of Run vs. Pressure

**Allows a maximum of 10 psi in the dripline.**
Recommended operating pressure: 10-45 psi

| Pressure | Head | WFPC 16-2-24 | WFPC 16-2-18 | WFPC 16-2-12 |
|---|---|---|---|---|
| 10 psi | 23.10 ft. | — | — | — |
| 15 psi | 34.65 ft. | 321 ft. | 260 ft. | 174 ft. |
| 20 psi | 46.20 ft. | 423 ft. | 330 ft. | 228 ft. |
| 25 psi | 57.75 ft. | 478 ft. | 377 ft. | 260 ft. |
| 30 psi | 69.30 ft. | 535 ft. | 415 ft. | 288 ft. |
| 35 psi | 80.85 ft. | 576 ft. | 448 ft. | 313 ft. |
| 40 psi | 92.40 ft. | 613 ft. | 475 ft. | 330 ft. |
| 45 psi | 103.95 ft. | 651 ft. | 501 ft. | 354 ft. |
| 50 psi* | 115.50 ft. | 675 ft. | 523 ft. | 363 ft. |
| 55 psi* | 127.05 ft. | 700 ft. | 544 ft. | 377 ft. |
| 60 psi* | 138.60 ft. | 727 ft. | 563 ft. | 403 ft. |

## ETI DRIPLINE 62 (BLPC 6224, 6218, & 6212)

### ETI Dripline 62 Specification

ETI Dripline 62 shall be Bioline dripperline, manufactured by Netafim, USA. It shall contain ½-inch (nominal) linear low-density polyethylene tubing drip emitters bonded to the inside wall. The tubing shall be purple and have an outside diameter (O.D.) of approximately 0.67-inches and an inside diameter (I.D.) of approximately 0.57-inches. The drip emitters shall be made of plastic with a hard plastic diaphragm retainer, with a self-flushing/cleaning elastrometric diaphragm. The emitters shall be impregnated with anti-microbial agent Vinyzene® to prevent attachment of slime to the emitter. Each emitter shall have individual an inlet filter with cross sectional area at least 5 times larger than that of the emitter flow path. The emitter's nominal discharge rate shall be 0.62 gph with an inlet pressure between 5 and 70 psi. The flow rate for any emitter shall not vary more than ± 10% from the designated nominal flow between 5 and 55 psi (between 25-50 ˚F). The dripline shall have emitters spaced every 24″ (or 18″ or 12″) apart. The dripline operating pressure shall be between 5 and 45 psi. Filtration shall be 120 mesh or finer. ETI Dripline 62 shall be Netafim USA Bioline models 08WRAM.6-24V, 08WRAM.6-18V, and 08WRAM.6-12V.


### Netafim Bioline Fittings

Minimum Flushing Flow (gpm) = 1.591 per dripline lateral (@2 feet per second)

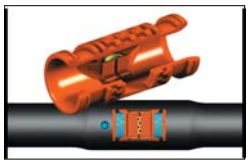
**Flow Rate per Length of Tubing (gallons per minute)**

| Dripper Flow Rate (gph) | Dripper Spacing (inches) | Total Length of Bioline Dripperline (feet) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 500 | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 | 3,500 | 4,000 | 4,500 | 5,000 |
| 0.62 | 12 | 5 | 10 | 16 | 21 | 26 | 31 | 36 | 41 | 47 | 52 |
| | 18 | 3 | 7 | 10 | 14 | 17 | 21 | 24 | 28 | 31 | 34 |
| | 24 | 3 | 5 | 8 | 10 | 13 | 16 | 18 | 21 | 23 | 26 |

**ETI DRIPLINE 102** (WFPC 10224, 10218, 10212)

WASTEFLOW PC 1.02 GPH

WFPC16-4-24 WASTEFLOW PC 24″ / 1.02gph
WFPC16-4-18 WASTEFLOWPC 18” /1.02 gph
WFPC16-4-12 WASTEFLOW PC 12″ / 1.02gph
Alternate spacing available upon request.


PC 1.02 Emitter

### ETI Dripline 102 Specification

ETI Dripline 102 shall consist of nominally sized ½-inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The emitter flow passage shall be 0.032″ x 0.045″ square. The tubing shall have an outside diameter (O.D.) of approximately 0.64-inches and an inside diameter (I.D.) of approximately 0.55-inches. The tubing shall consist of three layers; the inside layer shall have bactericide protection, the middle layer shall be black, and the outside layer shall be purple striped for easy identification. The dripline shall have emitters spaced every 24″ (18 or 12″) apart. Pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. Pressure compensating emitters shall have nominal discharge rates 1.02 gallons per hour. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. ETI Dripline 102 shall be WASTEFLOW PC manufactured by Geoflow, model numbers WFPC16-4-24 (WFPC 16-4-18 or WFPC16-4-12).

Minimum Flushing Flow (gpm) = 1.48 per dripline lateral (@2 feet per second)

### Maximum Length of Run vs. Pressure

Allows a maximum of 10 psi in the dripline.
Recommended operating pressure: 10-45 psi

| **Flow Rate vs. Pressure** | | |
|---|---|---|
| | | WASTEFLOW |
| Pressure | Head | WFPC16-4-24<br>WFPC16-4-18<br>WFPC16-4-12 |
| 7 - 60 psi* | 16 - 139 ft. | 1.02 gph |

Kd=2.07

Kd = 2.070

| Pressure | Head | WFPC 16-4-24 | WFPC 16-4-18 | WFPC 16-4-12 |
|---|---|---|---|---|
| 10 psi | 23.10 ft. | — | — | — |
| 15 psi | 34.65 ft. | 211 ft. | 172 ft. | 115 ft. |
| 20 psi | 46.20 ft. | 265 ft. | 210 ft. | 146 ft. |
| 25 psi | 57.75 ft. | 315 ft. | 242 ft. | 171 ft. |
| 30 psi | 69.30 ft. | 335 ft. | 266 ft. | 180 ft. |
| 35 psi | 80.85 ft. | 379 ft. | 287 ft. | 199 ft. |
| 40 psi | 92.40 ft. | 385 ft. | 305 ft. | 211 ft. |
| 45 psi | 103.95 ft. | 429 ft. | 321 ft. | 222 ft. |
| 50 psi* | 115.50 | 431 ft. | 334 ft. | 232 ft. |
| 55 psi* | 127.05 | 449 ft. | 347 ft. | 240 ft. |
| 60 psi* | 138.60 | 465 ft. | 360 ft. | 249 ft. |

# APPENDIX 2

## ETI HEADWORKS UNITS

### Description

ETI offers automatic and manual Headworks Units using screen or disc filters. Each model contains the following components:

Flow Meter (optional) Screen or Disc Filter Pressure Gauge
Filter Flush Valve Field Flush Valve Zone Valves (some models) Air Vent

Automatic Headworks Units (DHWA075, 100, & 150) with screen filters are sized to match flushing flow rates in the table below, and are used with ETI Driplines 130, 102, 62, and 53. They contain solenoid flush valves which are operated at precise intervals by the Control Panel. The Flow Meter should be located after the filter as an aid in trouble shooting. Dosing and field flush cycles are performed according to the following sequences:

Dose Cycle: Filter Flush (0-60 sec) → Field Dose. (0-30 min) → Absorption (0-4 hrs), incl. Field Drain (0-15 min)

Field Flush Cycle: Filter Flush (0-60 sec) → Field Flush/Dose (0-15 min).

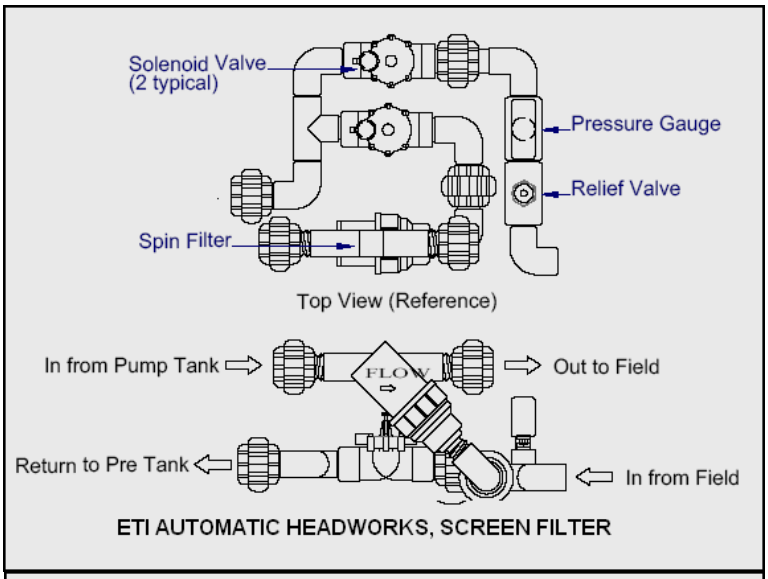
Where regulations allow, and if routine maintenance is provided by an ETI-authorized service provider, Manual Headworks Units with Screen Filters (DHWM075, 100, & 150) may be used for ETI Drip lines 130, 102, 62 and 53, according to the filter sizes and flow rates in the table below. They contain ball valves for filter and field flushing. At least once every six (6) months, or more often, if needed, the ball valves must be opened for a full flush, beginning with the screen filter and continuing with each drip zone. Upon completion of flushing activities, the valves should be left open enough to re-establish the design pressure readings for the original installation. Activate the pump after resetting the ball valves and check pressure readings with the originals. A pressure drop of 5 – 8 psi normally occurs across screen filters. **Check with state/local regulators for approval of manual headworks.**

ETI Dripline 62 may also be used use with Manual Headworks Units fitted with Disc Filters (DHWM075D, 100D, & 150D) for which sizes and flow rates are indicated below. They contain one ball valve for field flushing. At least once every six (6) months, or more often if needed, the ball valve must be opened for a full field flush of each drip zone. Upon completion of all flushing activities, the valve should be left open enough to re-establish the design pressure readings of the original installation. The disc filter should be removed and cleaned at each service visit to eliminate all accumulated debris. **Check with state/local regulators for approval of manual headworks.**

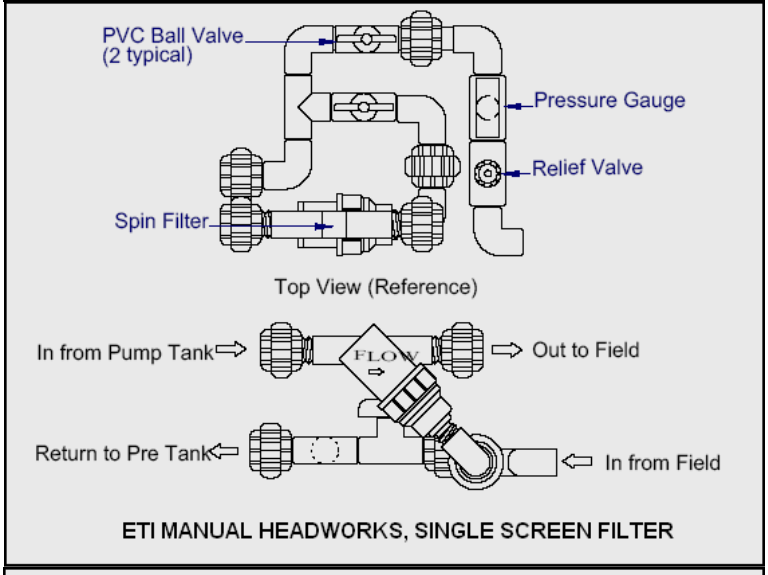
| **HEADWORKS UNIT MODEL #** | TYPE | FILTER TYPE | FILTER SIZE (in) | MIN. FLOW (gph) | MAX. FLOW (gpm) | CONTROL PANEL |
|---|---|---|---|---|---|---|
| DHWA075 | Auto | Screen | 0.75 | 4 | 11 | 218 |
| DHWA100 | Auto | Screen | 1.0 | 10 | 28 | 218 |
| DHWA150 | Auto | Screen | 1.5 | 34 | 42 | 218 |
| DHWM075 | Manual | Screen | 0.75 | 4 | 11 | 217 |
| DHWM100 | Manual | Screen | 1.0 | 10 | 28 | 217 |
| DHWM150 | Manual | Screen | 1.5 | 34 | 42 | 217 |
| DHWM075D | Manual | Disc | 0.75 | 1 | 18 | 217 |
| DHWM100D | Manual | Disc | 1.0 | 5 | 26 | 217 |
| DHWM150D | Manual | Disc | 1.5 | 10 | 35 | 217 |

Headworks Units are located within 30 feet of the pump and pre-treatment tanks. They are installed to drain to the pre-treatment, unless otherwise indicated. They can be ordered pre-installed in the riser of the pump tank supplied by ETI, or in a secure cover box. For freezing conditions insulation, insulation may be needed. Headworks units may be requested with Schrader Valves on the filter as an aid for future maintenance. The flow meter may be placed after the Headworks Unit in a separate cover box.

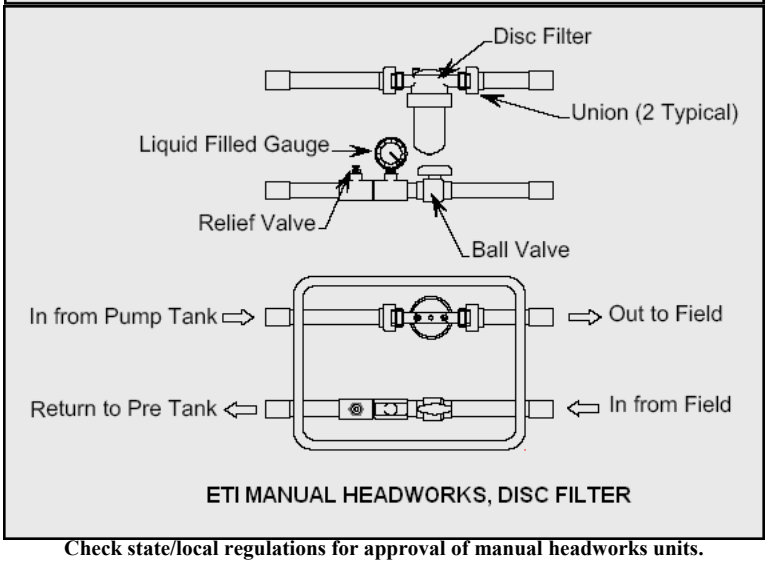
## ETI HEADWORKS UNITS with Screen or Disc Filters




ETI AUTOMATIC HEADWORKS, SCREEN FILTER



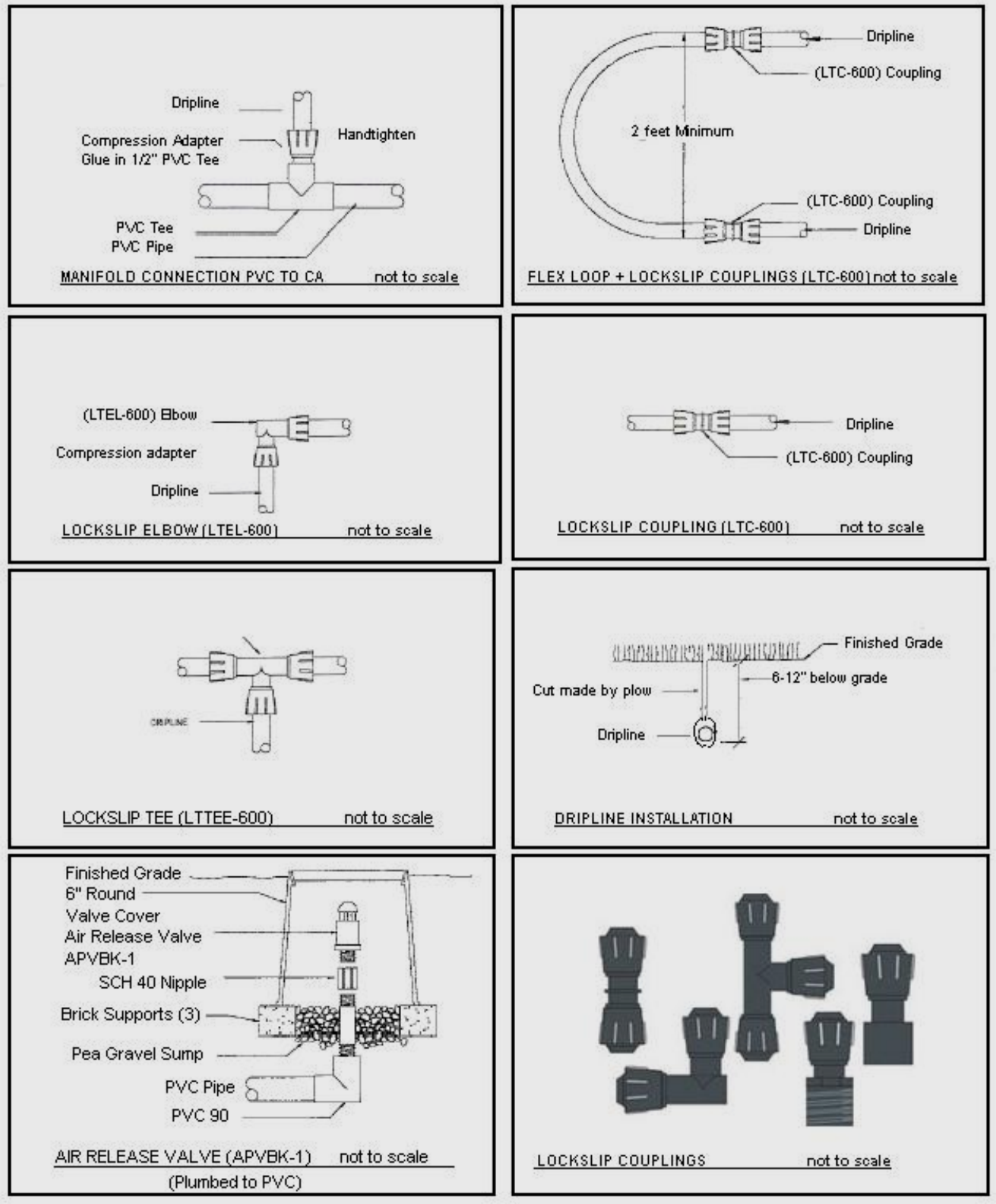

ETI MANUAL HEADWORKS, SINGLE SCREEN FILTER




ETI MANUAL HEADWORKS, DISC FILTER

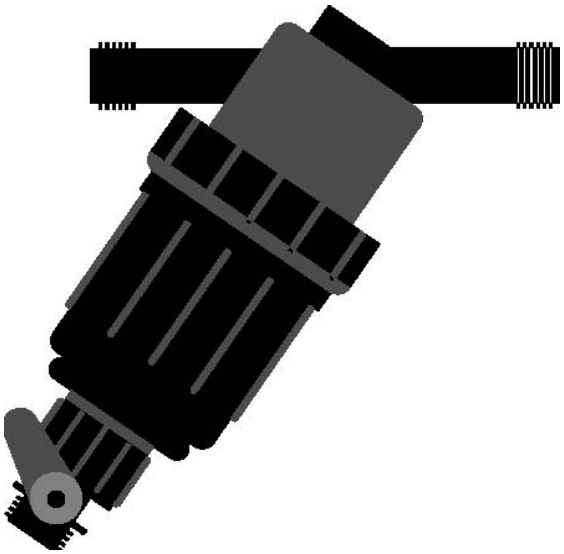
**Check state/local regulations for approval of manual headworks units.**

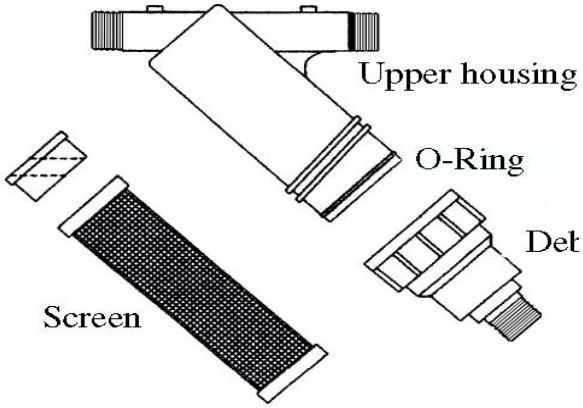
## ETI Dripline Fittings



## APPENDIX 3

# SCREEN FILTERS






**Description** **Debris basin**

Screen (Spin Clean Vortex) Filters are placed between the pump and dripfield to remove debris.
**Body** - Two-piece threaded housing with O-ring seal. Molded from high heat ABS and Chemical resistant glass reinforced plastic.
**Screen** - Sintered stainless steel. Sintering is a process in which three pieces of stainless steel mesh are transformed into one; a perforated plate, 30m then 150 mesh. Screen collars molded from vinyl for long life and durability.
**Spin Plate and drain** - Directional spin plate (on top of screen) is molded of PVC or fiberglass.
**Vortex Spin Action** - Incoming water is forced through a directional nozzle plate onto the inside of the stainless steel screen. A centrifugal motion starts inside the screen chamber, throwing organic and inorganic particles outward against the screen. Gravity moves the debris down the screen wall to the 3/4″ flush outlet at the base of the Vortex Filter.

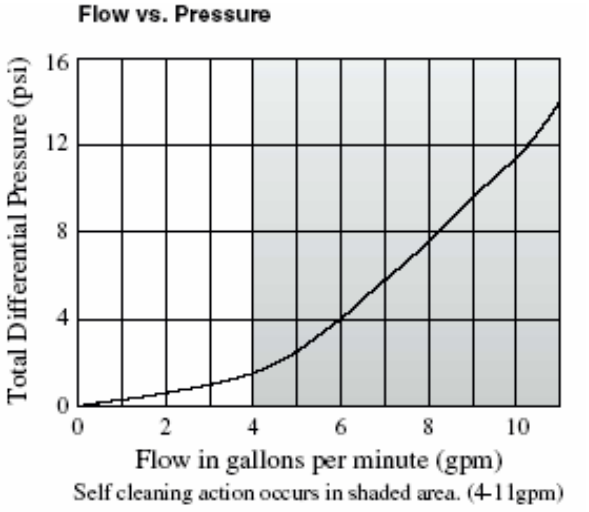
To stay clean, two criteria must be met:

1. Flow into the filter must be within the specified range to produce the 5-8 psi pressure loss across the filter.

2. The filter flush valve must be partially open allowing debris to flush away.

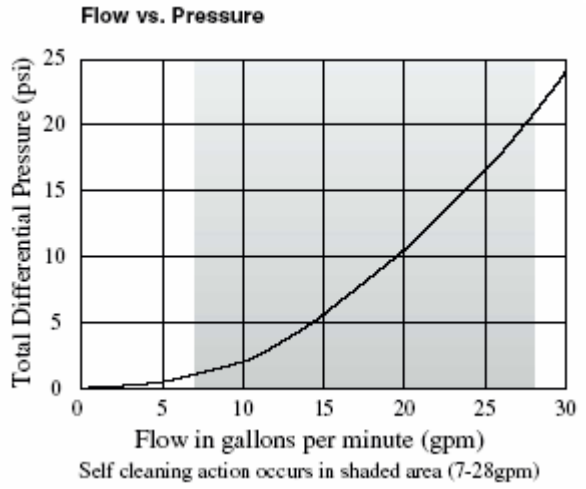
| ITEM NUMBER | SIZE (MIPT) | FLOW (GPM) | MAX. PRESSURE | WIDTH (thread to thread) | HEIGHT (with flush port) | SIZE OF FLUSH PORT | AREA OF FILTRATION |
|---|---|---|---|---|---|---|---|
| AP4E-75-2 | 3/4″ | 04 - 11 | 80 psi | 6.0″ | 12.0″ | 3/4″ MPT | 23.4 inches$^2$ |
| AP4E-100-2 | 1.0″ | 07 - 28 | 80 psi | 6.5″ | 13.0″ | 3/4″ MPT | 28.4 inches$^2$ |
| AP4E-150-3 | 1.5″ | 34 - 42 | 100 psi | 12.0″ | 15.5″ | 3/4″ MPT | 60.8 inches$^2$ |
| AP4E-150-4 | 1.5″ | 45 - 55 | 100 psi | 12.0″ | 15.5″ | 3/4″ MPT | 60.8 inches$^2$ |

Filters may be equipped with Shrader Valves for pressure readings as an option.




**APE4-75 ¾" Filter Specification**

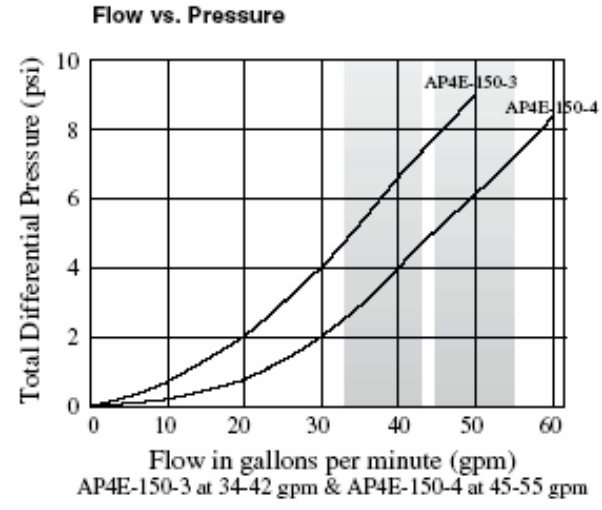
The Y filter body shall be molded from glass reinforced engineering grade black plast ic with a 3/4 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 23.4 square inch filtration area. The screen collar shall be molded from vinyl. The 3/4″ filter shall be Geoflow Vortex Filter model number AP4E-75.




**AP4E-100 1″ Filter Specification**

The Y filter body shall be molded from glass reinforced engineering grade black plastic with 1" male pipe thread (MIPT) inlet and outlet. The two piece 20 body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional ¾" MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is stainless steel, with 28.4 square inch filtration area. The screen collar shall be molded from vinyl. The 1″ filter shall be Geoflow Vortex Filter model number AP4E-100.

Note: Two or three 1" filters may be used side by side to give higher flow rates or to decrease pressure loss through filters.




**AP4E-150 1.5″ Filter Specification**

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1.5 inch male pipe thread (MIPT) inlet and outlet. The 2-piece body shall be capable of being serviced by unscrewing and shall include an O-ring seal. An additional ¾" MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless, with 60.8 $in^2$ of filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 1½″ filter shall be Geoflow model number AP4E-150-3 or AP4E-150-4.

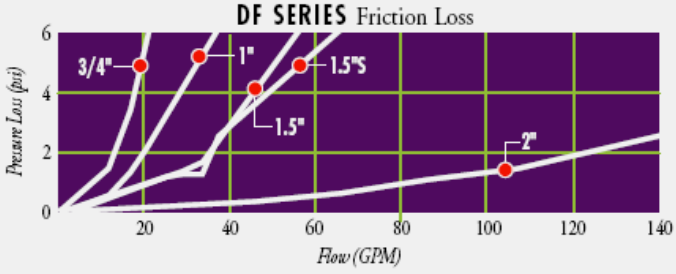
## DISC FILTERS

# NETAFIM USA

# DF Series Disc Filters

### Reliable, Efficient Plastic Discs Create Superior Filtration

Disk Filter Technology was originally developed to keep the hydraulic lines on military aircraft clean. Each filter element is a stack of grooved rings, or discs. Clean water must pass through the grooves in the stack of discs from the outside to the inside of the disc stack. The grooves on adjacent discs run cross-ways to each other, so the effluent must pass through a labyrinthine passageway on its way through the filter element. The debris is deposited in the grooves as the effluent makes its way through the filter element. Because the grooves have depth (a 3-dimensional volume vs. a 2-dimensional surface like a screen filter), they are able to hold a larger amount of debris than screen filters.






## Applications

- All domestic wastewater applications

## Product Advantages

- Extremely Reliable
  Unlike screen elements, the stack of discs that comprise the filter unit cannot tear or collapse. Organic material won't get pushed through as the filter loads.
- Higher Capacity for Holding Debris Means Less Frequent Cleaning
  The 3-dimensional nature of disc filtration enables the filter to safely hold more debris without clogging or 'sliming over' as can happen with screen filters used on water sources with organic loads.
- Simple, Easy and Thorough Filter Cleaning
- Low Friction Loss
- 100% Thermoplastic Discs Provide Extremely High Corrosion Resistance
- Color-coded Replacement Filter Rings Available

**FILTER SIZE**

| Filter | GPM |
|---|---|
| 3/4" | 13 |
| 1" | 22 |
| 1 1/2" | 35 |
| 2" | 132 |

Netafim USA offers filters up to 4000 GPM - please call for more information.

NETAFIM USA
PRECISION IRRIGATION™

5470 E. Home Ave. • Fresno, CA 93727
(888) 638-2346 • FAX (800) 695-4753
www.netafimusa.com

# APPENDIX 4

## SOLENOID FLUSH & ZONE VALVES

### Description

The Solenoid Valve is electrically operated and used as zone valves and to flush the dripfield and Vortex filter. It is normally closed, and in the event of a power failure the valve closes.

### Features

A Unique Dual Ported Diaphragm greatly minimizes clogging. In operation, the diaphragm ports flex to inhibit sand, silt and debris from blocking valve action. The port design allows equal pressure on both sides of the diaphragm wall, regardless of line pressure when valve is not operating, and nearly equal pressure across the wall when operating. This prevents diaphragm "stretching", a common cause of valve failure in valves ported through the seat. The 21000 Series DW Valve diaphragm is made of nylon fabric reinforced Buna-N rubber; a grooved rib interlocks with cover and body to prevent leakage. Nylon exhaust orifice is non-corrosive and has an opening sized larger than the diaphragm ports so that pieces of sand or silt passing through the diaphragm will not be trapped beneath the solenoid actuator.

Valves are constructed of molded epoxy resin with no carbon steel components exposed, thus eliminating external corrosion and deterioration. The valves are waterproof with O-ring seal, and meets NEC Class II circuit requirements for 24Va.c. operation (also operates on 12 volts d.c. up to 75 psi). The actuator is teflon coated stainless steel and brass with a molded-in place rubber exhaust port seal; a stainless steel spring assures positive seating.

The high strength plastic glass-filled body operates well in heavy duty commercial applications. Stainless steel 1/4 inch cover bolts and mating brass body inserts make re-assembly easy. Shock cone on diaphragm seat eliminates water hammer in all except extreme cases. A brass, non-rising type flow control stem throttles the valve from full open to close positions. Equipped with an easy-to-use manual bleed lever; hand operated control bleeds valve to downstream; has stops for open and closed positions.

### Operating Data

Cold water working pressure: 150 psi. The DW Valve has excellent low flow characteristics ideally suited for dripfield and Vortex filter applications.

### Installation

Use Teflon tape. A 1 inch FIP can be bushed to 3/4 inch. 1-1/2 inch FIP can be bushed to 1-1/4 inch. The manual bleed lever should always be in the horizontal position and the dial on top should be free spinning for valve to operate automatically. Clockwise rotation closes valve.

### Electrical

Wiring requires a single lead from the controller to each solenoid valve, plus a common neutral to all solenoids. Type UF wire, UL listed, is recommended for all hookups. Wire sizes that are too small can cause voltage to drop below the minimum required to operate controllers and valves. Do not use nominal voltage ratings listed for sizing valve wires. See wire-sizing tables below based on operating pressure and wire length.

| **24 VAC/60 Hz** | **24 VAC/50 Hz** | |
|---|---|---|
| Inrush:9.86 VA | Inrush: 10.7 VA | Wire Size—1 valve per station. |
| Holding: 5.69 VA | Holding: 7.5 VA | Input to controller is 115 Va.c. |

## **Pressure Loss Through Valves** (in psi)

| GMP | SVLV-100 | SVLV-150 | SVLV-200 |
|---|---|---|---|
| 0-4 | 1.2 max | | |
| 6 | 1.4 psi | | |
| 8 | 1.6 | | |
| 10 | 1.7 | | |
| 12 | 1.8 | | |
| 14 | 1.9 | | |
| 16 | 2.0 | | |
| 18 | 2.1 | | |
| 20 | 2.3 | 1.3 psi | |
| 22 | 2.5 | 1.4 | |
| 24 | 2.8 | 1.5 | |
| 26 | 3.2 | 1.6 | |
| 28 | 3.7 | 1.7 | |
| 30 | 4.3 | 1.9 | |
| 32 | 4.9 | 2.1 | |
| 34 | 5.6 | 2.3 | |
| 36 | 6.3 | 2.5 | |
| 38 | 7.0 | 2.8 | |
| 40 | 7.7 | 3.0 | 2.3 psi |
| 42 | 8.4 | 3.3 | 2.3 |
| 44 | 9.1 | 3.6 | 2.4 |
| 46 | 9.9 | 3.9 | 2.4 |
| 48 | 10.7 | 4.3 | 2.5 |
| 50 | 11.5 | 4.6 | 2.6 |
| 52 | | 5.0 | 2.6 |
| 54 | | 5.4 | 2.7 |
| 56 | | 5.8 | 2.7 |
| 58 | | 6.2 | 2.8 |
| 60 | | 6.7 | 2.9 |
| 70 | | 9.5 | 3.3 |
| 80 | | 13.0 | 3.4 |
| 90 | | | 4.3 |
| 100 | | | 5.2 |
| 110 | | | 6.7 |
| 120 | | | 7.7 |
| 130 | | | 8.8 |

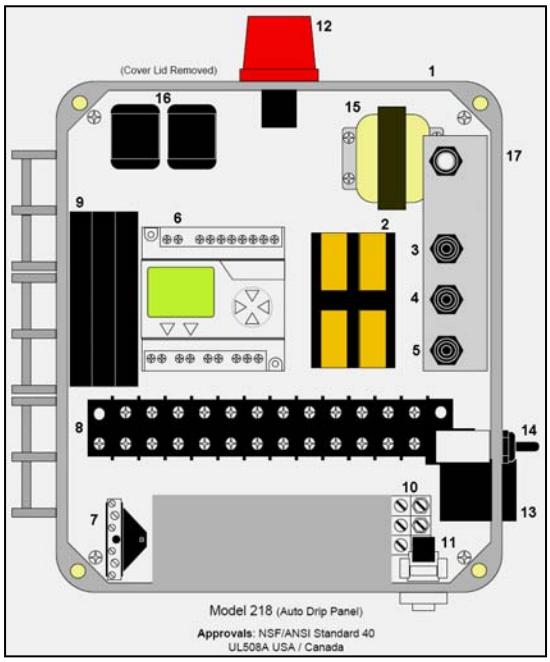
**Maximum length of wire run in feet from control to valve**

| AWG size | | Static pressure not exceeding | | | | |
|---|---|---|---|---|---|---|
| Diameter No. | In. | 75 psi | 85 psi | 100 psi | 125 psi | 160 psi |
| 18 | 0.040′ | 2200′ | 2000′ | 1600′ | 1,100′ | 700′ |
| 16 | 0.051′ | 3600′ | 3200′ | 2500′ | 1800′ | 1100′ |
| 14 | 0.064′ | 5700′ | 5000′ | 4000′ | 3000′ | 1700′ |
| 12 | 0.081′ | 9000′ | 8000′ | 6400′ | 4700′ | 2800′ |
| 10 | 0.102′ | 14000′ | 12700′ | 10200′ | 7400′ | 4400′ |
| 8 | 0.129′ | 22700′ | 20200′ | 16200′ | 11800′ | 7000′ |
| MULTIPLYING FACTOR: 2 valves per station * | | 0.43 | 0.40 | 0.41 | 0.38 | 0.31 |

* Use this multiplying factor only in the event two valves will be operating simultaneously.

# APPENDIX 5

## MODEL 218 CONTROL PANEL




Model 218 Control Panels are PLC-based subsurface drip panels which monitor aerator function for an aerobic treatment plant, and control and monitor one or two single-phase pumps, two solenoid flush valves, and individual solenoid zone valves, when used, for a fully automatic subsurface drip distribution system. The PLC device monitors and records the following operations:

a. Number of dosing cycles (each zone)
b. Number of field flush cycles (each zone)
c. Number of high water alarms
d. Number of low air alarms
e. Number of low water events (pump on float open)
f. Total dosing hours (excluding filter & field flush)
g. Total pump run hours (each zone)

Each panel will have the following connections:
(a) High water alarm float; (b) Override float;
(c) Pump-On float; (d) Redundant-Off float; (e) Alarm;
(f) Compressor (g) Pump; (h) Filter Flush Valve; (i) Field Flush Valve; & (j) Zone Valves, if used.

The first three floats are monitored by the control panel. The panel dampens the inputs for all three (on delay/off delay) to prevent float chatter due to turbulence in the pump tank. All floats are open and off when water level is below them. The Redundant Off float is wired in series with the pump to prevent the pump from operating in dry conditions, including during a cycle. The filter and field solenoid flush valves, and solenoid zone valves, are normally closed when off.

**PANEL COMPONENTS**

1. NEMA 4X Enclosure
2. Motor Contactor
3. HOA Pump Switch (hand/on/auto)
4. HOA Filter Valve (hand/on/auto)
5. HOA Field Valve (hand/on/auto)
6. Programmable Logic Controller (PLC)
7. Incoming Power Terminal
8. Terminal Block (Aerator, Pump, Valves, Floats, Alarm, Control)
9. Circuit Breakers
10. Ground Block
11. Air Switch
12. Alarm Beacon
13. Alarm Horn
14. Alarm Test (test/normal/mute)
15. Transformer
16. Power Relays

Operation:
The panel performs two distinct cycles – a normal dosing cycle and a separate field flush cycle. A dosing cycle begins when the Pump-On float rises and connects power to the pump and continues the dosing cycle as long as the float switch remains closed. A field flush cycle is performed between dosing cycles at a frequency programmed into the PLC. Once a dosing cycle has started, it will continue to completion. If the Pump-On float activates in the middle of a cycle, the panel will finish the cycle and wait for the Pump-On float to fall and open the float switch before the next cycle. The field flush cycle will activate only after a dosing cycle completes to ensure that there is enough water in the tank for a full field flush. The field flush cycle is not counted as a dosing cycle.

The dosing sequence runs as follows:
Step 1: Filter Flush (0-60 sec.)- pump on; filter flush valve on; field flush valve off.
Step 2: Dose (0-30 min.)- pump on; filter flush valve off; field flush valve off; zone valve on (if used).
Step 3a: Field Drain (0-15 min.)- pump off; filter flush valve off; field flush valve on; field flush valve off.
Step 3b: Absorption (0-4 hrs, in 1 min. increments)- pump off; filter flush valve off; field flush valve off.

The time allowed for the Field Drain is included in the Absorption step. If the Override Float is on (up) at the start of the Absorption Step, due to higher than normal sewage flow, the pre-set absorption time will be halved and the rest of the cycle will remain as shown above.
The field flush cycle runs according to the following sequence:

Step 1: Filter Flush (0-60 sec.)- pump on; filter flush valve on; field flush valve off.
Step 2: Field Flush (0-15 min.)- pump on; filter flush valve off; field flush valve on; zone valve on.

There is no absorption step during the field flush cycle. (**Dose-Off Time = Absorption Time**.)

Four 218 Control Panel Models:
(a) 1-zone Simplex 218 Control Panel – 120/240 VAC; up to ½ HP (Residential) (Part # 218)
(b) 2-zone Simplex 218 Control Panel – 120/240 VAC; up to ½ HP (Residential) (Part # 218-2)
(c) 2-6 zone Simplex 218 Control Panel -120/240 VAC; up to 1 HP (Commercial) (Part # 216-6)
(d) 2-6 zone Duplex 218 Control Panel – 120/240 VAC; up to 1 HP (Commercial) (Part # 218-6D)

(a) The 1-zone Simplex 218 Control Panel is designed for use with mechanical index valves or individual zone solenoid valves for zone dosing & flushing. Operation will be as described above, when using solenoid zone valves. When an index valve is used to alternate dosing and flushing of multiple zones, a zone solenoid zone valve will not be wired to the panel. The mechanical index valve will be open to a zone when Step 2 begins and will remain open until dosing is completed. As the Field Drain begins, and the drip zone depressurizes, the cam in the index valve will fall forward opening the next zone for a dose. The Field Flush Cycle will occur in that next zone after the PLC counts the pre-set number of dosing cycles to match the frequency programmed into the panel. The frequency selected for the Field Flush must be matched to the number of zones in the drip field so that no zones are skipped. The PLC device will record dosing cycles, field flush cycles, and total pump run hours only for the whole drip distribution system when an index valve is used.

(b) & (c) Operation of these Multi-zone panels is similar to that described above. The panels cycle through each zone one at a time performing the same dosing and field flush cycles. The dosing time, field drain, absorption time, the number of doses between field flushes, and the field flush time are programmed for each zone. The same filter flush time is programmed for all zones. These panels use the same alarms, floats, and solenoid valves as the 1-zone panel. One additional solenoid valve is wired to the panel for each zone in the drip field.

(d) Operation of the multi-zone Duplex 218 Control Panel is similar to the simplex panels. It will cycle through the zones in the same manner as panels (b) and (c). The duplex panel uses two pumps in the same pump tank to provide a redundant back-up in case of pump failure. The panel operates one pump for each cycle, alternating from one cycle to the next, so that each pumps accumulates the same pump run hours. The same alarms, floats, and solenoid valves are used as for the simplex panels. One additional redundant off float is used for the second pump.

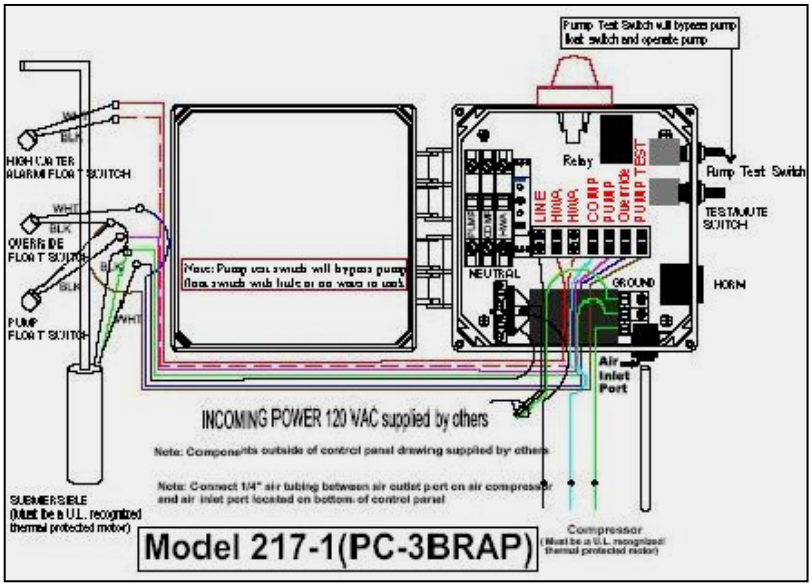
The principle difference between simplex and duplex panels is their reaction to a high water alarm. Simplex panels log the alarm and continue operating in the same manner. The duplex panel will continue running the normal cycles when a high water alarm occurs, but will operate both pumps at the same time. The assumption is that one pump has failed, allowing the water level to rise to activate the high water alarm. The panel will return to normal alternating operation when the high water alarm falls and the switch is open. For high water conditions caused by surges or extended power-outages, the panel will operate both pumps during each dosing cycle, until the water drops below the high water alarm float. Then normal operation will resume. Duplex panels store the same information in the PLC as do the simplex panels, with the addition of 'total pump run hours' for the second pump.

Monitoring the Air Compressor:

Under normal operating conditions, the air switch remains open if air pressure stays within a specified range (in psi). If the air pressure falls below or exceeds that range, the air switch will close and activate the alarm light and horn. The circuit will remain in the alarm state until the system is repaired.

**THE CONTROL PANEL IS DESIGNED TO OPERATE A SYSTEM WITH ALL NORMALLY OPENED FLOAT SWITCHES AND NORMALLY CLOSED SOLENOID VALVES.**

## MODEL 217 CONTROL PANEL




Model 217 Control Panels are subsurface drip panels which monitor aerator function for an aerobic treatment plant, and control one single-phase pump. They are used when manual flushing of the screen filter and drip field will be performed. They are used with manual headworks units containing screen or disc filters, and ball valves for flushing the filter and the drip field.

The use of manual controls and manual headworks units requires the following:

1. Approval by state/local regulations – check with your permitting authority, and
2. An ETI trained and authorized service provider to perform routine maintenance every six (6) months, or more often, if needed, under a continuing maintenance agreement. Failure to provide such routine maintenance may result in excessive accumulation of debris in the drip tubing and on the filter, clogging of the drip emitters, or conditions which lead to pump failure or other malfunction.

Each panel will have the following connections:
(a) High water alarm float; (b) Override float; (c) Pump-On float; (d) Pump; (e) Compressor, and (e) Alarm.

**Programmable Timer**

The panel performs a normal dosing cycle at set intervals and for set run times, which are controlled by the analog programmable timer, shown to the right. A dosing cycle begins when the Pump-On float rises and connects power to the pump until the pre-set Pump-On Time has elapsed, or until the Pump-On float falls and the float switch opens, breaking the electric circuit.

The dosing sequence runs as follows:
Step 1:Dose (0-30 min.)- pump on; filter & field flush valves closed.
Step 2: Absorption (0-4 hrs)- pump off; filter & field flush valves closed.

If the Override Float is on (up) at the start of the Absorption Step, due to higher than normal sewage flow, the pre-set absorption time will be halved. The dose cycle will repeat twice as often until water levels return to normal.

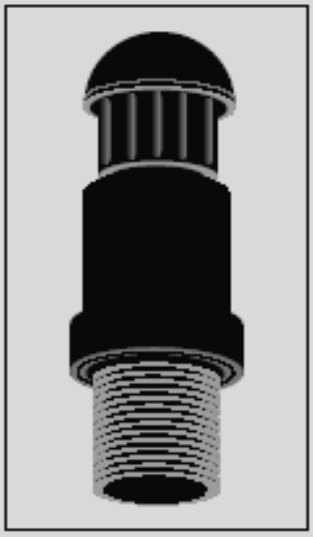
A full filter flush and field flush must be performed at least once every six (6) months, or more often if needed, in the following sequence:
Step 1: Filter Flush (0-60 sec.)- pump on; filter flush valve open; field flush valve off.
Step 2: Field Flush (0-15 min.)- pump on; filter flush valve closed; field flush valve open.

(**Dose-Off Time = Absorption Time**.)

See Appendix 2 for instructions on performing filter and field flushing.

# APPENDIX 6

**AIR RELEASE VALVES**

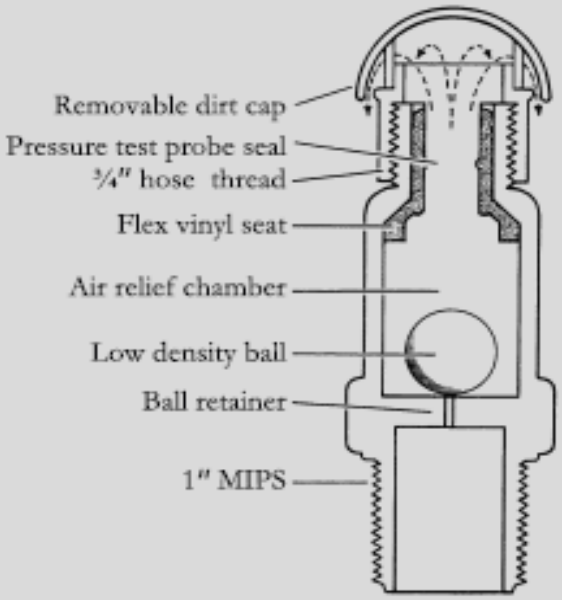


## AIR VACUUM BREAKERS

### Description

Air Vacuum Breakers are installed at the high points of the WASTEFLOW dripfield to keep soil from being sucked into the drip emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in freezing conditions. Use one on the high end of the supply manifold and one at the high point of the flush manifold and any other high points in the system.

- Instant and continuous vacuum relief
- Non-continuous air relief
- Seals tight at 5 psi
- Durable, weather resistant
- Readily accessible pressure test point
- Easy to install
- Removable dirt cover
- Maximum flow of 50 gpm




### Air Vacuum Specification

The air vacuum relief valve provides instant and continuous vacuum relief and non-continuous air relief. Both the body and the removable dirt cover shall be constructed of molded plastic. The body and the dirt cover shall be connected with a 3/4 inch hose thread. The ball shall be constructed of low density plastic and the internal seat shall be constructed of vinyl. The air vacuum relief valve shall seal at 5 psi. Inlet size shall be a 1 inch male pipe thread. The air vent shall be Geoflow item number APVBK-1.

# APPENDIX 7

## INDEX ZONE VALVES

## TECHNICAL SPECIFICATIONS: 6000 SERIES DISTRIBUTING VALVE

### SPECIFICATIONS

- *Flow Range: 15 - 150 GPM*
- *Pressure Rating: 25 - 150 PSI*
- *Pressure Loss:* ***4 outlet valve:***

| Flow (GPM) | 20 | 40 | 60 | 80 | 100 |
|---|---|---|---|---|---|
| PSI Loss | 2.5 | 3.5 | 5.0 | 7.5 | 10.0 |

***6 outlet valve:***

| Flow (GPM) | 20 | 40 | 60 | 80 | 100 |
|---|---|---|---|---|---|
| PSI Loss | 3.0 | 4.0 | 6.0 | 9.0 | 11.0 |

- *Inlet: Threaded 1 1/2" NPT Connection*
- *Outlets: Slip and Glue connections to 1 1/2" PVC Pipe*
- *Construction: Valve Top/Housing: Die Cast Metal*

  *Valve Outlets: High Strength ABS Polymer*
- *Dimensions: Height 7" Width 8"*

K-Rain offers a complete line of irrigation equipment, designed, engineered and manufactured in the USA.

- Single Station Controllers
- Short Duration Controllers
- Distributing Valves Up To 6 Zones
- Pump Start Relays
- Gear Driven Sprinklers
- Spray Heads

### MODELS

***4 Outlet Models:***

*6402 - Cammed for 2 zone operation*
*6403 - Cammed for 3 zone operation*
*6404 - Cammed for 4 zone operation*

***6 Outlet Models:***

*6605 - Cammed for 5 zone operation*
*6606 - Cammed for 6 zone operation*

### HOW TO SPECIFY


K-RAIN
IDEAS IN IRRIGATION

**K-Rain Manufacturing Corp.**
1640 Australian Avenue
Riviera Beach, FL 33404 USA
PH: 561 844-1002
FAX: 561 842-9493
EMAIL: krain@k-rain.com
WEB: http://www.k-rain.com

# APPENDIX 8

## PRESSURE REGULATORS

F-luent-Master®

# PRESSURE REGULATORS
## LOW, MEDIUM & HIGH FLOW

### DESCRIPTION

Senninger pressure regulators are ideal for disposing effluent by the land treatment method in accordance with EPA guidelines. They are suitable for use on solid-set and pivot systems. They help maintain correct pressure throughout an irrigation system. Correct pressure is needed for uniform water application and proper flow through each sprinkler. Senninger regulators are designed to maintain a constant preset outlet pressure though inlet pressures vary. Precision parts and close tolerances help provide consistent, reliable regulation with very low hysteresis and little inherent friction loss.

### SPECIFICATIONS

Pressure regulator shall be designed to maintain a constant preset pressure and handle flow rates from
(LF model) ___ 1/10 to 8 gpm or 0.006 to 0.50 L/s
(MF model) ___ 2 to 20 gpm or 0.13 to 1.26 L/s
(HF model) ___ 10 to 32 gpm or 0.63 to 2.02 L/s
Flow restriction shall be negligible until the factory preset operating pressure of _____ (psi / bar) is reached.
Regulating accuracy shall be within ±6%.
Inlet size shall be:
(LF model) ___ 3/4" NPT female; ___ 3/4" hose female
(MF model) ___ 3/4" NPT female; or ___ 1" NPT female; ___ 1" NPT male
(HF model) ___ 1 1/4" NPT female
Outlet size shall be:
(LF model) ___ 3/4" NPT female; ___ 3/4" hose male
(MF model) ___ 3/4" NPT female; or ___ 1" NPT female
(HF model) ___ 1" NPT female

Pressure regulator shall be constructed of high-impact engineering-grade thermoplastics for strength and durability. Regulation shall be accomplished by a fixed stainless steel compression spring, which shall be enclosed in a chamber separate from the normal water passage. Each regulator shall be water-tested for accuracy and shall carry a two-year manufacturer's warranty on materials, workmanship and performance.

*F-luent-Master and Pressure-Master Regulator are registered trademarks of Senninger Irrigation Inc.*

### FEATURES

- Maintains constant preset outlet pressure
- 100% water-tested for accuracy - no adjustments ever needed (± 6% variance of design pressure)
- Strong, durable construction of high-impact engineering-grade thermoplastics with stainless steel compression spring and securing screws
- Very low hysteresis and friction losses
- Models available:

  ***Pressure-Master Regulator® Low-Flow (PMR-LF):***
  Flow: 1/10 to 8 gpm (0.006 to 0.50 L/s)
  Inlet: 3/4" NPT female, 3/4" hose female
  Outlet: 3/4" NPT female, 3/4" hose male
  Factory preset pressures: 6 to 40 psi (0.41 to 2.76 bar)

  ***Pressure-Master Regulator® Medium-Flow (PMR-MF):***
  Flow: 2 to 20 gpm (0.13 to 1.26 L/s)
  Inlet: 3/4" NPT female, 1" NPT female or 1" NPT male
  Outlet: 3/4" NPT female or 1" NPT female
  Factory preset pressures: 6 to 60 psi (0.41 to 4.14 bar)

  ***Pressure Regulator High-Flow (PMR-HF):***
  Flow: 10 to 32 gpm (0.63 to 2.02 L/s)
  Inlet: 1 1/4" NPT female; Outlet: 1" NPT female
  Factory preset pressures: 10 to 50 psi (0.69 to 3.45 bar)
- Above or below ground installation
- Two-year manufacturer's warranty on materials, workmanship and performance

*High levels of particulate matter can lead to clogging. Pressure regulators not recommended for use in poor quality water applications.*

*Available through leading irrigation dealers.*

*Designed and manufactured by:*

**Senninger Irrigation Inc.**

6416 Old Winter Garden Road
Orlando, FL 32835 U.S.A.
Phone: (407) 293-5555 • Fax: (407) 293-5740
www. senninger.com • e-mail: info@senninger.com

Pressure Regulators provided for the drip distribution systems described in this manual include:

20 psi Pressure Regulators required with WASTEFLOW Classic dripline; and

40 psi Pressure Regulators required with WASTEFLOW PC dripline, as a standard component, or with WASTEFRLOW Classic dripline (in addition to the 20 psi regulator), if drip zone pressures will exceed 40 psi. The latter may occur when the drip field is located down gradient from the Headworks Unit, for example.

Specific models of pressure regulators must be matched to effluent flow as follows:

| PR MODEL | OUTLET PRESSURE | FLOW RANGE | MAX. INLET PRESSURE | INLET SIZE | OUTLET SIZE |
|---|---|---|---|---|---|
| **PMR-20LF** | 20 psi | 0.1-8 gpm | 150 psi | ¾" FIPT | ¾" FIPT |
| **PMR-20MF** | 20 psi | 2-20 gpm | 150 psi | 1" FIPT | 1" FIPT |
| **PMR-20HF** | 20 psi | 10-32 gpm | 150 psi | 1¼" FIPT | 1" FIPT |
| **PMR-40LF** | 40 psi | 0.1-8 gpm | 150 psi | ¾" FIPT | ¾" FIPT |
| **PMR-40MF** | 40 psi | 2-20 gpm | 150 psi | 1" FIPT | 1" FIPT |
| **PMR-40HF** | 40 psi | 10-32 gpm | 150 psi | 1¼" FIPT | 1"FIPT |

NOTE: Pressure regulators should always be located downstream from all shut-off valves.

# APPENDIX 9

## PVC 40 FRICTION LOSS CHART

Pounds per square inch (psi) per 100 ft. of pipe

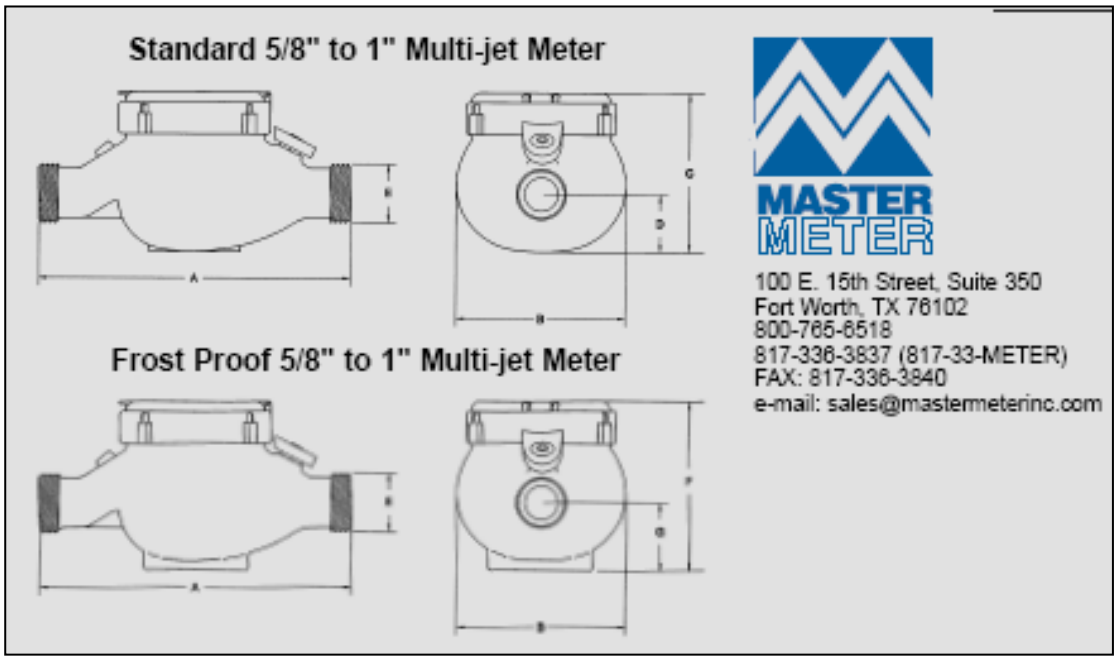
| | ½" | | ¾" | | 1" | | 1¼" | | 1½" | |
|---|---|---|---|---|---|---|---|---|---|---|
| Flow GPM | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI |
| 1 | 1.05 | 0.43 | 0.60 | 0.11 | 0.37 | 0.03 | | | | |
| 2 | 2.11 | 1.55 | 1.2 | 0.39 | 0.74 | 0.12 | 0.43 | 0.03 | | |
| 3 | 3.17 | 3.27 | 1.8 | 0.83 | 1.11 | 0.26 | 0.64 | 0.07 | 0.47 | 0.03 |
| 4 | 4.22 | 5.57 | 2.41 | 1.42 | 1.48 | 0.44 | 0.86 | 0.11 | 0.63 | 0.05 |
| 5 | 5.28 | 8.42 | 3.01 | 2.15 | 1.86 | 0.66 | 1.07 | 0.17 | 0.79 | 0.08 |
| 6 | 6.33 | 11.81 | 3.61 | 3.01 | 2.23 | 0.93 | 1.29 | 0.24 | 0.95 | 0.11 |
| 8 | 8.44 | 20.10 | 4.81 | 5.12 | 2.97 | 1.58 | 1.72 | 0.42 | 1.26 | 0.20 |
| 10 | 10.55 | 30.37 | 6.02 | 7.73 | 3.71 | 2.39 | 2.15 | 0.63 | 1.58 | 0.30 |
| 15 | | | 9.02 | 16.37 | 5.57 | 5.06 | 3.22 | 1.33 | 2.36 | 0.63 |
| 20 | | | | | 7.42 | 8.61 | 4.29 | 2.27 | 3.15 | 1.07 |
| 25 | | | | | 9.28 | 13.01 | 5.36 | 3.42 | 3.94 | 1.63 |
| 30 | | | | | 11.14 | 18.22 | 6.43 | 4.80 | 4.73 | 2.27 |
| 35 | | | | | | | 7.51 | 6.38 | 5.52 | 3.01 |
| 40 | | | | | | | 8.58 | 8.17 | 6.30 | 3.88 |
| 45 | | | | | | | 9.65 | 10.16 | 7.09 | 4.80 |
| 50 | | | | | | | 10.72 | 12.35 | 7.88 | 5.83 |
| 60 | | | | | | | | | 9.46 | 8.17 |
| 70 | | | | | | | | | 11.03 | 10.87 |

| | 2" Pipe | | 2½"" Pipe | | 3" Pipe | | 4" Pipe | | 6" Pipe | |
|---|---|---|---|---|---|---|---|---|---|---|
| Flow GPM | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI | Velocity FPS | Pressure Drop PSI |
| 6 | 0.57 | 0.03 | | | | | | | | |
| 8 | 0.76 | 0.06 | 0.54 | 0.02 | | | | | | |
| 10 | 0.96 | 0.09 | 0.67 | 0.04 | | | | | | |
| 15 | 1.43 | 0.19 | 1.01 | 0.08 | 0.65 | 0.03 | | | | |
| 20 | 1.91 | 0.32 | 1.34 | 0.13 | 0.87 | 0.05 | | | | |
| 25 | 2.39 | 0.48 | 1.67 | 0.20 | 1.08 | 0.07 | | | | |
| 30 | 2.87 | 0.67 | 2.01 | 0.28 | 1.30 | 0.10 | | | | |
| 35 | 3.35 | 0.89 | 2.35 | 0.38 | 1.52 | 0.13 | 0.88 | 0.03 | | |
| 40 | 3.82 | 1.14 | 2.64 | 0.48 | 1.73 | 0.17 | 1.01 | 0.04 | | |
| 45 | 4.30 | 1.42 | 3.01 | 0.60 | 1.95 | 0.21 | 1.13 | 0.05 | | |
| 50 | 4.78 | 1.73 | 3.35 | 0.73 | 2.17 | 0.25 | 1.26 | 0.07 | | |
| 60 | 5.74 | 2.42 | 4.02 | 1.02 | 2.60 | 0.35 | 1.51 | 0.09 | | |
| 70 | 6.69 | 3.22 | 4.69 | 1.36 | 3.04 | 0.47 | 1.76 | 0.12 | | |
| 80 | 7.65 | 4.13 | 5.36 | 1.74 | 3.47 | 0.60 | 2.02 | 0.16 | | |
| 90 | 8.60 | 5.13 | 6.03 | 2.16 | 3.91 | 0.75 | 2.27 | 0.20 | | |
| 100 | 9.56 | 6.23 | 6.70 | 2.63 | 4.34 | 0.91 | 2.52 | 0.24 | 1.11 | 0.03 |
| 125 | 11.95 | 9.42 | 8.38 | 3.97 | 5.42 | 1.38 | 3.15 | 0.37 | 1.39 | 0.05 |
| 150 | | | 10.05 | 5.56 | 6.51 | 1.93 | 3.78 | 0.51 | 1.67 | 0.07 |
| 175 | | | | | 7.59 | 2.57 | 4.41 | 0.68 | 1.94 | 0.09 |
| 200 | | | | | 8.68 | 3.40 | 5.04 | 0.90 | 2.22 | 0.12 |

Optimum velocity is 2 - 5 ft. per second.
The pipe is Schedule 40
ASTM D 1785, D2672, D1784 Cell Class 12454-A

# APPENDIX 10

## FLOW METER &PRESSURE GAUGE




**Master Meter Multi-jet Flow Meters ⅝ - 2”**

## PRESSURE GAUGE

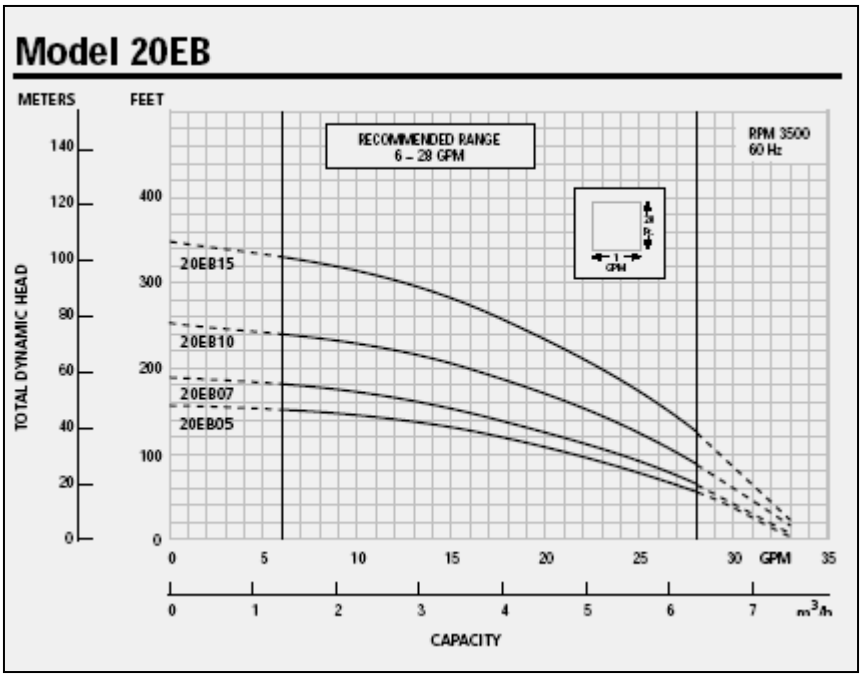

**GEOFLOW Pressure Gauge**
Geoflow pressures gauges are suitable for corrosive environments in wastewater applications. The PGM series comes in a 2 1 /2 " or 4" case, features all stainless steel construction, and is environmentally protected to IP65.

# APPENDIX 11

## PUMPS, FLOATS, & CHECK VALVES

PUMP SELECTION CHART FOR DRIP DISTRIBUTION SYSTEMS,

| SELECTION | PUMP MODEL | SIZE (HP) | FLOW (gpm) | VOLTAGE (v) |
|---|---|---|---|---|
| A | 20EB05 | ½ | 20 | 115 |
| B | 20EB10 | 1 | 20 | 230 |
| C | Other as approved | | | |




## CHECK VALVES

NIBCO
AHEAD OF THE FLOW®
www.nibco.com

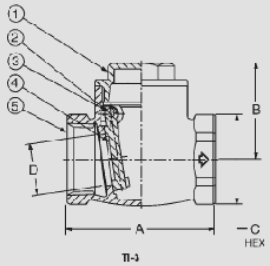
### Brass Check Valves

Brass Body • Swing Type Check

**200 PSI/14 Bar Non-Shock Cold Working Pressure**
**NSF/ANSI 61-8 Compliant**

MATERIAL LIST

| PART | SPECIFICATION |
|---|---|
| 1. Bonnet | Bronze ASTM B 584 Alloy C85700 |
| 2. Plug | Bronze ASTM B 16 Alloy C36000 |
| 3. Pin | Brass ASTM B 16 Alloy C37700 |
| 4. Disc | Brass ASTM B 124 Alloy C37700 |
| 5. Body | Brass ASTM B 584 Alloy C85700 or Alloy C83600 |




TI-3
NPT to NPT

TI-3
Threaded

NIBCO INC. WORLD HEADQUARTERS • 1516 MIDDLEBURY ST. • ELKHART, IN 46516-4740 • USA • PH: 1.800.234.6227
TECH SERVICES PH: 1.888.446.4226 • FAX: 1.800.234.0327 • INTERNATIONAL SERVICE PH: +1.574.295.3327 • FAX: +1.574.295.3465
www.nibco.com

DIMENSIONS—WEIGHTS

| Size | | Dimensions TI-3 A | | SI-3 A | | TI-3 B | | SI-3 B | | TI-3 C | | SI-3 C | | TI-3 D | | SI-3 D | | SI-3 E | | WEIGHT TI-3 | | SI-3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | In. | mm. | Lbs. | Kg. | Lbs. | Kg. |
| ½ | 15 | 2.05 | 52 | 2.13 | 54 | 1.50 | 38 | 1.50 | 38 | 1.00 | 25 | 0.63 | 16 | 0.52 | 13 | 0.52 | 13 | 0.50 | 13 | 0.46 | 0.21 | 0.46 | 0.21 |
| ¾ | 20 | 2.32 | 59 | 2.99 | 76 | 1.57 | 40 | 1.57 | 40 | 1.22 | 31 | 0.88 | 22 | 0.70 | 18 | 0.70 | 18 | 0.75 | 19 | 0.66 | 0.30 | 0.66 | 0.30 |
| 1 | 25 | 2.72 | 69 | 3.66 | 93 | 1.77 | 45 | 1.77 | 45 | 1.50 | 38 | 1.13 | 29 | 0.94 | 24 | 0.94 | 24 | 0.91 | 23 | 0.92 | 0.42 | 0.92 | 0.42 |
| 1¼ | 32 | 3.11 | 79 | 4.09 | 104 | 2.01 | 51 | 2.01 | 51 | 1.85 | 47 | 1.38 | 35 | 1.24 | 32 | 1.24 | 32 | 0.97 | 25 | 1.60 | 0.73 | 1.60 | 0.73 |
| 1½ | 40 | 3.50 | 89 | 4.57 | 116 | 2.17 | 55 | 2.17 | 55 | 2.11 | 54 | 1.63 | 41 | 1.42 | 36 | 1.42 | 36 | 1.09 | 28 | 1.79 | 0.81 | 1.79 | 0.81 |
| 2 | 50 | 4.29 | 109 | 5.51 | 140 | 2.64 | 67 | 2.64 | 67 | 2.60 | 66 | 2.13 | 54 | 1.81 | 46 | 1.81 | 46 | 1.34 | 34 | 2.87 | 1.30 | 2.87 | 1.30 |
| 2½ | 65 | 5.31 | 135 | — | — | 3.31 | 84 | — | — | 3.23 | 82 | — | — | 2.26 | 57 | — | — | — | — | 5.29 | 2.40 | — | — |
| 3 | 80 | 6.30 | 160 | — | — | 3.78 | 96 | — | — | 3.78 | 96 | — | — | 2.70 | 69 | — | — | — | — | 8.82 | 4.01 | — | — |
| 4 | 100 | 7.38 | 190 | — | — | 4.45 | 113 | — | — | 4.80 | 122 | — | — | 3.78 | 96 | — | — | — | — | 13.23 | 6.01 | — | — |

# SJE Rhombus CONTROLS

## Control Switch Installation Instructions

SJE-Rhombus® narrow angle control switches accurately monitor liquid levels in sewage, and non-potable water applications. These switches are designed to activate pump control panels and alarms.

The SJE SignalMaster® and SJE SignalMaster® SPDT control switches passed NSF Standard 61 protocol by an approved Water Quality Association laboratory for use in potable water applications.

### SENSOR FLOAT®

- Mercury activated.
- Suitable for use with an intrinsically safe circuit.**
- Not sensitive to rotation.
- Mounting options: mounting clamp, internal or cable weight.

**Contact SJE-Rhombus for specific intrinsically safe applications.

### SENSOR FLOAT® MINI

- Mercury activated.
- Narrow angle float switch in a small float housing.
- Suitable for use with an intrinsically safe circuit.**
- Not sensitive to rotation.
- Mounting options: mounting clamp or cable weight.

**Contact SJE-Rhombus for specific intrinsically safe applications.

### SJE SIGNALMASTER®

- Mechanically activated.
- Control differential of 1.5 inches above or below horizontal.
- Not sensitive to rotation.
- Mounting options: mounting clamp or cable weight.

### SJE SIGNALMASTER® SPDT

- Mechanically activated.
- Control differential of 1.5 inches above or below horizontal.
- Not sensitive to rotation.
- Mounting options: mounting clamp or cable weight.

### PREVENTATIVE MAINTENANCE

- Periodically inspect the product. Check that the cable has not become worn or that the housing has not been damaged so as to impair the protection of the product. Replace the product immediately if any damage is found or suspected.
- Periodically check to see that the float is free to move and operate the switch.
- Use only SJE-Rhombus® replacement parts.
- The Sensor Float® and Sensor Float® Mini control switches contain mercury and MUST be recycled or disposed of according to local, state, and federal codes.

### SJE-RHOMBUS® THREE-YEAR LIMITED WARRANTY

**SJE-RHOMBUS®** warrants to the original consumer that this product shall be free of manufacturing defects for three years after the date of consumer purchase. During that time period and subject to the conditions set forth below, **SJE-RHOMBUS®** will repair or replace, for the original consumer, any component which proves to be defective due to defective materials or workmanship of **SJE-RHOMBUS®**.

**THIS EXPRESS WARRANTY DOES NOT APPLY TO THE MOTOR START KIT COMPONENT. SJE-RHOMBUS® MAKES NO WARRANTIES OF ANY TYPE WITH RESPECT TO THE MOTOR START KIT.**

**ELECTRICAL WIRING AND SERVICING OF THIS PRODUCT MUST BE PERFORMED BY A LICENSED ELECTRICIAN.**

**THIS WARRANTY DOES NOT APPLY:** (A) to damage due to lightning or conditions beyond the control of **SJE-RHOMBUS®**; (B) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (C) to failures resulting from abuse, misuse, accident, or negligence; (D) to units which are not installed in accordance with applicable local codes, ordinances, or accepted trade practices, and (E) to units repaired and/or modified without prior authorization from **SJE-RHOMBUS®**.

*Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.*

**TO OBTAIN WARRANTY SERVICE:** The consumer shall assume all responsibility and expense for removal, reinstallation, and freight. Any item to be repaired or replaced under this warranty must be returned to **SJE-RHOMBUS®**, or such place as designated by **SJE-RHOMBUS®**.

**ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS ARE LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. SJE-RHOMBUS® SHALL NOT, IN ANY MANNER, BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF A BREACH OF THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY.**

# SJE Rhombus CONTROLS

## Pump Switch Installation Instructions

SJE-Rhombus® wide angle pump switches are designed to provide automatic control of pumps in non-potable water and sewage applications. The SJE PumpMaster®, SJE PumpMaster® Plus and SJE PumpMaster® SPDT passed NSF Standard 61 protocol by an approved Water Quality Association laboratory for use in potable water applications.

### JUNIOR SUPER SINGLE®

Mercury activated pump switch for direct control of pumps in:

- Sewage
- Non-potable Water
- Non-turbulent applications

U.S. Patent Nos. 4,429,864 & 4,672,934

| tether length | 3.5 min. | 6 | 8 | 10 | 12 | 15 | 17 |
|---|---|---|---|---|---|---|---|
| pumping range | 6.5 | 8.5 | 11 | 13 | 14 | 17 | 19 |

### SUPER SINGLE®

Mercury activated pump and control switch for:

- Sewage
- Non-potable Water

U.S. Patent No. 4,302,941

| tether length | 3.5 min. | 5 | 7 | 9 | 13 | 15 |
|---|---|---|---|---|---|---|
| pumping range | 6.5 | 7.5 | 8.5 | 11 | 12.5 | 13.5 |

### SJE AMPMASTER®

Mechanically activated pump switch for direct control of pumps in:

- Sewage
- Non-potable Water

U.S. Patent Nos. 5,097,091 & 5,142,109

| tether length | 5 min. | 10 | 14 | 18 | 22 max. |
|---|---|---|---|---|---|
| pumping range | 9 | 13 | 17 | 21 | 24 |

### SJE PUMPMASTER®

Mechanically activated pump switch for direct control of pumps in:

- Sewage
- Non-potable Water
- Potable Water

U.S. Patent Nos. 5,097,091 & 5,142,109

| tether length | 3.5 min. | 6 | 10 | 14 | 18 | 22 | 24 |
|---|---|---|---|---|---|---|---|
| pumping range | 7 | 10 | 16 | 22 | 28 | 33 | 36 |

### SJE PUMPMASTER® PLUS

Mechanically activated pump switch for direct control of pumps in:

- Sewage
- Non-potable Water
- Potable Water

U.S. Patent Nos. 5,097,091 & 5,142,109

| tether length | 3.5 min. | 6 | 10 | 14 | 18 | 22 | 24 |
|---|---|---|---|---|---|---|---|
| pumping range | 7 | 10 | 16 | 22 | 28 | 33 | 36 |

### SJE PUMPMASTER® SPDT

Mechanically activated pump switch for direct control of pumps in:

- Sewage
- Non-potable Water
- Potable Water

U.S. Patent Nos. 5,097,091 & 5,142,109

| tether length | 3.5 min. | 6 | 10 | 14 | 18 | 22 | 24 |
|---|---|---|---|---|---|---|---|
| pumping range | 7 | 10 | 16 | 22 | 28 | 33 | 36 |

### PREVENTATIVE MAINTENANCE

- Periodically inspect the product. Check that the cable has not become worn or that the housing has not been damaged so as to impair the protection of the product. Replace the product immediately if any damage is found or suspected.
- Periodically check to see that the float is free to move and operate the switch.
- Use only SJE-Rhombus® replacement parts.
- The Junior Super Single® and Super Single® pump switches contain mercury and MUST be recycled or disposed of according to local, state, and federal codes.

### SJE-RHOMBUS® THREE-YEAR LIMITED WARRANTY

**SJE-RHOMBUS®** warrants to the original consumer that this product shall be free of manufacturing defects for three years after the date of consumer purchase. During that time period and subject to the conditions set forth below, **SJE-RHOMBUS®** will repair or replace, for the original consumer, any component which proves to be defective due to defective materials or workmanship of **SJE-RHOMBUS®**.

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**ELECTRICAL WIRING AND SERVICING OF THIS PRODUCT MUST BE PERFORMED BY A LICENSED ELECTRICIAN.**

**THIS WARRANTY DOES NOT APPLY:** (A) to damage due to lightning or conditions beyond the control of **SJE-RHOMBUS®**; (B) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (C) to failures resulting from abuse, misuse, accident, or negligence; (D) to units which are not installed in accordance with applicable local codes, ordinances, or accepted trade practices, and (E) to units repaired and/

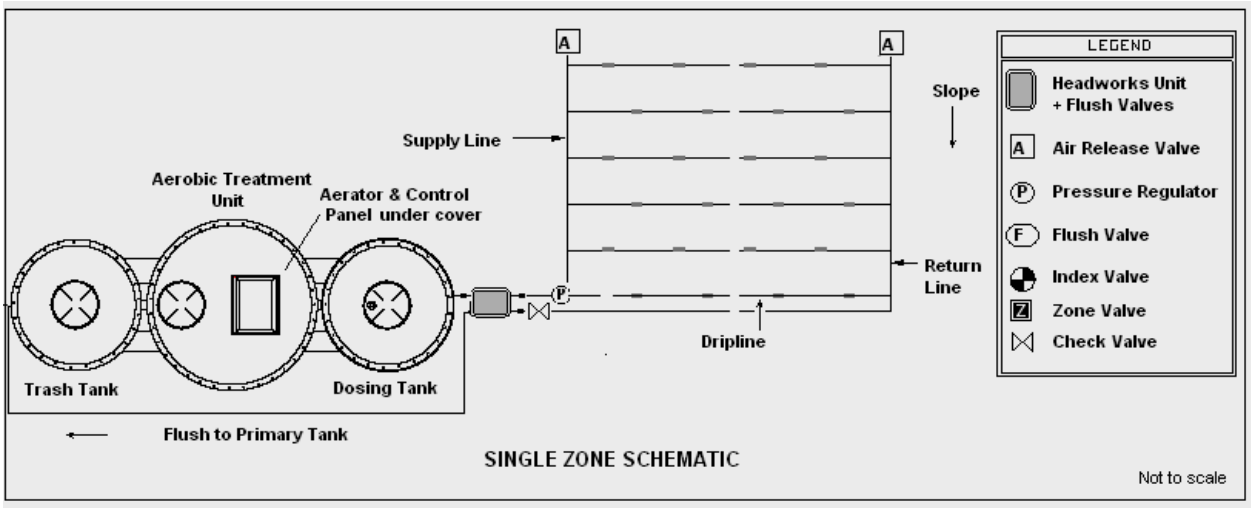
*Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.*

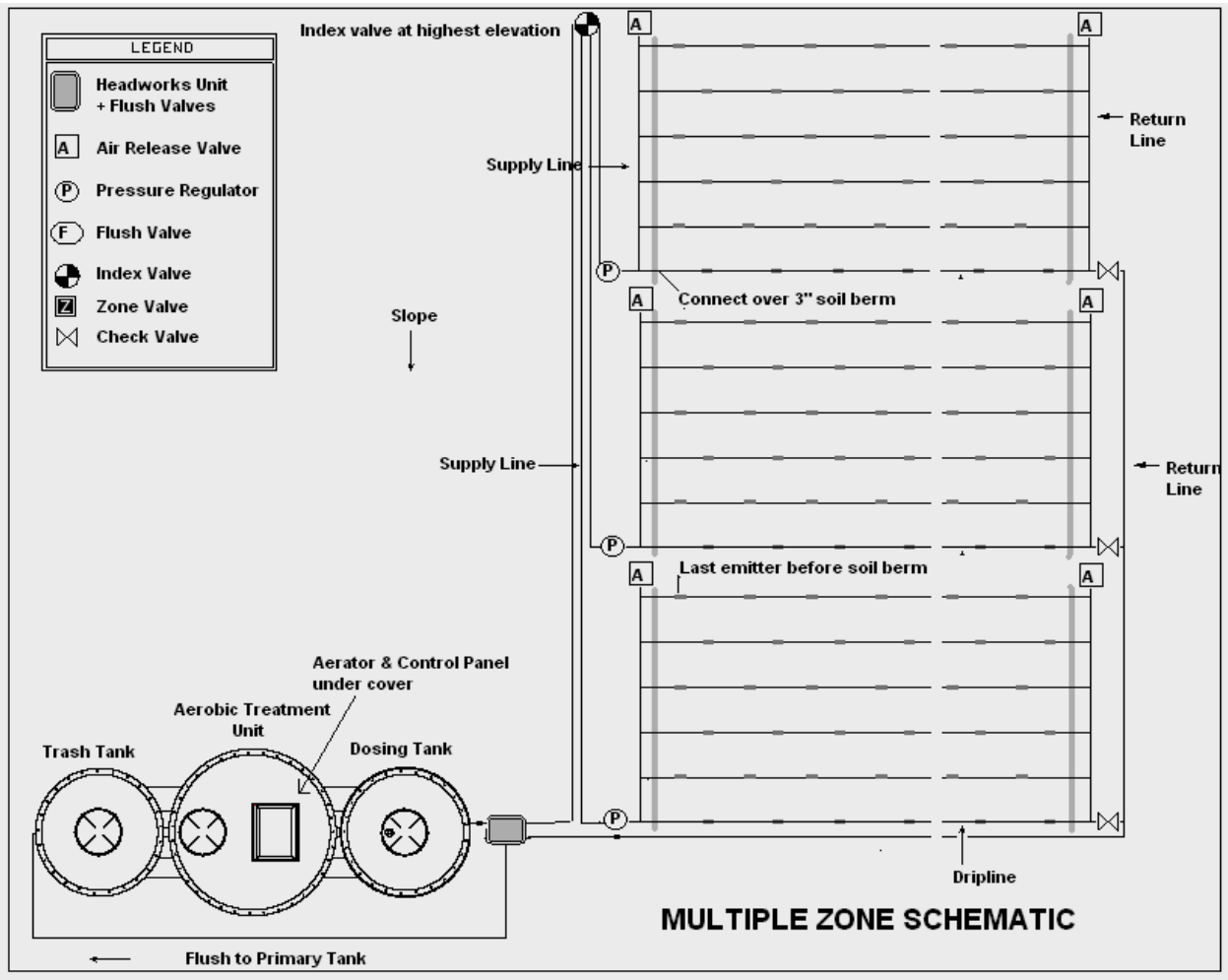
**TO OBTAIN WARRANTY SERVICE:** The consumer shall assume all responsibility and expense for removal, reinstallation, and freight. Any item to be repaired or replaced under this warranty must be returned to **SJE-RHOMBUS®**, or such place as designated by **SJE-RHOMBUS®**.

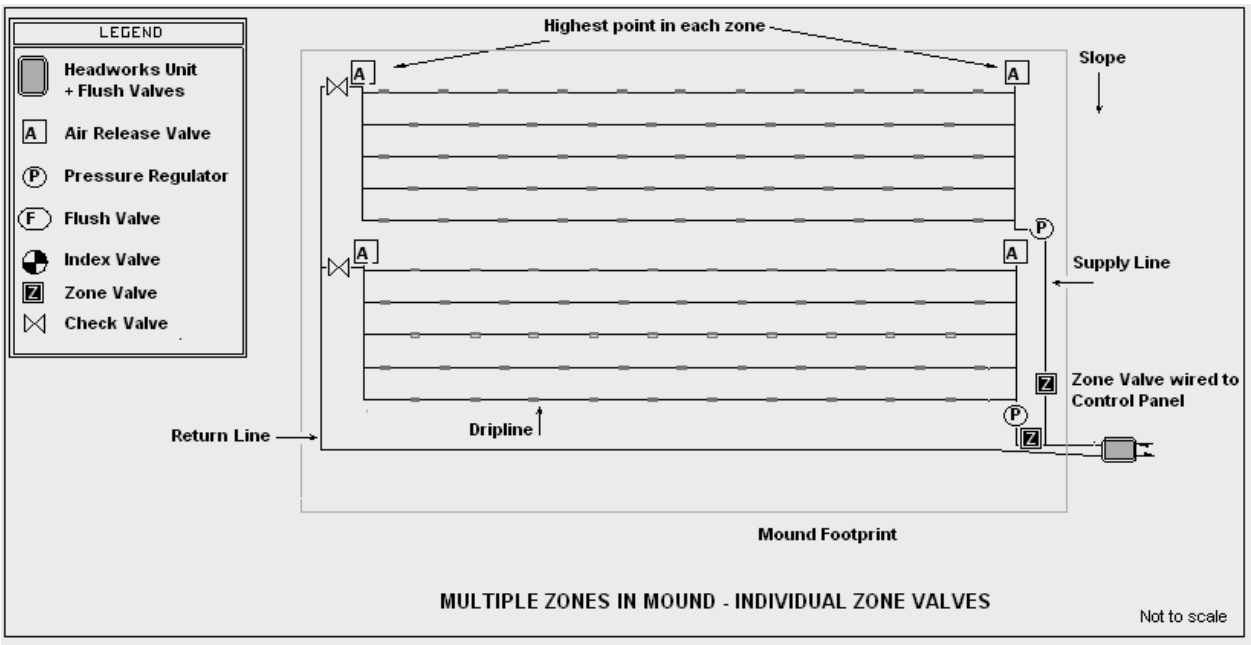
**ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS ARE LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. SJE-RHOMBUS® SHALL NOT, IN ANY MANNER, BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF A BREACH OF THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY.**

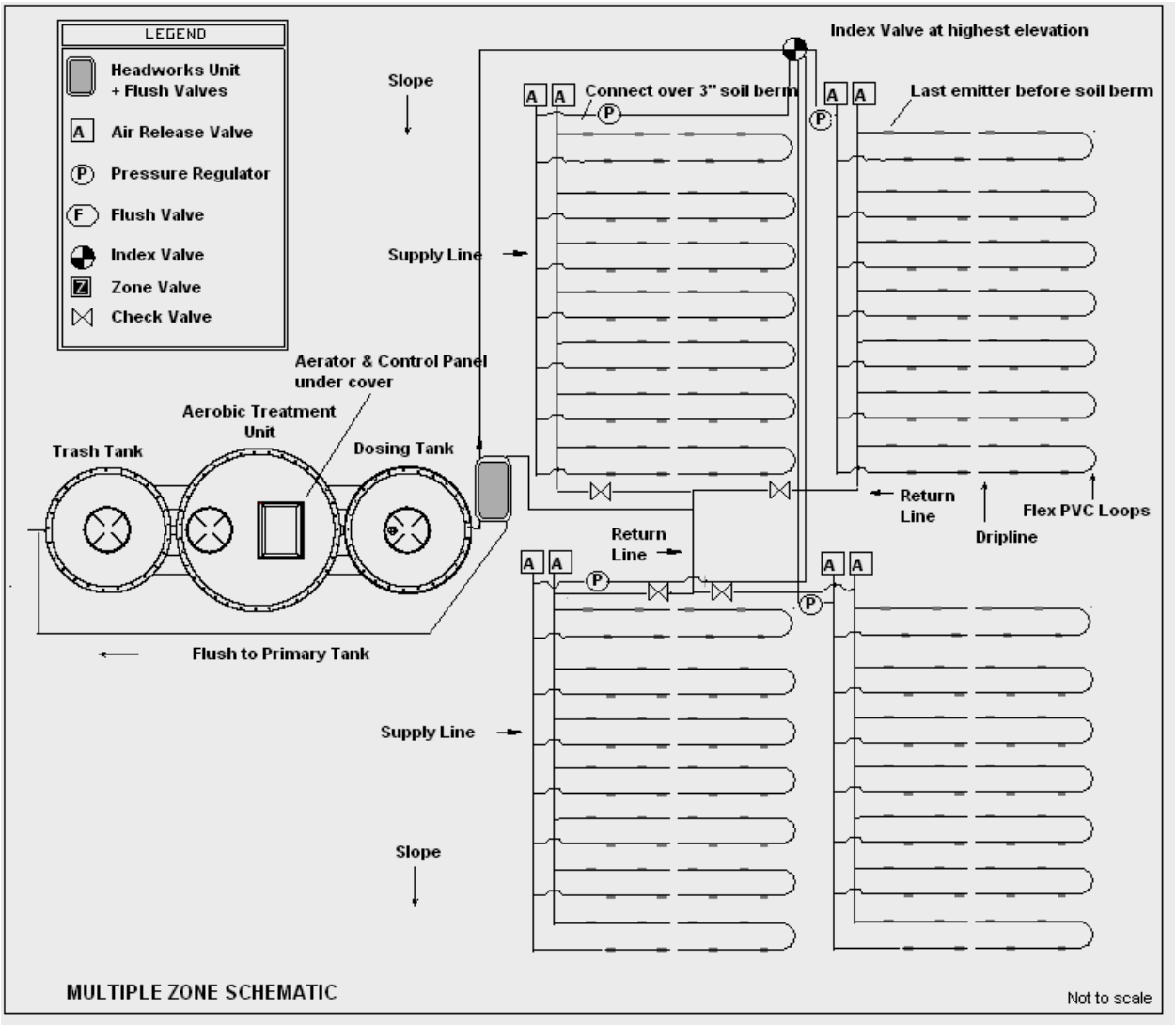
# APPENDIX 12

## DRAWINGS & ILLUSTRATIONS




LEGEND
Headworks Unit + Flush Valves
Air Release Valve
Pressure Regulator
Flush Valve
Index Valve
Zone Valve
Check Valve
Highest point in each zone
Slope
Supply Line
Zone Valve wired to Control Panel
Return Line
Dripline
Mound Footprint
MULTIPLE ZONES IN MOUND - INDIVIDUAL ZONE VALVES
Not to scale


LEGEND
Headworks Unit + Flush Valves
Air Release Valve
Pressure Regulator
Flush Valve
Index Valve
Zone Valve
Check Valve
Index Valve at highest elevation
Slope
Connect over 3" soil berm
Last emitter before soil berm
Supply Line
Aerator & Control Panel under cover
Aerobic Treatment Unit
Trash Tank
Dosing Tank
Return Line
Flex PVC Loops
Dripline
Return Line
Flush to Primary Tank
Supply Line
Slope
MULTIPLE ZONE SCHEMATIC
Not to scale

# APPENDIX 13
## OWNER'S MAINTENANCE AGREEMENT

**Ecological Tanks, Inc.** provides that a licensed, trained, and certified installer/service provider shall perform routine maintenance for the drip distribution system installed at the address indicated below for a minimum period of 2 years from the date of installation, as part of the purchase price. The treatment system and drip distribution shall be serviced at least once every six (6) months, when the following steps shall be performed:

- ☐ Check control panel and advanced treatment system for proper function.
- ☐ Check spin clean filter, & clean as needed.
- ☐ Check filter & field flush valves & manually operate.
- ☐ Check the pump flow rate & pressures in the drip distribution system.
- ☐ Check air release valves for proper operation.
- ☐ Check zone indexing valve & check valves for proper operation.
- ☐ Check condition of the drip field for wet spots.
- ☐ Check effluent quality, if necessary, (cost of samples not included in this agreement).
- ☐ Repair or replace component parts, if needed, & notify owner & manufacturer immediately.
- ☐ Record flow & pressure readings.
- ☐ Record repairs, replacements, adjustments, & other observations.
- ☐ Send of inspection report to owner, regulator, etc., as required.

The owner/purchaser is solely responsible for proper operation and routine maintenance of the drip distribution system, the advanced treatment system, and all other components of the onsite sewage system installed on owner/purchaser's property. The owner must read and follow manufacturer's instructions for system maintenance. Without continued routine, semi-annual maintenance of the onsite sewage system, beyond the term of this agreement, by a licensed, trained, and certified installer/service provider, the advanced treatment system and drip distribution system will not operate at their maximum efficiencies, and may malfunction, or fail. **The owner is advised to contact their service provider before this agreement expires and establish a new maintenance contract.**

This agreement covers the cost of two service visits per year for the initial two years; the repair or replacement of component parts of the drip distribution system, if defective; and the twelve tasks listed above. The agreement does not cover the cost of additional service visits or the repair or replacement of component parts caused by owner abuse or neglect.

**OWNER'S MAINTENANCE AGREEMENT**

**Purchaser**

Owner's Name_____ Phone_____
Physical Address_____ City_____
State_____ Zip Code_____ Serial #_____ Model #_____
Installation Date_____ _____ Signature_____ Date_____ Expiration_____

**Service Provider**

Name_____ License #_____
Company Name_____ Address_____
City_____ State_____ Zip Code_____ Phone_____
Training/Certification Date_____ Signature_____ Date_____

# APPENDIX 14
## LIMITED WARRANTY

Ecological Tanks, Inc. (hereinafter referred to as manufacturer) warrants each drip distribution system to be free from defects in workmanship and materials from the date of installation by an authorized dealer/installer for a period of two (2) year provided that the system has been installed and maintained according to manufacturer's instructions.

When properly installed and registered with the manufacturer, manufacturer's sole obligation under this limited warranty is to repair or exchange any components, F.O.B., that, in manufacturer's judgment, is defective, provided that said component part was paid for in full and returned through an authorized distributor. The warrantee must specify the nature of the defect in writing to manufacturer. The limited warranty makes no provisions for any informal dispute settlement agreement.

(a) The limited warranty does not cover any drip distribution system that was not properly installed; damaged due to altered or improper wiring or overload protection; flooded by external means; disassembled by unauthorized person(s); covered, paved, disturbed, or modified contrary to manufacturer's instructions; or damaged by an act of nature. The limited warranty does not cover damages or defects caused by insects, rodents, or other animals to any component part of the system. The limited warranty does not cover improper design; application (other than its intended use); improper soil evaluation; or hydraulic overloading.

No warranty is made as to the field performance of any system. The limited warranty applies only to the drip distribution system itself and does not include any of the purchaser's plumbing, pre-treatment plants, or any of the house wiring.

The manufacturer reserves the right to replace any component part covered under this warranty with a component part that in manufacturer's opinion is equivalent to the part replaced. The manufacturer claims no responsibility for delays or damages caused by defective components or materials which cause due to interruption of service for repairs or replacement of component parts covered by the limited warranty.

**MANUFACTURER'S WARRANTY REGISTATION CERTIFICATE**

**Purchaser Information**

Owner's Name_____ Phone_____
Physical Address_____ City_____
State_____ Zip Code_____ Serial #_____ Model #_____
Installation Date_____ _ Signature_____ Date_____

**Installer Information**

Installers' Name_____ License #_____
Company Name_____ Physical Address_____
City_____ State_____ Zip Code_____ Phone_____
Signature_____ Date_____

**System Information**

Treatment System_____ Size ____ gpd Manufacturer _____ Phone#_____
Designer_____ Address_____ City _____ Phone#_____
Service Provider _____ Address _____ City_____ Phone#_____
The original of this form shall be completed and mailed to Ecological Tanks, Inc. within 30 days of the date of installation for the warranty to be activated. A copy shall be given to the owner and installer for safe keeping.