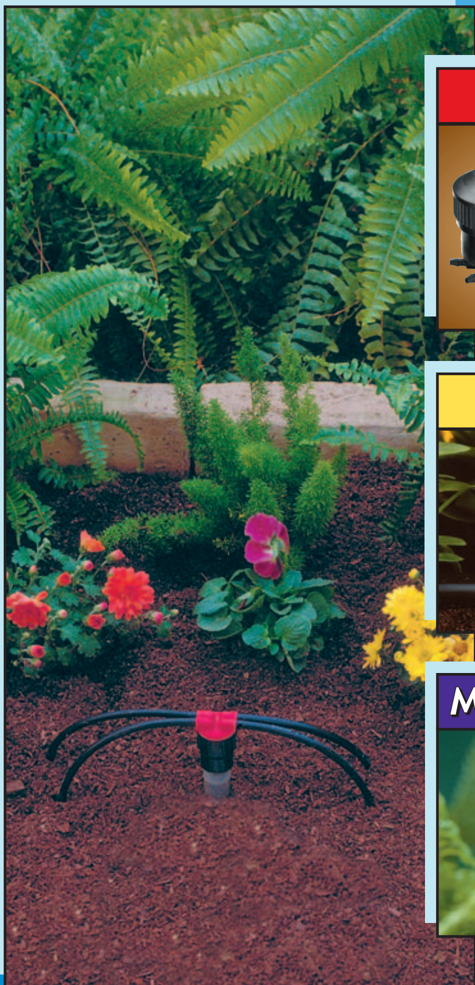
AQUARIUS BRANDS INCORPORATED™

Low Volume Irrigation Design & Installation

Contractor Specification Guide



Bubblers

Drip Systems

Micro-Irrigation

PEPCO™ API™

A Guide to Efficient Landscape Irrigation & Water Conservation

TABLE OF CONTENTS

Low Volume Irrigation Benefits
Water Conservation is a key benefit of Aquarius Brands Low Volume Irrigation Systems. Water, our most precious natural resource, can be utilized with unmatched efficiency in a properly designed, installed and maintained Low Volume System. No other type of irrigation offers better plant health, better soil conditioning or better utilization of resources than a Low Volume System.

Aquarius Brands Low Volume Irrigation Systems are designed to supply water directly to plants, based on their individual watering requirements. These systems can utilize 70% less water than traditional irrigation systems by applying water at very low application rates with minimal loss from wind, evaporation, sloped terrain or other environmental factors.

Along with the benefits of carefully directed water application, Low Volume Irrigation Systems promote plant health by applying water directly to the root zone, the area from which plants draw a majority of their usable nutrients; a well developed Root Zone results in more stable, vigorous plants. Low Volume Irrigation keeps water away from high-traffic pedestrian areas, lessening the possibility of slippage or accidents, and it keeps water off fences, buildings or hardscapes which may be damaged by traditional irrigation systems.

Resource Conservation, Plant Health, Landscape Aesthetics... all good reasons to consider Aquarius Brands Low Volume Irrigation.

System Considerations
Aquarius Brands Low Volume Irrigation Systems can be designed as 'stand alone' watering systems in new installations, or 'retrofit' into existing Sprinkler/Sprayhead systems, as part of overall water-conservation efforts. Identification of the system type helps determine the next step in the design process and assists in the appropriate selection of products.

Existing Sprinkler/Sprayhead systems are designed with higher flow rates and transport water via underground piping, so when 'retrofitting', a Bubbler System may be your best solution. Bubblers are also a good choice in new designs as part of an overall Low Volume System incorporating various components from Drip Systems or Micro-Irrigation.
See Bubbler Irrigation on pg. 17.

Drip Systems and Micro-Irrigation Systems are generally designed as 'stand alone'. They transport water, at lower flow rates, through flexible Supply Tubing, Distribution Tubing, and apply it with Emitters and MicroSprays. See Drip Irrigation on pg. 20 and Micro-Irrigation on pg. 25.

When considering a Low Volume Irrigation System, it is also necessary to determine whether or not pressure compensating and/or flow control devices are needed. There are several factors to consider: terrain, the slope of the land, the size and shape of the drip zone or area, location, and/or the number of points of connection. Systems where the terrain is irregular, has limited points of connection and/or large ground area might be a good application for pressure compensation and/or flow control devices. This is due to the longer lengths of tubing which will be needed to reach all the various areas and/or plants. Longer lengths of tubing usually cause larger pressure variations in the system and Pressure Compensating devices would be the ideal choice. However, typical residential drip zones/areas are small, and with proper pressure regulation can be irrigated with less expensive turbulent flow devices.

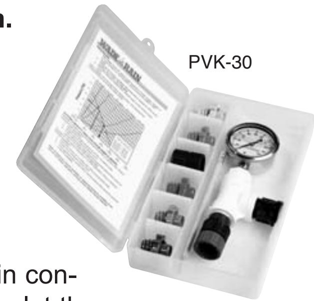
SYSTEM DESIGN & WATERING SCHEDULE

In designing an efficient Low Volume Irrigation System, it's important to take into account available Water Pressure, Filtration Requirements, Climate, Soil Type, Variations in Terrain - as well as - Plant Type, Size, Planting Density and Individual Plant Watering Needs. The following guidelines will help to plan and operate an efficient Landscape Irrigation System.

Draw a Plan of Your Landscape. A detailed plan of your landscape is essential in designing an efficient watering system. On your plan you should have a rough layout of your yard, planting areas, plant types and sizes, water locations and existing watering system elements, if present. Your plan does not need to be precisely to scale, but should be a fair representation of existing and future plantings. You should also note individual plant or area water requirements as determined later in this section.

Determine Pressure Available for Your System. Most bubblers, emitters, and spray systems will require about 20-30 PSI at the head. Make sure you have at least 30 PSI available at the source. If available pressure is higher, you may need to have one or more pressure regulators installed, depending on the type of irrigation device selected. A good method to check pressure is to use a Pressure Test Kit. This uses a series of nozzles in conjunction with a pressure gauge. It has a graph to plot the pressures for each nozzle. Once completed, you'll have a nice 'Flow verses Pressure' graph which can aid in the design of the system and help determine if a pressure regulator is needed.

PVK-30



4E-3/4A-150

Determine Filtration Requirements. It is a good practice to install a filter before most low volume systems to catch rust, sand and other particles before they get into the emission devices. In general, the lower the flow rate of the irrigation device, the more sensitive it will be to clogging from small particles. High flow rate bubblers and high flow rate micro-sprinklers are not as sensitive.

Determine System Type. Bubblers are high application rate systems designed to deliver water in a very short time period; these systems can discharge water directly to individual plants. They adapt to underground PVC piping systems and may be designed as new systems or they may be a retrofit to portions of an existing lawn sprinkler system. The bubblers allow you to meet the plant water requirements within the limited time frame of a typical lawn sprinkler system (15-30 minutes).

Q1633

QB2-186

OCT-816

High rate systems used on clay or sloping soils may require containment basins to prevent the water from running off the intended area. Mini-Pepline™ may be used as a means to provide multiple outlets from a bubbler to spread the water and prevent running off. On sandy soils where the water does not spread as well, Mini-Pepline™ can again be used to distribute the water from a single outlet to cover more soil area. Use the 6" Mini-Pepline™ spacing with bubblers. The length of 6" Mini-Pepline™ should be approximately equal to the flow rate. For example, a 6 GPH bubbler port would need about six feet of 6" spaced Mini-Pepline™, a 20 GPH bubbler port would need about twenty feet of 6" spaced Mini-Pepline™. (20 feet is the maximum recommended for good uniformity).

Drip and Micro-Irrigation are low application rate systems designed to deliver water over a longer period (1-2 hours or more). These systems use polyethylene tubing with emitters to discharge water directly to plants or micro-sprinklers to completely cover closely spaced plantings. It is easy to change the number and positions of these devices if there are changes in the landscape. Mini-Pepline™ may be used as a part of drip system to distribute water to closely spaced plants or for multiple outlets on larger shrubs or trees. 12" spaced Mini-Pepline™ is better suited for systems that run for 1 or more hours per day. For uniform distribution, the maximum recommended length of 12" spaced Mini-Pepline™ is 30'. A supply pressure of 10-15 PSI is recommended for the Mini-Pepline™.

Determine Your Plants Watering Needs.
A simple method for determining an average plant's daily water needs based on canopy diameter is:
(Canopy Diameter x Canopy Diameter) x .1 = PGR or Plant Gallonage Requirement. For example, a tree with a 15' canopy has a daily water need of 15 x 15 x .1 = **22.5 Gallons per day**. A 3' diameter shrub has a need of 3 x 3 x .1 = **.9 Gallons per day**. This formula is based on high density mixed plantings of average water using plants in a hot, dry environment.

Determine Your Run Time and the Number of Days in the Week You Plan to Run the System During the Hottest Part of the Season.
Note: It is usually best to irrigate less frequently and more deeply, if possible, to help establish a deeper root structure for plant health and appearance. If you have an existing lawn system you are retrofitting, it may have an optimum summer run time of 10 min. per day, twice a day and the system operates four times per week. This is 20 min/day x 4 days = 80 minutes (total) per week, which is the **WRT** or Weekly Run Time. If you are designing a drip system and you decide you want to run 2 hours, three times per week, this is a **WRT** of 120 x 3 = 360 minutes per week.

SYSTEM DESIGN & WATERING SCHEDULE

Determine the Flow Rate Required for Each Plant.
For the canopy sizes above, the flow rate per plant is figured as follows: 60 x **PGR** x 7/**WRT** = **GPH.** **Example:** **15' Canopy & 3' Canopy**

Retrofit System:	***Drip System:***
15' Canopy: 60 x 22.5 x 7/80 = 118 GPH (6 Bubbler outlets, 20 GPH each) 3" Canopy: 60 x .9 x 7/80 = 4.7 GPH (2 Bubbler outlets, 2 GPH ea)	15' Canopy: 60 x 22.5 x 7/360 = 26.25 GPH (13 Emitters, 2 GPH each or one Micro-Sprinkler 24 GPH each) 3" Canopy: 60 x .9 x 7/360 = 1.05 GPH (1 Emitter, 1 GPH or 2 Emitters, 1/2 GPH ea)

Refer to pg. 25 for more detail.

For closely spaced plants or groundcover, Mini-Pepline™ may be used as outlined previously, or Micro-Sprinklers may be used. With short run time Bubbler Systems, Micro-Sprinklers should be spaced to provide 'head to head' coverage, to deliver adequate water during the irrigation. For Drip Systems, Micro-Sprinklers may be used free standing, without overlap.

Determine the Zones of Your Irrigation System.
If possible, the hotter areas, which are in direct sunlight surrounded by pavement, should be separated from cooler shaded areas. Seasonal use garden areas should have their own zones. A grouping of potted plants could be zoned separately. Whatever makes it easier to manage the irrigation scheduling by breaking down the landscape into zones of similar water utilization is always a good idea. These zones are called **Hydrozones.**

Determine the Flow Rate Required in Each Zone.
Add up the individual flow rates for each emitter or bubbler outlet and for each micro-sprinkler in the zone. Divide this quantity by 60 to get the flow rate in gallons per minute for the zone.

To Figure the Amount of Water Available:
A given supply line will have a limit on the water available. To determine your water requirements, add up the flow rates of all bubbler outlets used, and then divide by 60 to arrive at gallons per minute. The chart to the right will assist you in determining the number of stations or zones needed to service your system.

To Service Any Area:

Size of Manifold or Mainline	Maximum Capacity
1/2"	5 Gallons/Min.
3/4"	10 Gallons/Min.
1"	15 Gallons/Min.

Scheduling Irrigations:
Using the above methods, your system is designed to handle maximum irrigation needs during the hottest time of the year. You will need to make adjustments to the schedule at different times of the year and during periods of rainfall. In hot, dry areas, July is usually 100% of maximum schedule. June and August may be only 80%-90%; May and September may be 60%-70%; April and October may be 30%-40% and so on.

LOW VOLUME RULES OF "GREEN THUMB"
Micro-Sprinklers need 1-2 hours run time to be effective. Application rates are low and shallow irrigation is the result if run times are too short. If run times must be short, sprinkler spacing should provide 'head to head' coverage.

Emitters need 1-2 hours run time to be effective except on very small plants or in pots or planters.

Higher flow rate **Bubblers** (6-20 GPH), only need 15-30 minutes run time to apply adequate water for an irrigation. On sandy soils, the water may not spread out far enough and may result in irrigating too deeply. In this case, more lower flow rate bubblers may be required. On clay soils or slopes, basins may be required to confine water to the plant area if runoff is a problem.

Vari-Rotors and **Rotor Sprays** have very low application rates, ideal for hillside groundcover or other difficult to irrigate plantings. Application rates are extremely low and run times of 3-6 hours are needed to be effective.

Vari-Jets™ and **Vari-Rotors** as well as **Vortex Sprayers**, **Mini-Bubblers** and **Shrubblers®** all feature flow adjustment. This is advantageous with growing plants or when changing landscape plantings.

Micro-Sprinklers are useful where there are many smaller plants with little open area, like flowerbeds and groundcover.

Emitters and **Bubblers** are used where water is to be confined to prevent weed growth, or to prevent watering where it is not needed or desired.

Small/shallow rooted plants in pots may require more frequent irrigations.

Larger plants with deeper roots require less frequent but longer irrigations to put water deep into the root zone.

Schedule irrigations so soil is wetted to the depth of each plant's root zone.

Sandy soils require more frequent irrigations than loam or clay soils.

Irrigations should be as infrequent as the plants will allow to maintain health and appearance. Generally two to four times a week in hot summer areas depending on soil type and plant size.

Irrigating too long puts water below the root zone, wasting water.

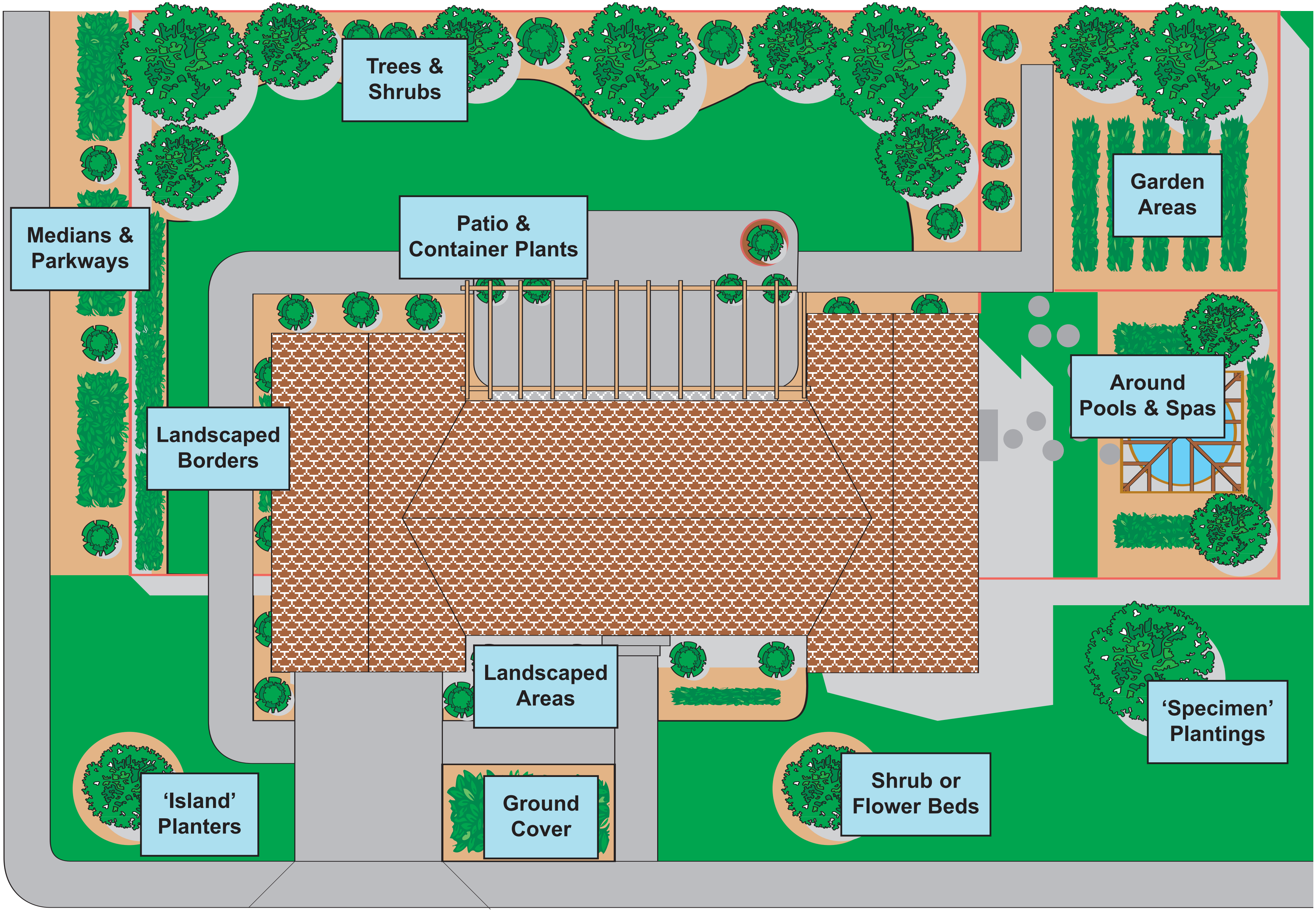
Irrigating too frequently with small applications does not fill the root zone to full depth, limiting plant growth, health and appearance.

Place **Emitters** or **Bubblers** at, or just inside, the drip line of trees, not directly at the base. Move outlets as canopy gets larger.

SYSTEM DESIGN

SYSTEM DESIGN & WATERING SCHEDULE

AQUARIUS BRANDS LOW VOLUME IRRIGATION SYSTEM - THE WATER-CONSERVING SOLUTION FOR A VARIETY OF LANDSCAPE APPLICATIONS

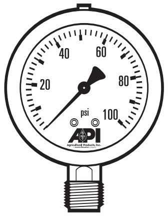


SYSTEM DESIGN

SYSTEM DESIGN & WATERING SCHEDULE

SYSTEM OVERVIEW

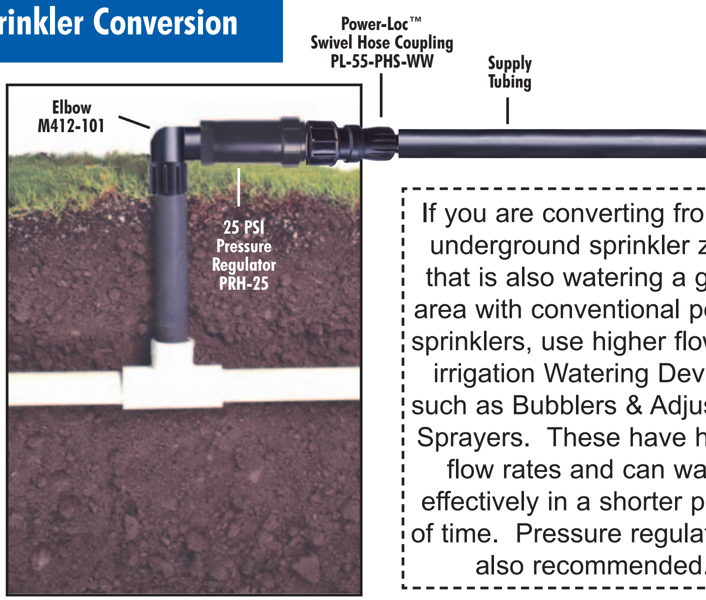
Faucet Connection



Always Check Water Supply Pressure. Low Volume Irrigation systems operate best at 25-35 PSI. Pressure Regulation may be required for optimal performance. Use the Aquarius Brands Pressure Test Kit PVK-30.

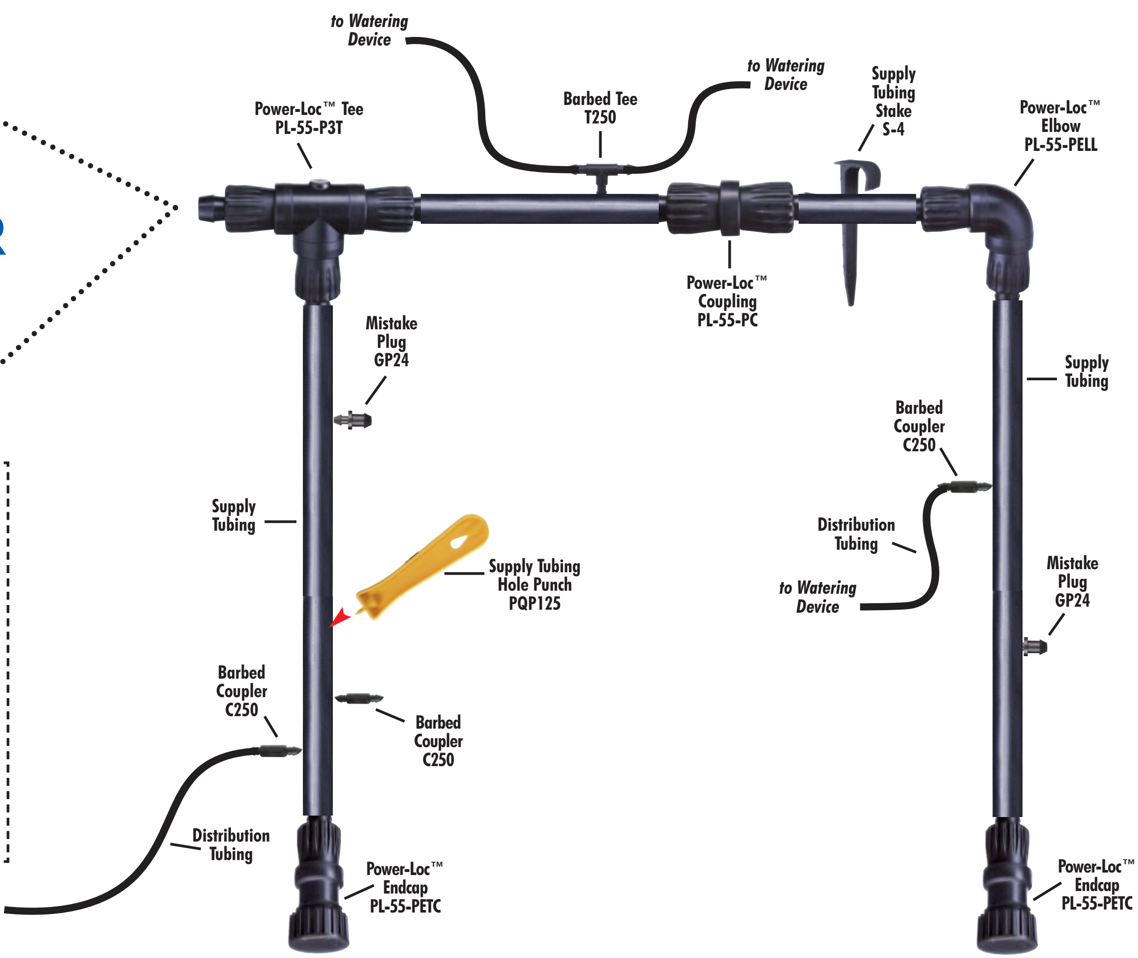
OR

Sprinkler Conversion



If you are converting from an underground sprinkler zone that is also watering a grass area with conventional pop-up sprinklers, use higher flow drip irrigation Watering Devices such as Bubblers & Adjustable Sprayers. These have higher flow rates and can water effectively in a shorter period of time. Pressure regulation is also recommended.

Example: Connection using API™ Power-Loc™ Fittings



SYSTEM BASICS

Every Low Volume irrigation System has basic requirements in order to function efficiently and effectively. Among these are: Point of Connection, Backflow Prevention, proper Filtration and Pressure Regulation.

Low Volume Irrigation Systems employ very small pathways and discharge ports to apply water at a plant's required rate- usually 1/2 Gallon Per Hour (GPH), 1 GPH or 2 GPH. This varies from standard irrigation/sprayhead systems which have larger flow paths and discharge water in Gallons Per Minute (GPM).

For these reasons, it is very important to keep the system free from debris and to regulate the pressure within the appropriate range of the chosen emission device. Aquarius Brands offers a variety of products to meet these needs and to keep the system operating properly.

POINT OF CONNECTION

The first component of a drip system is the control valve. There are many makes and styles available. It is best to choose the size of the valve after you have a good idea of the total flow requirement for each zone. A valve that is oversized for the flow rate will have difficulty closing. A 1" valve requires a minimum flow rate of 5 to 10 GPM; 5 GPM represents 300 1-GPH emitters.

Minimum Number of Emitters for Valve Sizes

Valve Size	3/4"	1"	1 1/2"
GPM	1	5	30
0.5	120	600	3600
1.0	60	300	1800
2.0	30	150	900

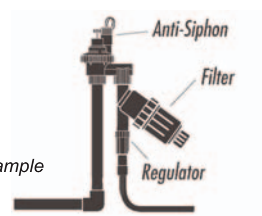
Note: Some valves on the market are designed for lower flow rates. Ask your Aquarius Brands Dealer for this information.

There are two standard Points of Connection in a Low Volume Irrigation System:

1. Hose Bib (outside faucet) or Garden Valve Connection from which an adapter can be attached; initiating the system either electronically or manually.

PASV77H

2. Professional/Valve Connection which may have been professionally installed utilizing underground piping to feed various watering zones.



*Example

**Reference local code for valve requirements.*

BACKFLOW PREVENTION

A back-flow prevention device is required on all irrigation systems. Check valves, double check valves and anti-siphon valves are available in 3/4" and 1" sizes. If the valve you choose does not have a built-in anti-siphon device, or if a hose bib will be the valve controlling your new system, you should install an anti-siphon device on your system. This device is installed just before or after the valve and before the filter and regulator.

PASV77H

FILTERS & FILTRATION

The next component is a filter. The filter is one of the most important components of a drip system. The filter traps all particles larger than the emitter pathways and prevents serious problems resulting from plugged emitters. A 150 mesh screen will provide the best protection for your investment. Remember to check and clean your filter regularly. There are Filters for different types of connections, depending on whether you are using a Hose Bib, Garden Hose or Professional/Valve connection.

API's
4E 3/4A

Y-Filters range in size from 3/4" to 2" (for Landscape Applications) and flow ranges from 9 GPM to 100 GPM.

Inline Filters are attached to a hose end and are generally used where city water is the main water source which is relatively free from debris. They contain 120 mesh poly screens which can be cleaned easily and removed when not in service.

Plastic Hose Thread T-Filters are attached to a Hose Bib (outside faucet) and are available with a variety of replaceable Stainless Steel Screens (50 mesh to 200 mesh) depending on water quality and levels of debris present. The Screen is removable for periodic cleaning, and the T-Filter is available with Auto Flush to reduce maintenance requirements.

4E 3/4T FCH w/ Auto Flush Valve

PRESSURE REGULATION

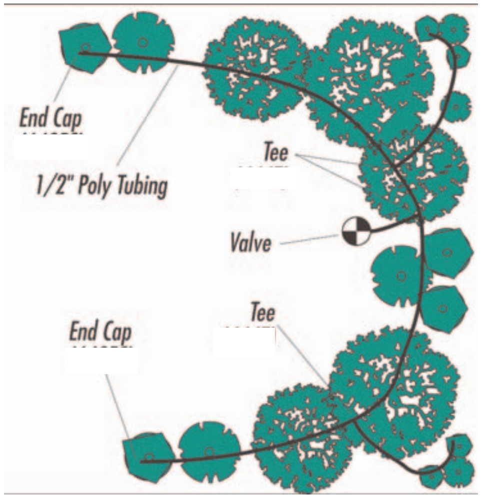
Pressure Regulators are installed after the Filter and are designed to reduce available water pressure to the appropriate operating range of the system. Many water sources have too much pressure for efficient operation of Low Volume Systems. In these cases using a Pressure Test Kit is a good method to evaluate your available water pressure and flow. This evaluation will help determine if a Pressure Regulator is necessary. Bubblers, Drip Systems and Micro-Irrigation Systems have different working pressure requirements- be sure to match the Regulator with the system pressure and the required flow rate.

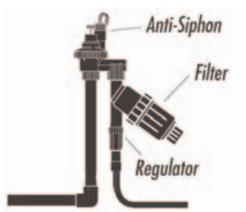
PRH 25 Pressure Regulator

TUBING

Supply Tubing

The most common method of transporting the irrigation water to the planted areas is through 1/2" polyethylene tubing. This is done by rolling the tubing out and placing it through the planted area. In sparsely planted areas, several sections of 1/2" tubing can be laid out using Tees, Elbows and End Caps as shown. When all the tubing is laid out, the system should be turned on and flushed before installing Emitters.





When a drip system is far from the water supply, PVC pipe can be used to transport the water to the planted area. It is best to put the regulator at the end of the PVC line closest to the drip system.

1/2" Supply Tubing is manufactured in a variety of sizes, the most prevalent being 620(O.D.) x 520(I.D.), 700x600, and 710x620. All serve the same purpose - to act as the main water supply line in an irrigation system- they just vary in their Outer Diameter (O.D.) and Inner Diameter (I.D.) and each will exhibit different flow characteristics as a result.

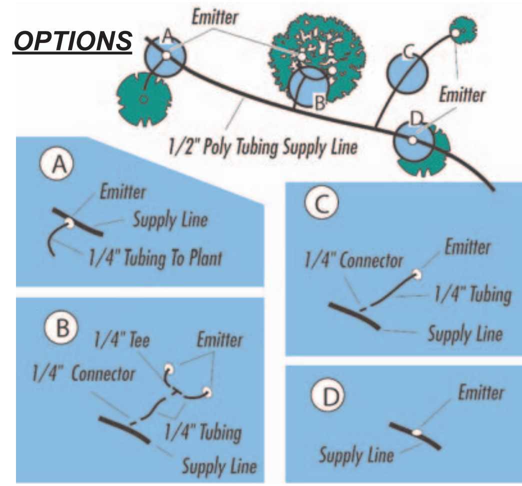
Supply Tubing can be used above ground, below ground, or covered with landscaping material for a less conspicuous installation. It is usually available in 100', 500' or 1000' Coils and can be UV Resistant, manufactured to proper specifications. All Aquarius Brands tubing is UV Resistant.

Micro/Distribution Tubing

Irrigation water is moved from the main Supply Tubing to plant locations and emission devices through Micro/Distribution Tubing, which can be 1/8" or 1/4" and is manufactured from Polyethylene or Vinyl. Distribution Tubing is attached via Connectors punched directly into the Supply Tubing by utilizing a Punch Tool.

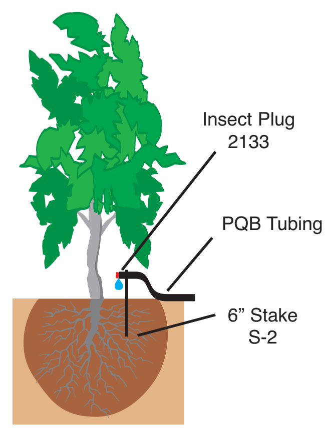
Pepco Quick Punch PQP125 punches 1/8" or 1/4" hole for Barb Fittings. Handle inserts 1/4" Barb Connectors

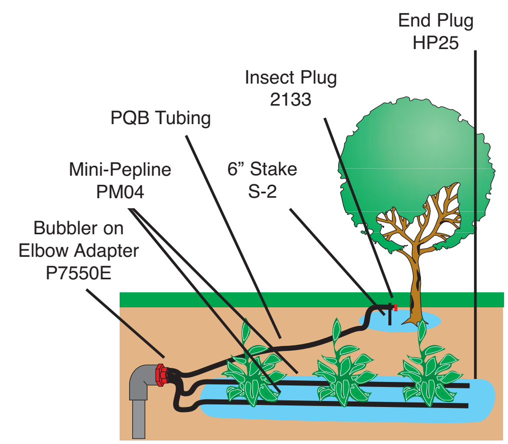
From the main Supply Tubing connection, Micro/Distribution Tubing is easily run to various plant and emitter locations through a series of Tees, Couplings and Elbows. With its small diameter, Micro/Distribution Tubing is very flexible and can be run in difficult locations and interspersed among plants, hardscapes or other obstacles.



Quadra-Bubbler® Tubing

The PQB Quadra-Bubbler® Distribution Tubing is made of the best materials available to ensure optimum performance and tubing life. PQB Tubing is designed to connect directly to Bubbler outlet ports and run directly to the plant intended for irrigation. PQB Tubing is available in polyethylene or vinyl. PQB Quadra-Bubbler® Tubing may be used to water trees and shrubs. Water is distributed directly to the root zone, where plants make the best use of it.





FITTINGS AND CONNECTORS

Low Volume Irrigation Fittings & Connectors come in a variety of sizes and configurations. The most common Fittings for use with Micro/Distribution Tubing are **1/8" or 1/4" Barb or Thread Fittings**, though small Compression Fittings are also used. These small fittings generally come in standard configurations: Adapters, Tees, Elbows, and Couplings.

Barbed Adapter
FHA250

Barbed Coupling
C250

Barbed Elbow
L250

Barbed Tee
T250

Compression Fittings were the industry standard for many years. Supply Tubing is inserted into the fitting, which secures the tubing in place. These fittings come in many sizes to accommodate the diversity of Supply Tubing, the predominant being: 600 Series (620x520 tubing), 700 Series (700x600 tubing), and 710 Series (710x620 tubing). Compression Fittings are not re-usable after installation, which makes line customization or alteration difficult, and Compression Fittings generally accommodate only one size of Tubing.

Versa-Grip® Compression Elbow
VG-700-CELL

Custom Fitting

Versa-Grip® Compression Fittings were developed specifically for the Landscape Industry. This innovation has resulted in a more ergonomically designed fitting, with a larger flow path (lessening flow restriction) to be customized to meet Inlet and Outlet requirements.

Power-Loc™ Fittings are the latest innovation in fittings - solving the problem of 'multiple fittings for multiple tubing sizes'. The Power-Loc™ 55 Series is a Multiple Tubing Size Fitting bringing the newest manufacturing technology together with field-proven experience. The Power-Loc™ 55 fits all standard 1/2" Supply Tubing (.520-.620 I.D.), is fully customizable to fit any Inlet/ Outlet requirement, and is reusable for line alteration or replacement. Supply Tubing is placed on the Power-Loc™ barb and the Locking Nut is tightened over the Supply Tubing - providing a secure seal from both inside and outside the tubing.

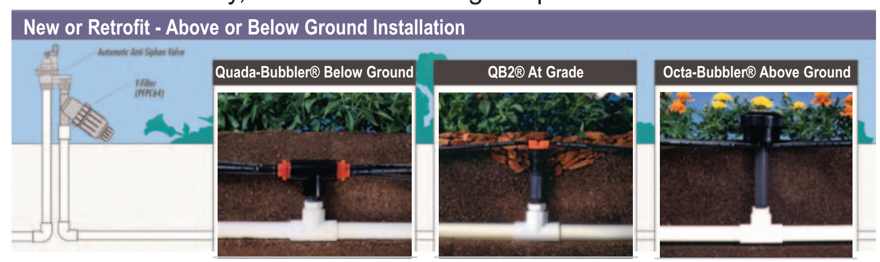
Power-Loc™ Tee
PL-55-P3T

Custom Fitting

EMISSION DEVICES are the final stage of every Low Volume Irrigation System. There are several emission devices to choose and the type needed will vary depending on each installation. There are three basic types of Low Volume Irrigation systems: Bubbler, Drip and Micro-Spray. All three types of systems are used for different applications and use different styles of devices. Bubblers can utilize higher flow rates and application rates which makes bubbler systems a method to retrofit existing Sprinkler/Sprayhead systems. Bubblers (see pg. 17) are also a good choice in new designs as part of an overall Low Volume System incorporating various components from Drip and Micro-Spray systems. Drip systems are usually designed as 'stand alone' systems. Drip systems utilize Emitterline and/or On-line Button Emitters. Both Emitterline and On-line Emitters can be Pressure Compensating or Turbulent Flow. Drip irrigation will apply water directly to the soil at the root zone of an individual plant (see pg. 20). Micro-Spray systems are designed as 'stand alone' and for areas that may be too large for traditional Drip irrigation or when plants requirements dictate the use of overhead, low-volume watering: areas with extensive root systems or groundcover, large flower beds, plants which need moisture on foliage are but a few examples (see pg. 25).

BUBBLER SYSTEMS - NEW OR RETROFIT

• Pepco Bubblers are developed especially for landscape irrigation, and designed to apply up to 70% less water than applied by Sprinkler/ Sprayhead systems. This is accomplished by applying the irrigation water at the root zone of the plants and not the areas where roots do not exist.
• The Pepco Bubbler, acting as a flow control device, splits a single water source into four to eight separate pressure compensating water outlets. The water flows from the bubbler port to the plant via Mini-Pepline® or PQB Distribution Tubing. These lines are run to groundcover, shrubs or trees, providing irrigation water to the exact spot specified for irrigation. This eliminates unsightly risers, overspray and staining of fences, sidewalks and exterior walls, and reduces bark fading and weeds.
• Pepco Bubblers are designed for above ground or under mulch installation with no effect to flow rates or emission points. This feature helps reduce vandalism or losses due to theft.
• Pepco Bubblers will provide most landscapes with the desired application of irrigation water within short watering cycles of 5 to 10 minutes, once or twice a day, under a broad range of pressures.



QUADRA-BUBBLER® & QB2® MULTI-PORT EMITTERS

Q1633

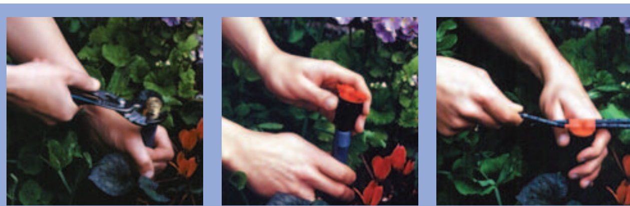
The **Quadra-Bubbler®**, Pepco's original Bubbler, is best for new installations, but adaptable to existing systems. The Quadra-Bubbler® provides precise watering to residential or commercial landscapes. The Quadra-Bubbler® may be used alone or in pairs using a 3/4" FPT adapter, such as a P7550T.

QB2-186

The **QB2®** is a convenient retrofit device and offers all the features of the Quadra-Bubbler®. Installation couldn't be simpler; the base readily fits a standard 1/2" riser. Both the Quadra-Bubbler® and QB2® come in convenient flow rates of 2, 6, 10 and 20 GPH, per port.

INSTALLATION IS AS SIMPLE AS 1 - 2 - 3

Pepco Bubblers fit standard 1/2" risers.

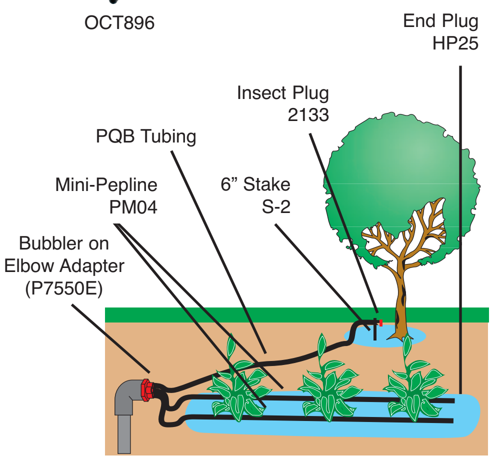


1. Simply remove existing spray head. **2.** Replace with Bubbler. **3.** Attach tubing, run above or below ground to plants.

OCTA-BUBBLER® MULTI-PORT BUBBLER

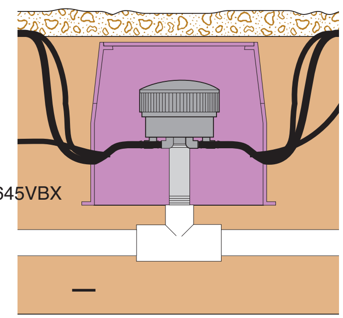
The **Octa-Bubbler®** features eight outlet ports for large planting areas. Designed for new or retrofit installation, the Octa-Bubbler® fits directly on a standard 1/2" riser. Swivel elbows at each barbed outlet port allow greater flexibility in design and installation. The flow rate of each port may be changed to suit the requirements. Octa-Bubblers are available in 2, 6, 10 and 20 GPH, per port.

OCT896



Underground Access Box

Keeps Bubblers safe and secure below ground. Metal insert in lid makes Access Box easily detectable.



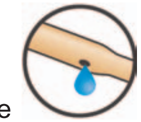
645VBX

ACU-FLO®

Acu-Flo® is a single port bubbler which can be used as a Pressure Compensating Flow Control device, for use with Jets and Sprays. It may also be used with Mini-Pepline™ or as a stand-alone bubbler. Acu-Flo® is available in 6, 8, 10, 12, 16 and 20 GPH.

TAFB20

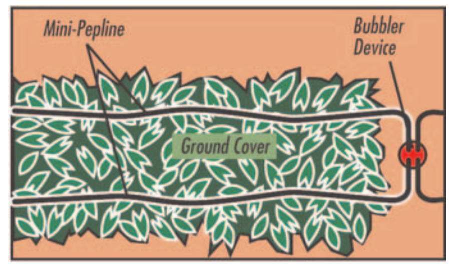
MINI-PEPLINE™ 1/4" EMITTERLINE

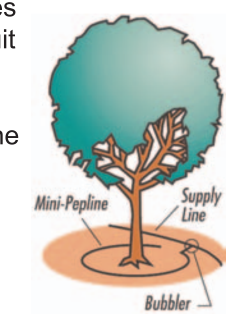


PM04

Mini-Pepline™ is 1/4" tubing with built-in 1/2 GPH inline turbulent flow emitters at 6" or 12" spacings; it is designed for use with Pressure-Regulated, Flow Controlling Bubbler Systems like the Quadra-Bubbler®, QB2® or the Octa-Bubbler®.

Mini-Pepline™ offers many advantages over sprinklers and sprayers for many landscape watering applications. Mini-Pepline™ is ideal for use in vegetable gardens, densely planted groundcover and for ringing trees and shrubs. And with Mini-Pepline™, you can save up to 50% of the water used by conventional sprinklers. Designed to be used with the Pepco family of Bubblers, you can evenly water every square foot of landscaping, and at a cost of no more than a conventional system. Mini-Pepline™ may be installed above ground or under mulch, eliminating wet walks, discoloring of decorative bark, fences and windows. Mini-Pepline™ comes in two models, with hole spacing every 6" or 12", to suit your application needs. It is designed to be directly connected to all Pepco Bubbler products. Mini-Pepline™ provides even distribution of the output of the bubbler over the desired landscape area. Output is approximately 1/2 gallon per outlet, per hour. Mini-Pepline™ may also be used on a manifold to provide even application of irrigation water over a larger area. *Not recommended for use without flow control inlet device.*





Maximum Length of Laterals

	Bubbler Flow Rate (GPH)		
Emitter Spacing	6	10	20
6" Spacing	6'	10'	19'
12" Spacing	10'	16.5'	33'

Flow Rates & Operation Time

Pressure (PSI)	10
Flow Per Outlet (GPH)	0.5
Precipitation Rate (Inches per Hour)	0.8
Minutes per Day for 1" per Week	10

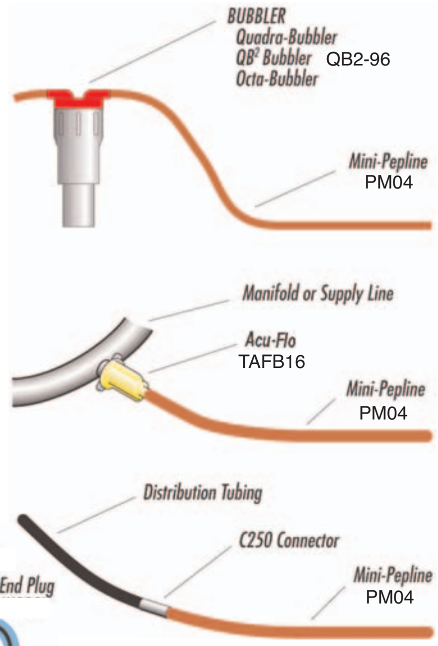
Recommended Spacing

Vegetable Gardens	Down each row if rows are more than 12" apart
Groundcover	12" apart or greater if on a slope
Trees	Ring tree at 75% of diameter of canopy or drip zone

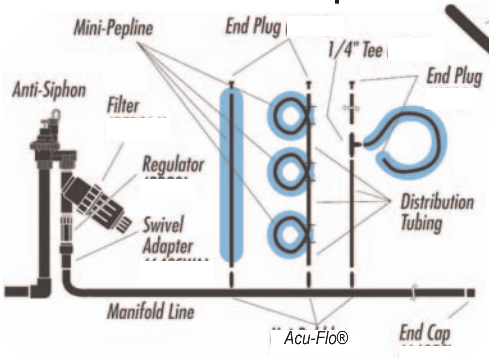
**Note: Spacing should be adjusted for soil type and degree of slope.*

Mini-Pepline™, when used with any Pepco series Bubbler, becomes an ideal emission device for gardens, closely spaced plantings and groundcover areas. Up to 30 feet of Tubing may be used with each lateral line to eliminate water waste between planting areas or to transport water from the Bubbler or manifold to planting areas. Small size Tubing and uniform distribution makes Mini-Pepline™ ideal for public places.

Typical Bubbler Hookup

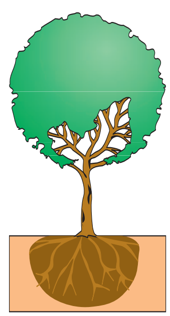


Manifold Hookup



DRIP IRRIGATION

Drip irrigation applies water directly to the soil at the root zone of an individual plant. The application rate is very slow and uniform, between 1/2 to 2 GPH. Because of this, the water is applied over a longer period of time, thus allowing maximum lateral movement of water while minimizing deep percolation through the soil beyond the root zone. Once the soil above the root zone reaches its saturation point, gravity will pull the water down through the soil into the root zone where the water is required.



By knowing the water requirement of a specific plant, shrub or tree, the type of soil you are working with (clay, loam, sand, etc.), the proper output for the drip emitter to be used, and the length of time and frequency to water, you can maintain the proper moisture content of the soil and provide near perfect soil moisture for healthy plant growth.

Conventional methods of overhead irrigation do not always provide the uniform coverage plants require. Spraying water on planted areas wets the entire area instead of specific plants, promoting unwanted weed growth, bark fading, disease and nutrient leaching.

Overhead irrigation also promotes higher water consumption because of evaporation and excessive water runoff. Many plants do not flourish in the environment that conventional watering methods produce when used for irrigation. This is due to high levels of soluble minerals and salts that burn and stain sensitive leaves of some plants.

EASY INSTALLATION

Drip irrigation utilizes very small pathways and ports to develop low discharge rates. For this reason it is very important to keep the drip system free of all sand and sediment, and to regulate the water pressure to the working range of the emitter. AQUARIUS BRANDS manufactures a variety of filters and regulators to meet your needs. To help your installation go smoothly, follow these simple guidelines:

EMITTERLINE INSTALLATION

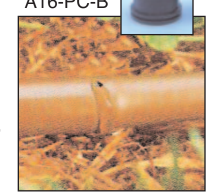
The emitterline should be installed under the canopy of the plants it will be irrigating. Place the emitterline halfway between the trunk and the edge of the canopy to ensure the plant gets the water it needs and keeps the crown of the plant from getting too wet. Several emitterline laterals may be needed in a single drip zone to ensure complete coverage.

AQUA-LINE™ PC 1/2" LANDSCAPE EMITTERLINE

Aqua-line™ PC Emitterline is 1/2" Polyethylene Tubing with Built-in Pressure Compensating Emitters (1/2 GPH, 1 GPH, or 2 GPH). These emitters are bonded inside the tubing during the extrusion process and are spaced at 12", 18", or 24" intervals - though other spacings are available to fit particular applications. Aqua-line™ PC is available in 16MM (640 O.D.).

Emitterline is common in narrow planting areas, under groundcover, along hedge rows, in vegetable gardens, and on undulating (or uneven) terrain. It is used widely under mulch or landscape bark to maximize water conservation and aesthetics. The Pressure Compensating feature allows Aqua-line™ PC to be utilized on slopes, hills or rolling fields - application rates will remain consistent with watering requirements and water will not be lost due to runoff or wind drift which is common to overhead systems.

A16-PC-B



DRIP IRRIGATION

Aqua-line™ PC uses standard fitting configurations to make transitions, additions or modifications to irrigation systems (see Fittings on pg.16). Power-Loc™ Fittings, Versa-Grip® Compression or standard Compression Fittings can be utilized for customization and to make various system connections. Aqua-line™ PC is also able to accept additional Drip Emitters or Micro irrigation Sprays for areas having additional watering requirements or if plants are in areas outside the emitterline placement.

˘ubing size is 16MM O.D. (Use 600 Series Compression Fittings or 55 Series Power-Loc™.
Emitter flow rate is constant over a range of pressure from 15 to 50 PSI. Nominal flow rates are 1/2 GPH and 1 GPH. See the Aqua-line™ PC specification sheet for more performance information.

PC Emitters feature:

- multiple raised inlet filter slots to prevent clogging
- turbulent flow path prior to pressure compensating flow control
- dual opposed outlets to prevent back-siphoning

MAXIMUM RECOMMENDED DRIPLINE LENGTH ON LEVEL GROUND (FT)

Emitter Flow Rate 1/2 GPH

Inlet Pressure* PSI	Emitter Spacing (inches)			
	12	18	24	36
20	213	333	426	597
25	266	383	492	690
30	293	423	544	765
35	317	456	588	825
40	337	486	626	882
45	355	513	660	930
50	372	537	692	975

*Allows for a minimum end pressure of 15 PSI.

MAXIMUM RECOMMENDED DRIPLINE LENGTH ON LEVEL GROUND (FT)

Emitter Flow Rate 1 GPH

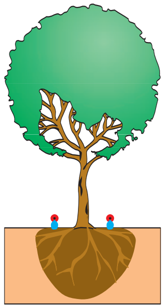
Inlet Pressure* PSI	Emitter Spacing (inches)			
	12	18	24	36
20	151	218	280	395
25	174	251	322	453
30	192	278	356	501
35	207	299	386	543
40	220	318	410	579
45	232	336	432	612
50	243	351	454	642

*Allows for a minimum end pressure of 15 PSI.

MINI-PEPLINE™ 1/4" EMITTERLINE

Mini-Pepline™ is 1/4" tubing with built-in 1/2 GPH inline turbulent flow emitters at 6" or 12" spacing. It is designed for use with Pressure-Regulated, Flow Controlling Bubbler Systems like the Acu-Flo® (see pg. 18 for more information on the Acu-Flo®). Please refer to the Mini-Pepline™ sections on page 19 for more details and advantages of the Mini-Pepline™. When using the Mini-Pepline™ in a traditional drip system, 1/2" supply tubing is needed as a transport line and the Mini-Pepline™ is used as the emission device. It is recommended that a Acu-Flo devices is used as the take-off component from the supply line. Please see diagram on page 20 for this type of installation. Please refer to the tables on page 19 for the design criteria.

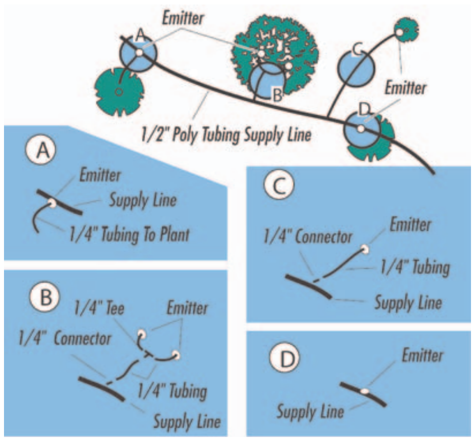
EMITTER INSTALLATION



The emitter should be installed under the canopy of the plant it will irrigate. Place the emitter halfway between the trunk and the edge of the canopy to ensure the plant gets the water it needs and keeps the crown of the plant from getting too wet.

The emitter can be installed directly into the 1/2" tubing where the tubing passes under a plant. If the tubing does not pass under a plant, a length of 1/4" distribution tubing can be used to extend the emitter to the plant. A connector is punched into the 1/2" tubing, 1/4" tubing is then inserted into the connector and the emitter is installed at the end of the 1/4" tubing at the plant. If more than one emitter is needed at a larger shrub or tree, simply use a Tee to add emitters as required.

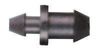
OPTIONS



DRIP IRRIGATION

DRIP IRRIGATION

To install the emitters and connectors into the 1/2" tubing, a **Hole Punch** is used. If an emitter or fitting is removed from the tubing for any reason, a **Mistake Plug** is installed to close the hole. AQUARIUS BRANDS also has a **Quick Action Valve** which may be used to isolate individual lines on a system.


GP24


PKB160


440VLBB

How Many Emitters To Use?

When planning your drip system, use 1/2, 1 or 2 GPH emitters. To determine the number of emitters needed, find your plant canopy size, follow the table on pg. 25 until you find the category closest to your plant type.

1/2 GPH 1 GPH 2 GPH


PSCE050 PSCE100 PSCE200

Then refer to the watering time table on pg. 25 to find the proper length of daily watering time. Remember that the line the emitters are on must be on a separate station from spray heads or sprinklers.

Pepco **Button Emitters** are Non Pressure Compensating emitters that use turbulent flow action to provide a regulated flow at a specified pressure. They are available in GPH flow rates of 1/2, 1, and 2, and two body styles: button and button with outlet nipple.


COER050

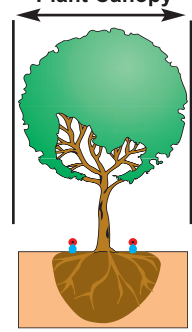
Primarily designed for trees, shrubs, & flower pots, button emitters use a 1/4" barb inlet that may be installed on any size drip tubing.

Aquarius Brands has two types of Pressure Compensating emitters, On-line and Micro-Flapper®. The On-line emitters have a pressure range of 20 - 60 PSI. They are available in 1/2, 1 and 2 GPH with a 1/8" outlet nipple and two different sizes of inlet barb, 1/8" and 1/4" self-piercing. The Micro-Flapper® is an angled configuration and has a very low profile. It is available in 1/2, 3/4, 1 and 2 GPH with a large inlet barb for maximum retention on poly hose, even under sustained high operating temperatures and pressures. It also has a 1/8" outlet barb to use with distribution tubing if necessary.

Application Rate Table for Aquarius Brands Emitters

▲ 1/2 GPH
● 1 GPH
■ 2 GPH

Plant Canopy



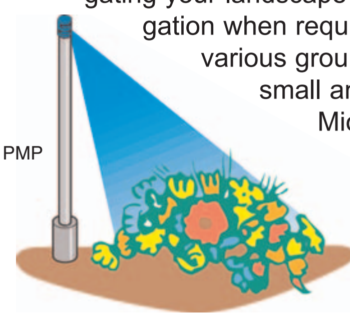
Number of Emitters Required for Each Plant or Tree			
Canopy Size Diameter in Ft.	Drought Tolerant Native Plants	Vines, Small Shrubs, Evergreens, Fruit Trees	Gardens, Shade Trees, Large Shrubs, Groundcover
2	▲	▲	▲
4	▲	●	▲
6	●	● ▲	■
8	● ▲	■ ●	■ ■
10	■	■ ■	■ ■ ■
12	■ ●	■ ■ ■	■ ■ ■ ■
14	■ ■	■ ■ ■ ■	6 x ■
16	■ ■ ●	5 x ■	8 x ■
18	■ ■ ■	6 x ■	10 x ■
20	■ ■ ■ ●	7 x ■	15 x ■

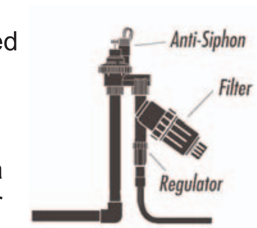
Example: *A 10 ft. diameter large shrub requires a 6 GPH application rate. Emitter selection would be any combination equal to 6 GPH (i.e., 3 of the 2 GPH emitters). For a hot summer day and loam soil, 2.5 hours of irrigation would be required.*

Drip Watering Schedule (hours per day)						
Soil Type	Spring		Summer		Year Round	
	Very Cool	Cool	Moderate	Hot	High Desert	Low Desert
Sand	1.5 hrs.	2 hrs.	2.5 hrs.	3 hrs.	3.5 hrs.	4 hrs.
Loam	1 hrs.	1.5 hrs.	2 hrs.	2.5 hrs.	3 hrs.	3.5 hrs.
Clay	.5 hrs.	1 hrs.	1.5 hrs.	2 hrs.	2.5 hrs.	3 hrs.

MICRO IRRIGATION LOW VOLUME SPRAYS

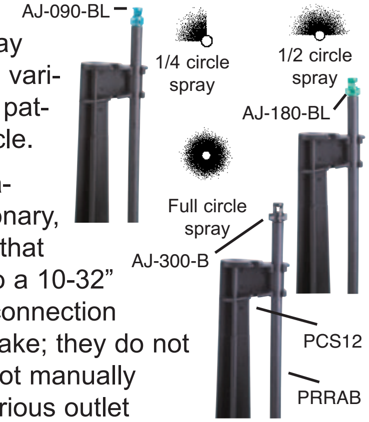
Aquarius Brands Micro-Irrigation products provide the method for irrigating your landscape environment with low volume overhead irrigation when required or preferred. Plants such as ferns and various groundcovers do well when water is applied in small amounts from above. Aquarius Brands Micro-Irrigation System installation requirements are virtually the same as for drip irrigation, and in most instances can be used with drip systems. Typically, systems should include an anti-siphon valve, a filter and a regulator. Components are designed for best performance at 20 PSI. An installation guide is included on pg. 31 to show various installation alternatives.


PMP



MICRO SPRAYS

Micro-Sprays are designed for areas that may be too large for traditional Drip Irrigation or in situations where plant requirements dictate the use of overhead, low-volume watering; areas with extensive root systems or groundcover, large flower beds, plants which need moisture on foliage are but a few examples. Micro-Sprays are very efficient if you have closely spaced plants, with similar watering requirements, in an area that may be difficult to irrigate with Drip Irrigation. Micro-Sprays should be spaced to provide 'head to head' coverage.



Micro-Sprays produce a fine, controlled spray that covers areas from 3' to 20' in diameter- various spray patterns are available. Common patterns are: 1/4 Circle, 1/2 Circle and Full Circle.

One Piece Aqua-Jets™ are stationary, fan-type sprays that are screwed into a 10-32" threaded base connection attached to a Stake; they do not rotate and are not manually adjustable. Aqua-Jets™ are available in various outlet sizes (Nozzle or Orifice) that have different Flows in Gallons per Hour (GPH) and different Diameters of Coverage in Feet (Ft.) based upon the available Water Pressure in Pounds per Square Inch (PSI).

Nozzle Size	Pressure PSI	Flow GPH	Model #	Approx. Dia. In Ft.	Model #	Approx. Dia. In Ft.	Model #	Approx. Dia. In Ft.
0.030 Black	5	3.8	AJ-300-BK	4.0	AJ-180-BK	4.0	AJ-090-BK	6.0
	10	4.4		6.0		6.0		7.0
	15	5.0		7.0		7.0		8.0
	20	6.0		8.0		8.0		9.0
	25	6.8		9.0		9.0		9.0
	30	7.3		10.0		10.0		10.0
0.040 Blue	5	4.8	AJ-300-BL	5.0	AJ-180-BL	5.0	AJ-090-BL	8.0
	10	7.0		7.0		7.0		10.0
	15	8.9		8.5		8.5		12.0
	20	10.4		10.0		10.0		12.5
	25	11.7		11.5		11.5		13.0
	30	12.6		12.5		12.5		13.0
0.050 Green	5	8.9	AJ-300-GR	8.0	AJ-180-GR	6.0	AJ-090-GR	11.0
	10	11.8		9.0		10.0		14.0
	15	15.3		11.0		12.0		15.0
	20	16.7		12.0		14.0		16.0
	25	19.5		14.0		16.0		17.0
	30	21.6		16.0		18.0		18.0
0.060 Red	5	15.0	AJ-300-RD	7.0	AJ-180-RD	7.0	AJ-090-RD	16.0
	10	18.2		10.0		11.0		18.0
	15	21.6		12.0		13.0		20.0
	20	24.0		14.0		15.0		22.0
	25	27.4		16.0		18.0		24.0
	30	30.5		18.0		20.0		26.0

VARI-JETS™


PVJ06F

Vari-Jets™ are a combination base, cap and control valve. The Vari-Jet™ control valve allows you to change the diameter (or radius) of the spray pattern to best fit the individual needs. The valve is a flow control and can shut off the water completely. Vari-Jets™ are available in .06 orifice with a 10-32 thread base. The patterns available are full, half, and quarter circle. The full pattern is an 18 hole finger spray.

Vari-Jet™ Performance Chart

Spray Pattern					
Desc.	Pressure (PSI)	Flow (GPH)	360° x 18 Diameter Ft.	180° Radius Ft.	90° Radius Ft.
0.06 Orifice	10	Up to 16.3	Up to 18.4	Up to 6.7	Up to 6.4
	15	Up to 20.1	Up to 22.6	Up to 8.1	Up to 8.1
	20	Up to 23.4	Up to 25.7	Up to 9.5	Up to 9.4
	25	Up to 26.2	Up to 26.7	Up to 10.1	Up to 9.8
	30	Up to 28.8	Up to 26.3	Up to 10.6	Up to 10.3

Recommended Operating Pressure 20 PSI.

ROTOR SPRAY™ MINI-SPRINKLERS


PMS

A scaled down micro rotary sprinkler, **Mini-Sprinklers** cover a 360° area at a diameter that is determined by the orifice size of the base. See the performance chart for specifications to suit your needs.

Mini-Sprinklers Performance Chart

Part # Orifice Size Orifice Color	Pressure (PSI)	Flow Rate (GPH)	Diameter (Ft.)
PMS-6 .035 Brown	15	8.4	18.8
	20	9.7	19.7
	25	10.8	19.7
PMS-12 .04 Blue	15	10.2	19.1
	20	11.7	19.3
	25	12.9	18.4
PMS-18 .05 Green	15	16.1	21.1
	20	18.5	22.5
	25	20.6	23.7
PMS-25 .06 Red	15	21.5	22.5
	20	24.8	24.5
	30	30.1	27.9

Recommended Operating Pressure 20 PSI.

VARI-ROTOR SPRAY™


PVM525

Incorporating the Vari-Flow® valve with the Mini-Sprinklers you can achieve the flexibility by varying the diameter of the Mini-Sprinkler. This is only available in the Red orifice size of 25 GPH which relates to a maximum diameter of 22.7 feet and a minimum diameter of 18.2 feet when operated at 20 PSI. For even distribution of the water droplets, we recommend that you only close the valve to a point where you achieve 80% of the maximum diameter (18.2 ft.). Anything smaller creates a donut effect (a high concentration of water in a circular strip rather than an even coverage of droplets from the center to the outer edge.)

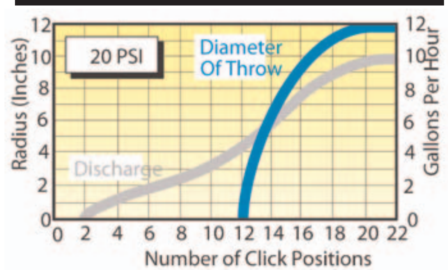
Model # Orifice Size Orifice Color	Pressure (PSI)	Flow Rate (GPH)	Diameter (Ft.)
PVMS25 .06 Orifice Black	20	Up to 24.8	Up to 24.5

SHRUBBLER® DRIPPER/SPRAYER

The **Shrubbler®** provides the versatility of a dripper, bubbler or sprayer

PVJS8B PVJS8T

Shrubbler® Performance



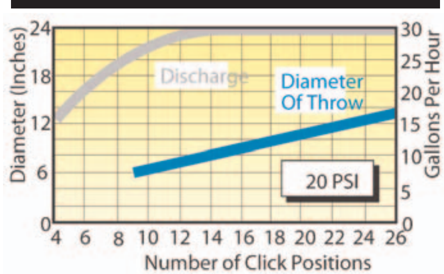
all in a single product. Turning the cap counter clockwise transforms this irrigation product from a 1 GPH dripper to a 3 GPH bubbler or a finger spray with a maximum output of 10 GPH with a diameter of 2 feet. The Shrubbler® can be installed either right side up or upside down, depending on whether the water source is from the ground or overhead. Available with 1/4" barb or 10-32 threaded base, or ready-mounted on a 5" stake with barbed inlet and snap-off 1/4" connector.

MINI-BUBBLER - ADJUSTABLE

The **Mini-Bubbler** is designed for applications where high volumes of

PVMBB PVMBT

Mini-Bubbler Performance



water are required in relatively short run time cycles. The Mini-Bubbler is adjustable from 0-30 GPH with a maximum spray diameter of 1.5 feet. Adjustment is made by turning the cap counter clockwise the appropriate number of clicks to achieve the required flow. Inlet supply pressure can range from 15-30 PSI, with a recommend pressure of 20 PSI. Available with 1/4" barb or 10-32 threaded base, or ready-mounted on a 5" stake with barbed inlet and snap-off 1/4" connector.

Mini-Bubbler on Supply Tube

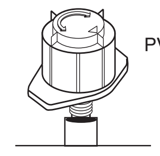
PVMBB

Adjust flow by twisting cap.

Spectrum 360™ Vortex Sprayer on 5" Plastic Stake w/ 1/4" Barb Adapter

PVJS8S PVSV360S

The Mini-Bubbler threads into a Riser or Stake which is easily attached to 1/4" Distribution Tubing to complete the assembly.

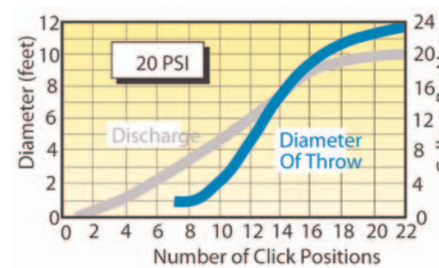


PVMBT

SPECTRUM 360™ VORTEX SPRAYER

PVSV360B PVSV360T

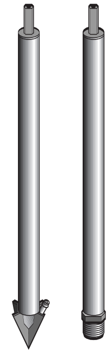
Spectrum 360™ Performance



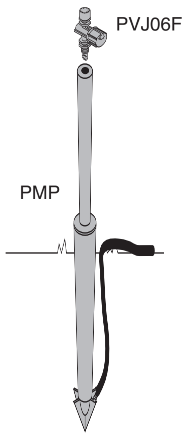
The unique vortex pattern of the Spectrum 360™, combined with a fully adjustable cap to control the amount of water used, provides a useful and practical irrigation tool for water distribution. The Spectrum 360™ emitter produces a unique spiral pattern for rapid watering near the plant root zone. Available with 1/4" barb or 10-32 threaded base, or ready-mounted on a 5" stake with barbed inlet and snap-off 1/4" connector.

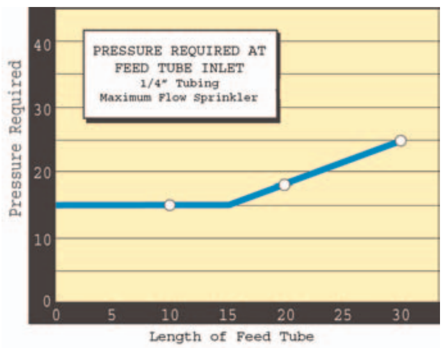
MICRO-POP™ RETRACTABLE RISER

The MicroPop™ base from Pepco rises above all others. In use, the MicroPop™ rises above most groundcovers for optimum watering. When not in use, the MicroPop™ base retracts to be unobtrusive, hidden by plants and foliage, minimizing damage due to landscape maintenance or vandalism. Available with barbed stake base or 1/2" threaded base, the MicroPop™ accepts all 10-32 threaded base micro devices for optimum watering configurations, and has a 1/4" barbed fitting for connection to supply line.



PMP





VARI-FLOW™ VALVES

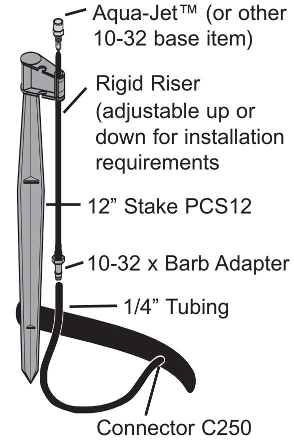
The Pepco Vari-Flow® in-line valve allows you to vary the water output.

Model #	Description
PVFVBB	1/4" barb x 1/4" barb

PVFVBB

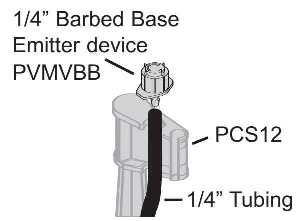
INSTALLATION GUIDE

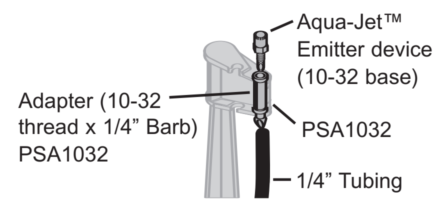
With Pepco parts and adapters, you can create a Micro-Irrigation system that will easily fit all your needs. Here we show some of the basics of installation.

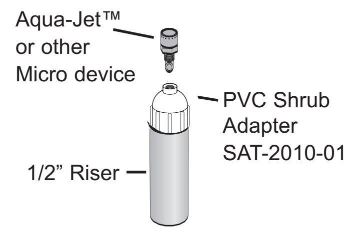


Pepco has designed a 12" Stake that allows versatility of installation of Micro-Irrigation products. The Stake allows snap-in installation of either .250 heavy walled tubing or .300 O.D. Rigid Riser. Micro-Irrigation items with a 10-32 base can be threaded directly into Rigid Risers. The Rigid Riser comes in a variety of lengths and may be raised or lowered to suit watering requirements.

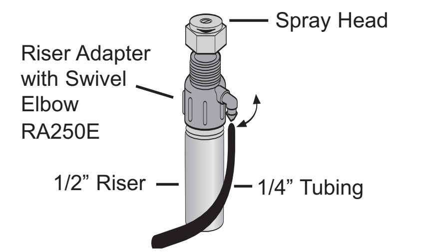
Below are a variety of ways to install Micro-Irrigation devices with the Pepco 12" Stake. If you are using standard 1/4" tubing from your supply line, you will need to use an adapter for products with 10-32 threaded bases. 10-32 threads will not hold in 1/4" tubing.







For systems using existing piping and 1/2" risers, Pepco offers a family of adapters that replace sprinkler heads or bubblers on the riser. Available for 10-32 threads, 1/8" or 1/4" barb based Micro-Irrigation devices.



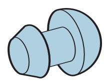
Pepco also makes a Riser Adapter with swivel elbow. Placed between the riser and sprinkler head, the Riser Adapter has a 1/4" swivel barb which allows attachment of 1/4" tubing. This allows the use of Micro-Irrigation products in areas adjacent to existing sprinklers.

MICRO

PEPCO™

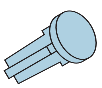
API™

ACCESSORIES

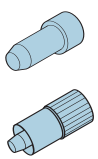


End Plug (HP25) - used to plug the end of Mini-Pepline™ so that water will flow out of emitter holes. May also be used as a "goof plug."

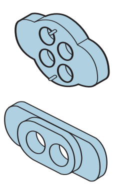
Dual Plug (GP24) - used to plug holes from .075" to .225". It also can be used to plug the end of 1/4" tubing.



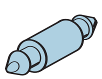
Insect Plug (2133) - used to prevent small insects from entering PQB tubing which could cause plugging. This plug does not restrict the flow nor is it a form of emitter.



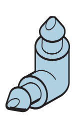
Port Plug (2135, 2132) - used to plug unused ports on Bubblers. Since each port works independently, there is no performance change in the output of the unplugged ports



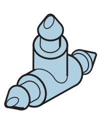
Clamp Plate (2131, 2134) - used to lock tubing to PEPCO Bubbler outlet port. Should be used if PEPCO Bubbler is installed above ground in high traffic areas.



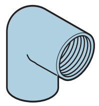
Connector (C250) - used to join two pieces of 1/4" or PQB tubing.



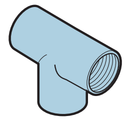
Ell (L250) - used when 90° bend iis required in 1/4" or PQB tubing.



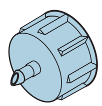
Tee (T250) - used when it is necessary to tee off from either type of tubing.



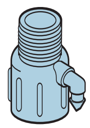
Ell (P7550E) - used to adapt a Quadra-Bubbler to a 1/2" MPT riser.



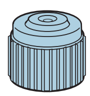
Tee (P7750T) - used to adapt two Quadra-Bubblers to a 1/2" MPT riser.



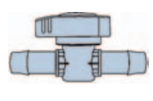
Hose Barb Adapter (FHA250) - used to connect 1/4" OR PQB tubing to 3/4" MHT (hose thread).



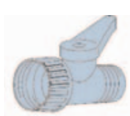
Riser Adapter with Swivel Elbow (RA250E) - threads between 1/2" riser and sprinkler head. Swivel elbow allows connection of 1/4" tubing without disrupting the sprinkler head. Micro-Irrigation device may be attached to run concurrently with sprinkler.



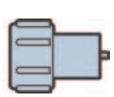
Riser Adapter (REA1032B)- available in three models to adapt 1/2" sprinkler riser to 1/8" barb, 1/4" barb or 10-32 thread for direct placement of Micro-Irrigation component.



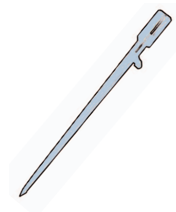
Quick Action Valve (440VLBB, 770VLBB) - provides positive on-off control as well as flow control to manifold supply tubing. Available to fit a variety of tubing sizes.



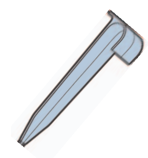
Ball Valve (3/4GB) - this is a FHT x MHT full port ball valve. It can be used as an isolation valve or the main valve in a Hose Bib application.



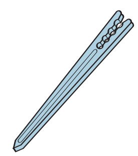
Automatic Flush Valve w/ Tattle Tail (FCH-H-FHT) - used at the end of a supply line to flush the system after every use. This helps prevent small particles from settling in the system and ultimately keeps the emitters from clogging.



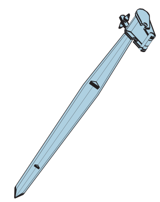
Plastic Stake (RSTAKE) - used with Rigid Risers to assemble Micro-Sprinklers and to extend them up above vegetation if needed.



Plastic Stake (S-4) - used to hold supply tubing in place in the landscaping

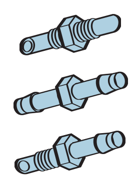


Plastic Stake (S-2) - used to hold Mini-Pepline, PQB, 1/4" or other 1/8" through 5/16" tubing in place in the landscape.

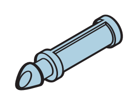


12" Plastic Stake (PCS12) - accepts both 1/4" tubing or .300 O.D. rigid riser, plus snap-in stake adapters listed below.

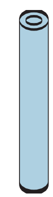
Wire Stake (S7) - used to hold supply tubing in place in the landscaping.



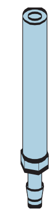
Connectors (PRA1032, PRAB170, PRAB160) - straight connectors in 10-32 x 10-32 thread, 10-32 x .170 barb and .160 x .160 barb.



Snap-In Stake Adapter - fits the 12" stake and is available with 10-32 female thread x 1/4" barb

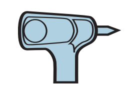


Rigid Riser - available in 4", 6", 8", 12" and 18" lengths. .160" ID x .300" OD. Snaps into 12" stake.

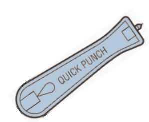


Assembled Rigid Riser - same as above with either .170 barbed or 10-32 threaded adapter.

Figure 8 Tubing End Closures (700-AP8) - used at the end of a supply line to plug off flow. It fits tubing O.D. up to .720"

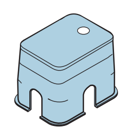


Hole Punch and Cap Remover Key (PKP160) - ideal for punching holes in tubing for 10-32 thread and .160 barb based items. Base of unit has socket for installing and removing Pep-Jet bases, Vari-Jets, Vari-Flow Valves and similar devices.



Quick Punch (PQP125) - ideal for punching holes for 1/8" and 1/4" barb fittings. Handle can also be used to insert 1/4" connectors.

Support Clamp (PC250, PC710) - used to hold 1/4" and 1/2" tubing to decks, patios and houses. It's ideal to help hide the tubing from sight and make installations more aesthetically appealing.



Valve Box (645VBX, 645VBXP) - used for bubblers for underground installation. Includes washer for metal detection. Available for standard water and reclaimed water.

Landscape Drip/Bubbler and MicroSpray Irrigation

Acceptable depth

Device	Flow rate	Dia. Ft.	Area Wetted Sq. Ft.		Depth of water applied inches in time period minutes				
	GPH	Clay	Clay	APP RATE	15	30	60	120	180
.5 Emitter	0.5	2	3.14	0.26	0.06	0.13	0.26	0.51	0.77
1 Emitter	1	2.5	4.91	0.33	0.08	0.16	0.33	0.65	0.98
2 Em/bub	2	3	7.07	0.45	0.11	0.23	0.45	0.91	1.36
6 Bubbler	6	3	7.07	1.36	0.34	0.68	1.36	2.73	4.09
10 Bubbler	10	3	7.07	2.27	0.57	1.14	2.27	4.54	6.81
20 Bubbler	20	4	12.56	2.55	0.64	1.28	2.55	5.11	7.66
6.0 jet 360	6	8	50.26	0.19	0.05	0.10	0.19	0.38	0.57
6.0 jet 180	6	8	25.13	0.38	0.10	0.19	0.38	0.77	1.15
6.0 jet 90	6	9	15.90	0.61	0.15	0.30	0.61	1.21	1.82
10.4 Jet 360	10.4	10	78.53	0.21	0.05	0.11	0.21	0.43	0.64
10.4 jet 180	10.4	10	39.26	0.43	0.11	0.21	0.43	0.85	1.28
10.4 jet 90	10.4	12.5	30.67	0.54	0.14	0.27	0.54	1.09	1.63
16.7 jet 360	16.7	12	113.08	0.24	0.06	0.12	0.24	0.47	0.71
16.7 jet 180	16.7	14	76.95	0.35	0.09	0.17	0.35	0.70	1.04
16.7 jet 90	16.7	16	50.26	0.53	0.13	0.27	0.53	1.07	1.60
24 jet 360	24	14	153.91	0.25	0.06	0.13	0.25	0.50	0.75
24 jet 180	24	15	88.34	0.44	0.11	0.22	0.44	0.87	1.31
24 jet 90	24	22	95.02	0.41	0.10	0.20	0.41	0.81	1.22

Device	Flow rate	Dia. Ft.	Area Wetted Sq. Ft.		Depth of water applied inches in time period minutes				
	GPH	Loam	Loam	APP RATE	15	30	60	120	180
.5 Emitter	0.5	1.5	1.77	0.45	0.11	0.23	0.45	0.91	1.36
1 Emitter	1	2	3.14	0.51	0.13	0.26	0.51	1.02	1.53
2 Em/bub	2	2.5	4.91	0.65	0.16	0.33	0.65	1.31	1.96
6 Bubbler	6	2.5	4.91	1.96	0.49	0.98	1.96	3.92	5.89
10 Bubbler	10	2.5	4.91	3.27	0.82	1.64	3.27	6.54	9.81
20 Bubbler	20	3	7.07	4.54	1.14	2.27	4.54	9.08	13.63
6.0 jet 360	6	8	50.26	0.19	0.05	0.10	0.19	0.38	0.57
6.0 jet 180	6	8	25.13	0.38	0.10	0.19	0.38	0.77	1.15
6.0 jet 90	6	9	15.90	0.61	0.15	0.30	0.61	1.21	1.82
10.4 Jet 360	10.4	10	78.53	0.21	0.05	0.11	0.21	0.43	0.64
10.4 jet 180	10.4	10	39.26	0.43	0.11	0.21	0.43	0.85	1.28
10.4 jet 90	10.4	12.5	30.67	0.54	0.14	0.27	0.54	1.09	1.63
16.7 jet 360	16.7	12	113.08	0.24	0.06	0.12	0.24	0.47	0.71
16.7 jet 180	16.7	14	76.95	0.35	0.09	0.17	0.35	0.70	1.04
16.7 jet 90	16.7	16	50.26	0.53	0.13	0.27	0.53	1.07	1.60
24 jet 360	24	14	153.91	0.25	0.06	0.13	0.25	0.50	0.75
24 jet 180	24	15	88.34	0.44	0.11	0.22	0.44	0.87	1.31
24 jet 90	24	22	95.02	0.41	0.10	0.20	0.41	0.81	1.22

Device	Flow rate	Dia. Ft.	Area Wetted Sq. Ft.		Depth of water applied inches in time period minutes				
	GPH	Sand	Sand	APP RATE	15	30	60	120	180
.5 Emitter	0.5	1	0.79	1.02	0.26	0.51	1.02	2.04	3.07
1 Emitter	1	1	0.79	2.04	0.51	1.02	2.04	4.09	6.13
2 Em/bub	2	1.25	1.23	2.62	0.65	1.31	2.62	5.23	7.85
6 Bubbler	6	1.25	1.23	7.85	1.96	3.92	7.85	15.70	23.55
10 Bubbler	10	1.5	1.77	9.08	2.27	4.54	9.08	18.17	27.25
20 Bubbler	20	2	3.14	10.22	2.55	5.11	10.22	20.44	30.66
6.0 jet 360	6	8	50.26	0.19	0.05	0.10	0.19	0.38	0.57
6.0 jet 180	6	8	25.13	0.38	0.10	0.19	0.38	0.77	1.15
6.0 jet 90	6	9	15.90	0.61	0.15	0.30	0.61	1.21	1.82
10.4 Jet 360	10.4	10	78.53	0.21	0.05	0.11	0.21	0.43	0.64
10.4 jet 180	10.4	10	39.26	0.43	0.11	0.21	0.43	0.85	1.28
10.4 jet 90	10.4	12.5	30.67	0.54	0.14	0.27	0.54	1.09	1.63
16.7 jet 360	16.7	12	113.08	0.24	0.06	0.12	0.24	0.47	0.71
16.7 jet 180	16.7	14	76.95	0.35	0.09	0.17	0.35	0.70	1.04
16.7 jet 90	16.7	16	50.26	0.53	0.13	0.27	0.53	1.07	1.60
24 jet 360	24	14	153.91	0.25	0.06	0.13	0.25	0.50	0.75
24 jet 180	24	15	88.34	0.44	0.11	0.22	0.44	0.87	1.31
24 jet 90	24	22	95.02	0.41	0.10	0.20	0.41	0.81	1.22

TABLES OF MAXIMUM LENGTH AND MAXIMUM FLOWRATE FOR A CERTAIN PRESSURE LOSS

5 PSI LOSS FOR BEST PERFORMANCE OF NON-PRESSURE COMPENSATING EMISSION DEVICES
ANY TABLE MAY BE USED WITH PRESSURE COMPENSATING (PC) EMISSION DEVICES

Maximum Length in Feet of Supply Tubing
5 PSI Drop in Supply Tubing

GPH	0.520" ID	.600" ID	.620" ID
100	347	685	801
200	103	204	238
300	51	100	117
400	31	61	71
500	21	41	48

Maximum Flowrate in GPH for Supply Tubing
5 PSI Drop in Supply Tubing

Feet	0.520" ID	.600" ID	.620" ID
50	303	446	488
100	204	300	328
200	137	202	221
300	109	160	175
400	92	136	149
500	81	120	131

Maximum Length in Feet of Supply Tubing
10 PSI Drop in Supply Tubing

GPH	0.520" ID	.600" ID	.620" ID
100	694	1370	1601
200	206	407	476
300	102	200	234
400	61	121	142
500	42	82	96

Maximum Flowrate in GPH for Supply Tubing
10 PSI Drop in Supply Tubing

Feet	0.520" ID	.600" ID	.620" ID
50	450	663	725
100	303	446	488
200	204	300	328
300	162	238	260
400	137	202	221
500	121	178	194

Maximum Length in Feet of Supply Tubing
20 PSI Drop in Supply Tubing

GPH	0.520" ID	.600" ID	.620" ID
200	413	815	952
300	203	401	468
400	123	242	283
500	83	164	192

Maximum Flowrate in GPH for Supply Tubing
20 PSI Drop in Supply Tubing

Feet	0.520" ID	.600" ID	.620" ID
50	668	985	1077
100	450	663	725
200	303	446	488
300	240	354	387
400	204	300	328
500	179	264	289

In this section we have tried to answer some of the most commonly asked questions. Most problems are caused by incorrect installation or improper usage of a particular component. If you have a problem or question you cannot resolve, please call the experts at Aquarius Brands at (800) 828-9919.

BUBBLER WATERING SYSTEMS

If Tubing Blows off Bubbler Port:

- Tubing is kinked.
- Insect Plug is inserted too far.
- Emitters have been inserted into the end of the bubbler tubing.
- Tubing is in a high traffic area and requires a clamp plate.
- Tubing has been pulled off bubbler too many times. Cut one inch off end and reinsert.
- Improper tubing size.

If Bubbler Ports have Uneven Flows:

- Bubbler flow path is partially plugged with debris. Remove screen and diaphragm to clean flow path notch.
- System's filter is plugged.

Mini-Pepline™ is Emitting Water Unevenly:

- Length of line exceeds manufacturers recommendations for bubbler flow rate.
- Mini-Pepline™ is kinked.
- Tubing clogged. Clean or replace and add 150 mesh filter.

DRIP IRRIGATION SYSTEMS

Emitter Distribution is Uneven:

- Wrong emitters being used. Verify color code and flow rate.
- Too many emitters hooked up to supply line.
- Supply pressure less than 5, or more than 45 PSI.
- Emitters are clogged. Replace emitters and use a 150 mesh filter.

Emitters are Blowing off Tubing:

- Hole punch too large.
- System's pressure is too great.

MICRO-IRRIGATION SYSTEMS

Spray Head is Not Performing up to Standards:

- Tubing supply pressure is too low or too great. Pressure should be 10-20 PSI.
- Supply tubing is kinked.
- Filter is plugged.
- Spray head is plugged with debris and needs cleaning.
- Supply tubing is run too far from the point of connection or too many spray heads are used for the size of polyethylene tubing. (Pinch supply tubing at halfway point and check performance).

MINI-PEPLINE™

Uneven Distribution of Water:

- Supply pressure incorrect. Should be 6-20 PSI.
- Lateral run length exceeds recommendations.
- Tubing clogged. Clean or replace and add 150 mesh filter .
- Lateral lines running up hill rather than side hill or down hill.
- Lateral lines are greater than 12" apart.

NOTES:

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