YOUR PERSONAL

Drip Irrigation Design Guide

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General Overview

History & Origin of Drip Irrigation

Drip Irrigation, also commonly referred to as micro-irrigation, trickle irrigation, low volume irrigation or xerigation. This is a method of irrigation which efficiently delivers water to the soil surface or the root zone; this is done by having water drip slowly from emission devices, most commonly called “drip emitters” or “drippers”.

Early forms of drip irrigation can be traced back to ancient times where clay pots were filled with water and then buried in the ground, this allowed the water to gradually leak out and into the root zone of nearby vegetation. The first formal development of drip irrigation supplies began around 1866 in Afghanistan, where they tested drip irrigation and drainage systems by using various types of clay pipe. A researcher at Colorado State University, Mr. E.B. House, began applying subsurface water directly to the root zone in 1913. Perforated Pipe was first used for irrigation in Germany around 1920.

After WWII, the ability to mold plastics became widespread and more cost effective. This helped pave the way for innovations in the manufacturing of drip irrigation system components. At this time, Polyethylene (PE) tubing, also referred to as “micro tubing” or “spaghetti tubing”, and early versions of emitters (drippers), became more common and began to be installed throughout the US and Europe.

In Israel, Simcha Blass & Yeshayahu Blass were innovating in the area of emitter design. They created a method that allowed water to flow through longer and wider passageways inside of the emitter. These “labyrinths” as they were called, resulted in less clogging. The velocity of water moving through the labyrinth, and resulting turbulence, helps to slow it down, creating a “drip”. In 1959 Kibbutz Harzerim partnered with Blass to form a company called Netafim, to further develop and test this concept. Netafim was then able to patent the first drip irrigation emitter. This development helped the technology of drip irrigation rapidly expand to Australia, North America, & South America in the late 60’s.

Advantages & Benefits of Drip Irrigation

In this time of water and resource conservation, drip irrigation makes sense. It is generally less expensive to install than conventional subsurface PVC systems and uses much less water.

Water Conservation - Drip irrigation allows you an efficient watering by supplying water where it is needed - at the very roots of the plants. As a result, water is not wasted on leaves or soil. This significantly reduces the chances for evaporation and run off. Both are common with traditional irrigation systems where the water is often supplied at a rate greater than the soil can absorb it.

Advantages & Benefits of Drip Irrigation, Continued

Reduce Weed Growth - When water is applied using a conventional sprinkler, everything gets wet. Since drip irrigation applies water to the root zone of your plants, the spaces in between plants remain dry. This greatly inhibits weed seed germination. If the soil remains dry, most seeds will not germinate. Landscape maintenance takes less time with drip irrigation.

Reduce Plant Stress - When plants get deep, consistent watering, they thrive. Inefficient, shallow watering can contribute to plant stress. Promote healthy growth and disease resistance plants in your garden with drip.

Extremely Flexible Application - You have many options with drip irrigation tubing, fittings, and emitters. It is a versatile watering system which can easily be installed on hillsides or flat terrains. Drip is the perfect irrigation method for oddly shaped landscapes and windy areas. Existing sprinkler systems can be retrofit with drip irrigation with very little effort.

Save Money - Once a drip irrigation system is installed, you will use less water to irrigate. If you are on a well, you will notice a severe drop in your pumping costs. You will no longer need to hand watering your garden. Automate you system with an irrigation controller and eliminate the need to pay someone to while are on vacation. With the reduction of plant disease and unwanted weeds, your gardening labor and maintenance costs will also drop considerably.

Anatomy of a Drip System

Knowing all the parts and pieces that are needed to make up a drip irrigation system can seem a bit daunting. But if you look close enough, you will find that all drip irrigation systems break down into 3 main sections.

The first section is the **Water Source Connection**. This covers all the parts needed to attach your drip system to your water supply. The parts common to this section are the Hose Timer, Vacuum Breaker, Hose Filter, Pressure Regulator and Tubing Adapter. The water supply can either be a hose bibb, spigot, faucet connection or irrigation valve. In general, most water supply connections will come with either ¾" male hose threads or pipe threads.

Next is **Water Distribution**. This covers all the parts needed to bring your water to the areas that require watering. The parts common to this section are Solid Poly tubing, Fittings and Stakes.

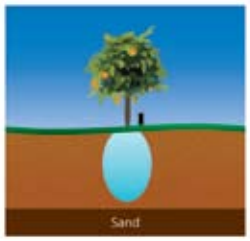
Last is the **Water Devices**. This covers all the parts needed to deliver water directly to the plants. The parts common to this section are Drip Emitters, Micro Jets, Sprayers and Soaker Hose Dripline.

General Overview

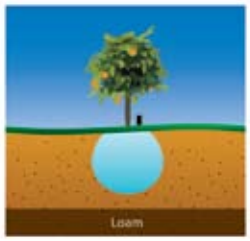
Soil Types

Not all soils are the same and each soil type will absorb water differently. Different soil types will also have an effect on which type of drip emitters will work best on your drip system. While all soils contain the same elements, different types of soils will contain different proportions of these given elements. Although there many different types of soils, drip irrigation focuses on the following three soil types: Clay, Sand and Loam.

Clay soils have densely packed particles that have little space for water or air. Water is absorbed very slowly and run off can occur if water is applied to quickly. When wet, water tends to move outward, away from the drip emitter. Clay soils will hold water very well and can stay wet for several days. Choose ½ & 1 GPH drip emitters when planting in clay soils. Drip emitter spacing tends to be further apart.



Sandy soils are very loose and have plenty of space for water or air. Water is absorbed very quickly and runoff usually doesn't occur. When wet, water tends to move straight down through the soil. Sandy soils do not hold water very well and can dry out very quickly. Choose 2 & 4 GPH drip emitters when planting in sandy soils. Drip emitter spacing tends to be closer together.



Loam soils are an ideal in-between mix of clay and sandy soils. Its absorption rate is greater than that of clay soil but not as fast as sandy soil. When wet, water will move outward and down more evenly. Loam soils will hold water well and dry out at a medium rate. Choose 1 & 2 GPH drip emitters when planting in loamy soils.

Drip Terminology

Drip irrigation can seem like it comes with a language all its own. Knowing the specific drip terminology is important before planning your drip irrigation system.

PSI – Pounds per Square Inch

GPM – Gallons per Minute

GPH – Gallons per Hour

GAL – Gallons

FT – Foot

MHT – Male Hose Threads

FHT – Female Hose Threads

MPT – Male Pipe Threads

FPT – Female Pipe Threads

Water Source Connection Items, aka Head Assembly

Timers: aka Hose Timer, Irrigation Timer, Water Timer, Controller, Clock. Timers are used to automate the watering of a drip irrigation system or sprinkler system.

- Hose End Timer, Irrigation Controller

Valves: A manual or electric irrigation device used to control the flow of water. It is used in conjunction with an Irrigation Controller

Ball Valves: aka Shut off valves: Hose thread ball valves are used to shut off individual water lines or to split an existing water source to make two separate connections. Connect to 3/4" hose bibb, faucet, spigot, or garden hose end.

- Inline Ball Valve, Y Ball Valve

Vacuum Breakers: aka Backflow Preventers: Prevents water from flowing back from your drip irrigation system into your household water. This prevents contamination of your water supply. Most municipalities require backflow prevention devices at the beginning of most irrigation systems.

Fertilizer Injector: aka Fert Injector: Fertilizer injectors are installed on the drip systems mainline to deliver liquid fertilizers and nutrients. Dilution rate is adjustable, so you can feed your drip system as needed.

Filters: aka Hose Filters, Drip Filters: Filters are installed between the hose vacuum breaker and the drip regulator and protects drip emitters, soaker hose dripline, sprayers and bubblers from rust, sand and other impurities that may clog them. Filters have removable screens for easy cleaning.

- Inline Hose, Y Filter

Water Source Connection Items, Continued & Water Distribution

Pressure Regulators: aka Pressure Reducers: A pressure regulator reduces household water pressure to a lower set pressure for use with a drip system. Always install a regulator after the filter.

Swivel Adapters: aka Tubing Adapters: Use to attach 1/2" or 1/4" mainline drip tubing to a water source connection assembly, hose bibb, spigot, faucet or the end of a garden hose. The swivel end screws onto male hose threads. Drip tubing inserts into the compression, direct-loc or barbed end.

Drip Zone Kit: Preassembled inline drip valve kit for drip irrigation systems. Includes valve, Y style filter and pressure regulator. It's available in 3/4" or 1" pipe threads.

Water Distribution

Drip Tubing: aka Poly Tubing, Poly Pipe, Supply Line, Trunk Line: Common term for Polyethylene pipe. Flexible, black tubing used for both drip irrigation main and lateral lines. Emitters can be inserted into tubing or connected via micro tubing. Common sizes are 1/2" (aka 5/8") or 3/4" tubing.

Micro Tubing: aka Spaghetti Tubing, Feeder Tubing: 1/4" micro tubing can be used as the main line for small deck/flower-pot installations, but is more often used as a lateral supply line off of 1/2" main line tubing. The micro tubing carries water to emitters (drippers) and micro sprays. Also referred to as "Distribution Tubing" it is available in Polyethylene (PE) or the more flexible Poly Vinyl Chloride (PVC).

Water Distribution, Continued

Compression Fittings: Fittings used to connect lengths of 1/2" and 3/4" solid drip tubing. The drip tubing is inserted into the compression fitting. The fittings internal compression ring squeezes the tubing slightly making a secure water tight seal. Compression fittings are more of a permanent connection and are not recommended for reuse. Glue or lubricants are not required.

Direct-Loc Fittings: aka Spin Loc, Perma Loc, Easy Loc, Power Loc: Twist barbed fittings onto 1/2" drip poly tubing, twist lock nut to lock tubing in place and make a water tight seal. Removable fittings make it easy to reconfigure your drip system if your needs or landscape designs change. Best fittings for winterizing your drip system – unscrew fittings, remove and store tubing away for winter. No glue or Teflon tape required.

¼" Barbed Connectors: aka Micro Connectors: Used to make connections between 1/4" micro tubing or to connect 1/4" micro tubing and 1/4" soaker hose dripline to 1/2" or 3/4" drip poly tubing. Use with a hole punch to attach to 1/2" or 3/4" solid tubing. No glue or lubricants are required.

Stakes: aka Clips, Hold Downs. Plastic or metal stakes used to hold drip tubing in place. Also available in 1/4" or 1/2" mounting clips to attach drip tubing to wood decks, eves, overhangs and fences.

Water Devices

Emitters: aka Drip Emitters, Drippers: Emitters distribute water droplets at a specified flow rate when used as part of a drip irrigation system. Emitters come in a variety of sizes, styles, and flow rates. They have barbed or threaded bases. Barbed ends are either poked directly into 1/2" drip tubing or inserted into the end of 1/4" tubing. Threaded bases are screwed into micro tubing stakes and risers.

- Pressure Compensating Emitters: Pressure compensating emitters deliver a consistent output of water, even with changes in pressure due to long drip tubing runs or changes in elevation.

  - Button Emitters, Turbo Style Emitters, Self Piercing Emitters with 1/4" barbed inlets

  - Multi Outlet & Retro Fit Emitters with 1/2" FPT inlets

- **Non Pressure Compensating Emitters:** Non pressure compensating emitters output will vary with changes in elevation and pressure. These emitters are best used where the watering zone is level.

  - Flag Emitters, Turbo Key Style Emitters, Inline Emitters with 1/4" barbed inlets

Sprayers: aka Micro Sprays & Jets: Micro spray covers a category of spray caps, bases, one-piece, and adjustable sprayers and bubblers that are small and designed to operate with drip irrigation systems. They can be used for ground cover, flower beds, vegetable gardens and landscapes where you need to water a large area.

- Adjustable Sprayers, Stream Bubblers, Micro Sprays, Foggers & Misters with barbed and threaded ends

Water Devices, Continued & Overall Consideration

Tubing Stakes & Risers: aka Spray Stakes, Rigid Risers: Stakes and risers are use to create adjustable sprayer platforms to raise water above plants, shrubs or ground cover.

Soaker Hose Dripline: aka Drip Emitter Tubing, Dripper Line, Drip-a-Long: Soaker Hose Dripline has drip emitters injected into the tubing as it is extruded. The tubing comes with emitters evenly spaced from 6 to 12 inches for 1/4" size tubing and 12" to 3 feet for 1/2" size tubing. It's useful in row crops, vegetable gardens and evenly-spaced tree and shrub plantings. It is available in both 1/2" and 1/4" tubing sizes. Soaker hose dripline limits are based on tubing size, emitter output and spacing.

- 1/4" & 1/2" Soaker Hose Dripline

Hole Punches: aka Tubing Punch: Tool used to punch a hole into solid drip poly tubing for the insertion of drip emitters or 1/4" barbed fittings.

- Key Punch, Deluxe Hole Punch, Super Punch

Overall Consideration

When planning out a drip irrigation system, it's important to take in all the different variables that come with designing a system. Conditions such as soil type, sun exposure and slopes can all have an impact on the parts that you will need to install. It's also important to know your water source's flow rate and pressure. Know the limitations of each drip component and any special requirements they may need. Product details for each part can be found on our website by clicking on the details tab.

Whether installing a drip system by yourself or turning it into a family project, a drip system can be a rewarding endeavor and doing your homework before hand can help make the installation of your drip irrigation system painless and hassle free.

Planning Your Layout

Before you begin your drip irrigation system, it's best to start by making a sketch of the areas that you want to water. Be sure to include and label all your plant types, including shrubs, trees, ground cover, flower beds, vegetable gardens and containers. Identify all the site watering sources, what type they are, and any existing connections. Add any buildings, walkways, retaining walls or obstacles that you may need to work around.

Draw out each run of drip mainline tubing and any laterals that will be needed to supply water to each planting area. For plants that are away from the mainline, draw out runs of 1/4" micro tubing to cover each plant. Working from a good plan will help aid you when making a materials list and is essential in designing an efficient drip irrigation system.

Grouping Plant Types

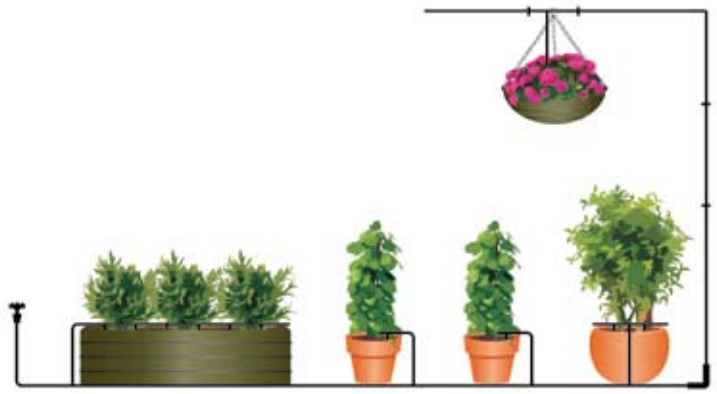
Plants of similar sizes and growth habits generally have watering requirements that are much the same. Always try to group watering zones by plant moisture needs and local climate conditions (shade, partial shade, full sun).

Consider the following:

- Plants that need **frequent, shallow watering,** like annual flowers and ground cover, should be grouped separately from those needing **less frequent, deep watering,** like trees.
- Seasonal plantings like **crops or vegetable gardens** should be kept separate from permanent plantings like shrubs. Install inexpensive flow control valves to shut off these areas when not in use.
- Create separate zones for **plants in the shade** versus hot, sunny spots.
- **Container plants** should be watered separately from plants in the ground. They have confined root systems and may dry out more quickly.

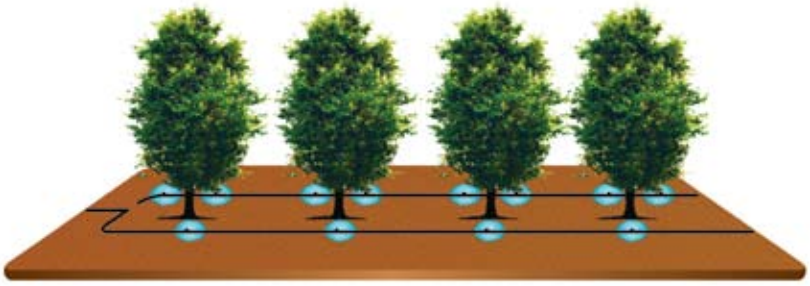
Drip Component Options by Plant Types

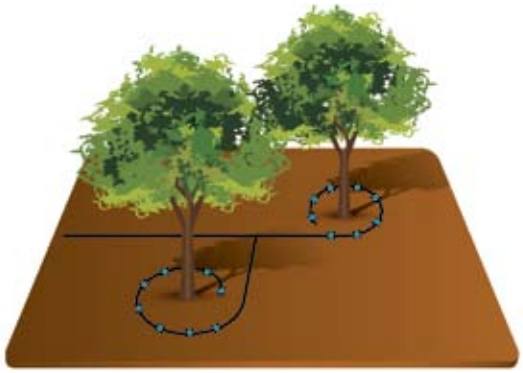
- **Containers or Flower Pots**: Use pressure compensating drip emitters in small containers with 1/4" micro tubing or attached to 1/2" solid tubing. Use 1/4" soaker hose dripline, stream bubblers or sprayers in larger pots.



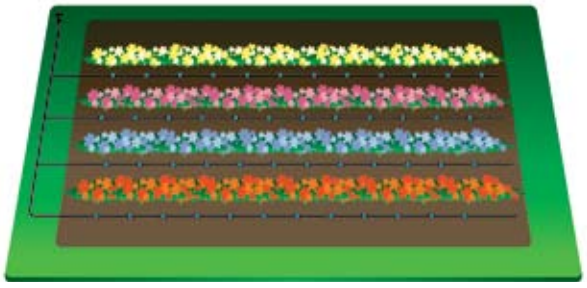
Drip Component Options by Plant Types, Continued

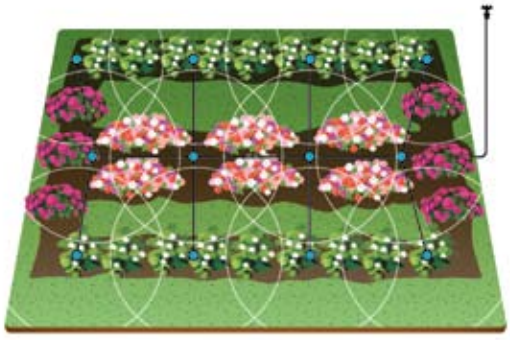
- **Trees and Shrubs**: Use either pressure compensating or non pressure compensating drip emitters with 1/2" drip tubing or off 1/4" micro tubing attached to 1/2" drip line. Use soaker hose dripline to create drip rings around medium and large shrubs and small to large trees.





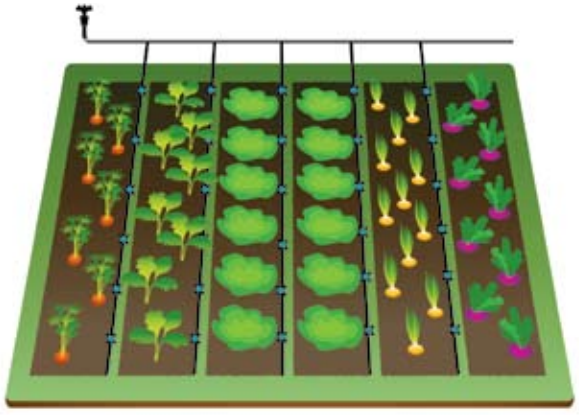
- **Flower Beds & Ground Cover**: To cover small flower beds and ground cover, use 1/4" soaker hose dripline. For larger beds and ground covers, use micro sprayers and jets.



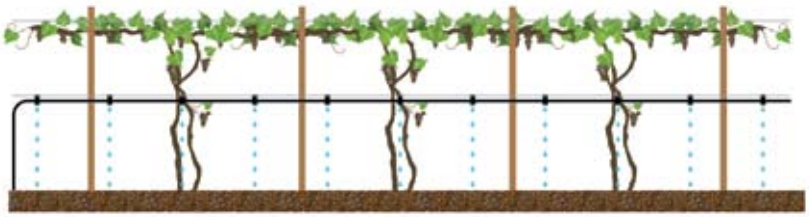


Drip Components Options by Plant Types, Continued

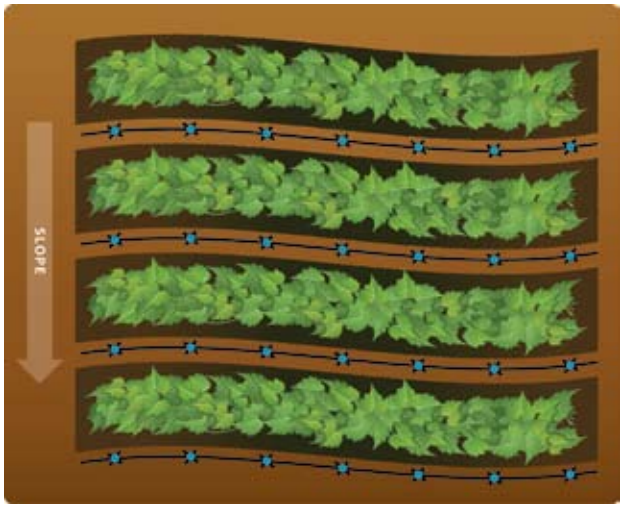
- **Vegetable Gardens & Berry Bushes**: For small vegetable gardens and berry bushes, use 1/4" soaker hose dripline with 6" or 12" drip emitter spacing. For large vegetable gardens and berry bushes, use 1/2" soaker hose dripline with 12" to 36" emitter spacing. For gardens with uneven plant spacing, use 1/4" micro tubing with inline drip emitters or 1/2" solid drip tubing with self installed drip emitters.



- **Vineyards**: Use 1/2" or 3/4" solid drip tubing attached to trellis. Install pressure compensating drip emitters in tubing facing down.



- **Slopes**: When designing a drip system for slopes, it's best to install drip tubing along the parallel of the slope and install .5 gph drip emitters. Lower flow emitters along with shorter but more frequent watering times will help prevent runoff and soil erosion.



Determining Your Water Source Flow Rate & Pressure

The flow rate of your water supply determines how much water you have available for your drip emitters and micro sprinklers. It is commonly measured in gallons per hour (GPH) or gallons per minute (GPM). The greater the rate of flow of water, the more drip emitters you can install on a single watering zone and the more zones you can run from a single irrigation valve.

Water pressure is the force pushing the flow of water through your system and is measured in pound per square inch (psi). If your water pressure is too low, drip emitters and sprayers won't work properly. Too high a pressure and drip tubing and fittings can blow apart. A standard drip systems optimal operating pressure is between 20 to 30 psi. The higher the pressure, the greater the need for a pressure regulator in your drip system.

To determine the flow rate out of your faucet, follow these five steps:

1. Turn off any running water sources in the house (Washer, Dishwasher….ect)
2. Place a 5-gallon bucket under the faucet.
3. Quickly turn on the faucet so that it is fully open.
4. Record how many seconds it takes to fill the 5-gallon bucket (gallons per second).
5. Calculate your flow rate to determine Gallons per Hour:
(5 gallons ÷ X seconds) X 60 seconds/minute X 60 minutes/hour = Gallons per Hour (GPH)

Example: If it takes 75 seconds to fill our 5-gallon bucket. The formula is:
(5 gallons ÷ 75 seconds) X 60 seconds/minute X 60 minutes/hour = 240 GPH

Now you know the limit of emitter output for your system. In the example above, you can place a total of 240 1-gph or 480 1/2-gph drip emitters on your system. Note: This is only one factor in designing your system. You also need to consider water pressure and maximum run for mainline tubing.

QUICK TIP: *The maximum recommended flow rate for 1/2" drip poly tubing is 240 GPH (4 GPM).*

Although your water source may flow more the 240 GPH, it's important to understand that the size of the drip tubing will limit how much water can pass through.

QUICK TIP: *The maximum recommended flow rate for 3/4" drip poly tubing is 540 GPH (9 GPM).*

Determining Your Water Source Flow Rate & Pressure, Continued

To determine the water pressure at your faucet, follow these four steps:

1. Purchase an inexpensive water pressure gauge at your local hardware store (Around $10).
2. Screw the pressure gauge onto your hose bibb.
3. Turn on the hose bibb and read the psi (pounds per square inch) off of the gauge.
4. Test the pressure at each water source you will connect too.

Drip systems operate best between 20-30 psi. Most household water systems operate at 50-70 psi. Install a pressure regulator to reduce the pressure if you measure above 40 psi.

QUICK TIP: *If your household water pressure is at 90 psi or greater, it may compromise the operation of your drip regulator.*

If this is the case, we recommend hiring a plumber to reduce the pressure of your household water system.

Water Connections Options

In general, most of the water source connections in drip irrigation fall into two main categories; **Hose Bibb** and **Irrigation Valves**. While irrigation valves are more specific, hose bibbs tend to cover a much wider range of connections.

Known as a spigot, faucet or hydrant, hose bibbs offer the most convenient water source connection available for your drip system. Standard hose bibb connections come with 3/4" male hose threads and use hose washers to make water tight seals. If your water source connection has pipe threads, Irrigation Direct sells adapter fittings to convert either 1/2" or 3/4" male and female pipe threads to 3/4" male hose threads.




Water Connections Options, Continued

For larger drip systems with multiple zones, irrigation valves and controllers are typical installed. This usually involves more work in setting up and installing. Valves typically use pipe threads for connections and require Teflon tape to make water tight seals. It also may require you to cut into your existing household water main to supply the valves. If you are unsure about how or where to install irrigation valves, it may be best to contact an irrigation professional to help with installation.




Calculating Total Flow & Creating Watering Zones

When planning your drip system, it's important not to exceed your drip zones water source capacity. To determine a flow zones capacity, add up the total number of drip emitters and their flows. This same method applies for micro sprays and jets.

Example: Your drip irrigation plan calls for using a total of 80 drip emitters and 40 ft of soaker hose dripline. The emitters consist of 25 – 2 GPH, 15 – 1 GPH, 40 - 1/2 GPH drip emitters and 40 ft of soaker hose dripline with 6" spacing with 1/2 GPH emitters. The plan also includes using 4 micro sprayers for ground cover at 10 GPH each.

To calculate the overall flow rate:

25 – 2 GPH Emitters (25 x 2) = 50 Gallons per hour

15 – 1 GPH Emitters (15 x 1) = 15 Gallons per hour

40 – 1/2 GPH Emitters (40 x .5) = 20 Gallons per hour

40 Ft soaker hose drip line (40 /.5) x .5) = 40 Galling per hour

4 – 10 GPH Micro Sprayers (4 x 10) = 40 Gallons per hour

Total flow rate = 165 GPH or 2.75 GPM. If the max capacity of 1/2" drip tubing is 240 GPH, you will have a flow reserve of 75 GPH or 1.25 GPM.

Calculating Total Flow & Creating Watering Zones, Continued

If your drip systems flow demand exceeds its water source capacity, you will need to create a new water zone. Installing a hose splitter will give you extra water source connections for additional drip zones.

QUICK TIP: *When planning a drip zone, be sure to leave enough flow for future system expansions or when plants mature and require more water.*

QUICK TIP: *Install flow control valves on both 1/2" & 1/4" drip tubing to isolate and control water to various sections of your drip system.*

Watering Schedules

When determining your water schedule, it's important to understand that there are several factors that need to be taken into account. Plants with deep root zones require longer watering than those with shallow root zones. Conditions such as temperature, wind, humidity, sun exposure and soil type will all have an effect on how much water can be applied at one time.

The follow watering times and intervals are meant to be guidelines to help you with setting up a watering schedule. When starting, it's best to water for 2 or 3 irrigation cycles. Check for moisture around drip emitters and root zones. Be sure the soil is neither too wet nor too dry and the plants look healthy. Make gradual changes to your schedule to adjust for your drip systems conditions. As the seasons change, increase or decrease your watering schedule accordingly.

Watering Schedules, Continued

Drip Emitters & Soaker Hose Dripline:

Type of Plants	Watering Time	Hot Climate	Warm Climate	Cool Climate
Flowers	30 Mins to 1 Hr	Every 1-2 Days	Every 3 Days	Every 3-4 Days
Small Trees & Shrubs	1 to 2 Hrs	Every 1-2 Days	Every 2-3 Days	Every 3-4 Days
Medium Trees & Shrubs	4 to 6 Hrs	Every 2-3 Days	Every 3-4 Days	Every 4-5 Days
Large Trees & Shrubs	6 to 8 Hrs	Every 2-3 Days	Every 3-4 Days	Every 4-5 Days
Vegetables	30 Mins to 1 Hr	Every 1-2 Days	Every 3 Days	Every 3-4 Days
Vines	3 to 6 Hrs	Every 1-2 Days	Every 3 Days	Every 3-4 Days
Containers	10 to 30 Mins	Every 1-2 Days	Every 2 Days	Every 3 Days

Example: In late spring time, a row of small trees would need to be watered for 1 to 2 hours with a scheduled interval of every 2nd or 3rd day.

Micro Sprays and Jets:

Type of Plants	Watering Time	Hot Climate	Warm Climate	Cool Climate
Flower Beds & Ground Cover	30 Mins to 1 Hr	Every 1-2 Days	Every 3 Days	Every 4-6 Days
Small Trees & Shrubs	1 to 2 Hrs	Every 1-2 Days	Every 4-5 Days	Every 5-6 Days
Medium Trees & Shrubs	2 to 3 Hrs	Every 2-3 Days	Every 4-5 Days	Every 6-7 Days
Large Trees & Shrubs	2 to 5 Hrs	Every 2-3 Days	Every 4-5 Days	Every 5-7 Days
Greenhouses	5 to 15 Mins	2-4 times/day	2 times/day	1-2 times/day

Example: In the middle of summer, a flower bed & ground cover would need to be watered for 30 to 60 minutes with a scheduled interval of every day or 2nd day.

Design FAQs

Q. Where do I start? The best advice when planning a drip system is to start small. Designing and installing a small drip system will give you valuable experience if and when you decide to expand. Start with containers, pots or a small garden. Irrigation Direct offers several drip irrigation starter kits to help you get started.

Q. What is my water source's flow rate? Flow rates will vary from location to location. Saying that you have enough flow might work for a small drip system, but may cause problems when designing a large system. Follow the instructions in the design section to determine your water sources flow rate.

Q. Do I need to install a filter? Designed to filter out rust, sand or debris, installing a drip filter is necessary to protect your emitters from clogging over time. Even if your drip system is connected to your household water source, installing a filter is a low cost solution to protect your investment.

Design FAQs, Continued

Q. Do I need a pressure regulator? Most household pressure is around 50 to 70 psi. Drip irrigation systems operate in the 20 to 30 psi. Excessive pressure can cause fittings and emitters to blow off the tubing. Follow the instructions in the design section to determine your water sources pressure.

Q. Which pressure regulator do I need? Most drip systems will work with a 20 psi regulator. Large drip systems with elevation changes or systems with hanging baskets do better with a 30 psi regulator.

Q. How far can I run my 1/2" drip tubing? This is the main feeder line for your drip irrigation system. It is used to create manifolds and branch lines. The maximum distance that you can run drip tubing will vary with the number of emitters you install and the spacing between emitters, but here are two conservative guidelines:

Maximum Run per circuit (Zone): 200 ft

Maximum Flow Capacity: 240 gph

Our **Drip Tubing Maximum Run Chart** will help you compare different scenarios. The maximum run will increase if you use low-output emitters (1/2 gallon-per-hour). Increasing pressure regulator size from a **20 psi regulator** to a **30 psi regulator** will also extend the distance that you can run drip mainline.

.600" ID x .700" OD Tubing Maximum Length Run Chart									
	PCE Pressure Compensation Emitters						Non Pressure Compensation Emitters		
	0.5 GPH		1.0 GPH		2.0 GPH		0.5 GPH	1.0 GPH	2.0 GPH
	20 P.S.I.	30 P.S.I.	20 P.S.I.	30 P.S.I.	20 P.S.I.	30 P.S.I.	20 P.S.I.	20 P.S.I.	20 P.S.I.
12" Spacing (100 Emitters per 100')									
Maximum Run in Feet	360	465	225	245	165	200			
GPH Required	180	233	225	245	330	400			
18" Spacing (66 Emitters per 100')									
Maximum Run in Feet	440	590	280	375	200	265	300	210	135
GPH Required	147	197	187	250	267	353	100	140	180
24" Spacing (50 Emitters per 100')									
Maximum Run in Feet	535	710	340	450	240	320	360	250	160
GPH Required	134	178	170	225	240	320	90	125	160
36" Spacing (33 Emitters per 100')									
Maximum Run in Feet	680	900	440	580	305	405	470	325	210
GPH Required	113	150	147	193	203	270	78	108	140
48" Spacing (25 Emitters per 100')									
Maximum Run in Feet	820	1090	530	690	370	590	560	400	250
GPH Required	103	136	133	173	185	245	70	100	125
60" Spacing (20 Emitters per 100')									
Maximum Run in Feet	970	1290	620	820	435	575	650	460	290
GPH Required	97	129	124	164	174	230	65	92	116

Note: If your water source is from a Hose Bibb (Water Faucet, Spigot or Hydrant) you are limited to 240 GPH.

Design FAQs, Continued

Q. How many drip emitters can I install? You can add as many drip emitters as your flow rate will support. A typical hose bibb delivers 240 gallons per hour. So you have 240 gallons available for your emitters to "consume". Simply add up the total number of gallons to be consumed by the emitters that you plan to add. You can put 240 1 gallon-per-hour emitters on the line (or 480 1/2 gallon-per-hour emitters or 120 2 gallon-per-hour emitters).

Keep in mind that if you're adding adjustable emitters and micro sprays, the output can be in excess of 30 gallons per hour for each emitter or sprayer. It doesn't take many sprays to use up those 240 gallons.

Q. How far can I run my 1/4" micro tubing? Due to its smaller size, any single run of micro tubing must not exceed to 50 feet.

Q. Can I bury my drip tubing? It is not recommended to bury drip tubing. Drip tubing can become compressed over time causing reduced water flow to your system. If you need to bury your drip tubing, it's best to sleeve it in solid PVC pipe.

Q. Can I expand my system? Expanding your drip system will depend on the reserve of water left over from your initial installation. Make sure you know your water source flow rate and the total flow that your current drip system is using. This will allow you to determine any excess water that may be used to expand your system.

Q. How long do I water my drip system? Watering times will vary from location to location and also on the current season. Reference the charts in the watering schedule section to determine your watering time needs

Q. What's the difference between PC and non PC emitters? Pressure compensating emitters are the best choice for many applications. If your landscape has elevation changes (hills, dips, etc.) go with pressure-compensating emitters. They have a diaphragm inside which maintains the same water flow through the emitter even if the elevation (and pressure) changes.

With non-pressure-compensating emitters, the emitters on the higher elevations will distribute less water than those at the bottom of the slope. Non-pressure compensating emitters are a great choice for flat landscapes and with gravity-fed drip systems.

Pressure Compensating Emitters

- Delivers the stated gph (gallon per hour) even if pressure range is from 10-50 psi
- Works well with elevation changes
- Self-flushing to reduce clogging

Non-Pressure Compensating Emitters

- The output will vary with changes in pressure and elevation
- Less expensive than pressure compensating emitters
- Recommended pressure: 15-20 psi

Design FAQs, Continued

Q. Can I retrofit my existing sprinkler system to drip? Retrofitting an existing sprinkler system can be done by adding adapter fittings to convert the sprinkler risers to accept a water source connection assembly or multi port drip emitters. Follow the instructions in the design section for information on retrofitting.

Q. Can I combine both sprinklers and drip in the same system? We do not recommend mixing sprinklers and drip irrigation on the same system. The problem lies in the output difference between the two. Sprinklers are designed to deliver a lot of water over a very short time while drip emitters and components are designed to deliver lower amounts of water over a very long time. Running both types on one system would cause over watering in one case and under watering in another.

System Materials Checklist

With your flow information and a design plan sketched out, it's time to work up a materials list of all the parts you will need for your drip irrigation system. Start with the parts for your water source connection; make sure to add all the required items and any adapter fittings that may be needed. Next, include the items necessary for your water distribution. Be sure to include enough 1/2" & 1/4" drip tubing, fittings and tubing holder stakes to cover the entire area to be watered. The final parts to add will be the drip emitters, soaker hose dripline, sprayers and bubblers.

We have included a materials checklist for you to use in conjunction with your design plan to source out all the items you will need for your drip system. Use the columns to the left for hash marks when you are counting up the individual items, then use the columns to the right to record the total needed for each part.

QUICK TIP: *When creating your parts list, it's best to included a few extra fittings, emitters and goof plugs. These extra parts can be used to make repairs to your system if necessary and can help to keep your down time to a minimum.*

Water Source Connection Items

Tally Column		Total Quantity
_____	 Timer **(DD-HEDT)**	Qty_____
_____	 Drip Zone Kit	
	3/4" Drip Assembly w/20 psi regulator **(DD-DZ75LF20)**	Qty_____
	3/4" Drip Assembly w/30 psi regulator **(DD-DZ75LF30)**	Qty_____
_____	 Irrigation Valve	
	3/4" Valve w/pipe threads **(DD-DFV075)**	Qty_____
	1" Valve w/pipe threads **(DD-DFV100)**	Qty_____
	1" Valve w/slip inlets **(DD-DFV100SS)**	Qty_____
_____	 Ball Valve	
	Inline Valve **(DD-BV75)**	Qty_____
	Y Ball Valve **(DD-YBV75)**	Qty_____
_____	 Backflow Preventer **(DD-HVB)**	Qty_____
_____	 Fertilizer Injector **(FI-EZ2013-HB)**	Qty_____
_____	 Filter	
	Inline Filter 3/4" hose threads **(DD-HIF75)**	Qty_____
	Y Style Filter 3/4" hose threads **(DD-YS75HFM)**	Qty_____
	Y Style Filter 3/4" pipe threads **(DD-YS75)**	Qty_____
	Y Style Filter 1" pipe threads **(DD-YS100)**	Qty_____
_____	 Pressure Regulator	
	20 psi 3/4" hose threads **(DD-HPR20)**	Qty_____
	30 psi 3/4" hose threads **(DD-HPR30)**	Qty_____
	45 psi 3/4" hose threads **(DD-HPR45)**	Qty_____
	20 psi 3/4" pipe threads **(DD-PR20LF-75)**	Qty_____
	30 psi 3/4" pipe threads **(DD-PR30LF-75)**	Qty_____

System Materials Checklist

Water Source Connection Items, Continued

Tally Column | Total Quantity

_____  Drip Tubing Adapter

Compression Adapter w/FHT **(DD-CHS700)** Qty_____

Compression Adapter w/FPT **(DD-CFP700)** Qty_____

Direct-Loc Adapter w/FHT **(DL-FHS600)** Qty_____

1/4" Barbed Adapter w/FHT **(DD-CHS250)** Qty_____

Misc Adapter Fittings _____

Drip Tubing, Fittings & Accessories

Solid Drip Tubing

_____  1/4" Micro Tubing **(DD-DH250-50, -100)** Ft_____

_____  1/2" Solid Drip Tubing **(DH-700-50, -100, -500, -1000)** Ft_____

_____  3/4" Solid Drip Tubing **(DH-940-50, -100, -500)** Ft_____

Fittings – 1/2" & 3/4" Compression or Direct-Loc (DD for Compression / DL for Direct-Loc)

_____  Couplings **(DD-C700 or DL-C600)** Qty_____

_____  Elbows **(DD-L700 or DL-L600)** Qty_____

_____  Tees **(DD-T700 or DL-T600)** Qty_____

_____  Crosses **(DL-CS600)** Qty_____

_____  Flow Valve **(DD-FCV700 or DL-FCV600)** Qty_____

_____  End Caps **(DD-EC700 or DL-EC600)** Qty_____

_____  Figure 8 End Cap **(DD-F8)** Qty_____

Misc Fittings _____

Drip Tubing, Fittings & Accessories, Continued

Tally Column		Total Quantity
Fittings - 1/4" Barbed		
_____	 Connectors **(DD-C250)**	Qty_____
_____	 Elbows **(DD-L250)**	Qty_____
_____	 Tees **(DD-T250)**	Qty_____
_____	 Crosses **(DD-CS250)**	Qty_____
_____	 Flow Valves **(DD-FVC250)**	Qty_____
_____	 Goof Plug **(DD-GP)**	Qty_____
_____	 Bug Plugs **(DD-BP250)**	Qty_____
	 Tubing Stakes	
_____	1/4" Micro Stakes **(DD-D2)**	Qty_____
_____	1/2" Plastic Hold Down Stake **(DD-S1)**	Qty_____
_____	1/2" Metal Hold Down Stake **(DD-S8)**	Qty_____
	 Tubing Mounting Clips (x = W for White and B for Black)	
_____	1/4" Micro Clips **(DD-MC700x)**	Qty_____
_____	1/2" Clips **(DD-MC250x)**	Qty_____
	 Hole Punch	
_____	Key Punch **(DD-KP)**	Qty_____
_____	Deluxe Hand Punch **(DD-HP250)**	Qty_____
_____	Super Punch **(DD-SP250)**	Qty_____

System Materials Checklist

Drip Emitters

Tally Column — Total Quantity

Pressure Compensating Emitters

_____ .5 GPH **(DD-PCE5, DD-TC5, DD-PCP5)** Qty_____

_____ 1 GPH **(DD-PCE10, DD-TC10, DD-PCP10)** Qty_____

_____ 2 GPH **(DD-PCE20, DD-TC20, DD-PCP20)** Qty_____

Non Pressure Compensating Emitters

_____ .5 GPH **(DD-TTE5, DD-ILE5)** Qty_____

_____ 1 GPH **(DD-TTE10, DD-ILE10, DD-TAE10)** Qty_____

_____ 2 GPH **(DD-TTE20, DD-TAE20)** Qty_____

_____ 4 GPH **(DD-TAE40)** Qty_____

Soaker Hose Dripline

_____ 1/4" Soaker Hose Emitter Spacing_____ Ft_____

_____ 1/2" Soaker Hose Emitter Spacing_____ Ft_____

Micro Spray Jets & Sprayers

Adjustable Stream Bubbler

_____ 180° Bubbler w/6" Stake **(DD-SR180S)** Qty_____

_____ 360° Bubbler w/6" Stake **(DD-SR360S)** Qty_____

_____ 180° Bubbler w/Barbed End **(DD-SR180B)** Qty_____

_____ 360° Bubbler w/Barbed End **(DD-SR360B)** Qty_____

_____ 180° Bubbler w/10-32 Threads **(DD-SR180T)** Qty_____

_____ 360° Bubbler w/10-32 Threads **(DD-SR360T)** Qty_____

Adjustable Spectrum Sprayer

_____ 360° Sprayer w/6" Stake **(DD-SM360S)** Qty_____

_____ 360° Sprayer w/Barbed End **(DD-SM360B)** Qty_____

_____ 360° Sprayer w/10-32 Threads **(DD-SM360T)** Qty_____

Micro Spray Jets & Sprayers, Continued

Tally Column | Total Quantity

Adjustable Stream Sprayer

_____ 90° Sprayer **(DD-MJVQ)** Qty_____

_____ 180° Sprayer **(DD-MJVH)** Qty_____

_____ 360° Sprayer **(DD-MJVF)** Qty_____

Adjustable Rotary Sprinkler

_____ 360° Sprinkler w/10-32 Threads **(DD-VRS)** Qty_____

Micro Sprays – 1 Piece 0.040 Orifice

_____ 90° **(DD-MSQ40)** Qty_____

_____ 180° **(DD-MSH40)** Qty_____

_____ 360° **(DD-MSF40)** Qty_____

Micro Sprays – 1 Piece 0.060 Orifice

_____ 90° **(DD-MSQ60)** Qty_____

_____ 180° Sprayer **(DD-MJVH)** Qty_____

_____ 360° Sprayer **(DD-MJVF)** Qty_____

Micro Sprays – Base & Caps

_____ Black .030" Orifice **(DD-MSB30)** Qty_____

_____ Blue .040" Orifice **(DD-MSB40)** Qty_____

_____ Green .050" Orifice **(DD-MSB50)** Qty_____

_____ Red .060" Orifice **(DD-MSB60)** Qty_____

_____ 90° Green Cap **(DD-MCQ)** Qty_____

_____ 180° Red Cap **(DD-MCH)** Qty_____

_____ 360° Blue Cap **(DD-MCF)** Qty_____

Adjustable Stake Assembly

_____ 13" Stake (DD-MJCS13) Qty_____

Micro Spray Jets & Sprayers, Continued

Tally Column		Total Quantity
	Rigid Riser w/Barb	
_____	8" Riser **(DD-MJRB8)**	Qty_____
_____	12" Riser **(DD-MJRB12)**	Qty_____
_____	18" Riser **(DD-MJRB18)**	Qty_____
	Micro Spray Stake w/Vinyl Tubing	
_____	12" Stake **(DD-MJSA12)**	Qty_____
_____	20" Stake **(DD-MJSA20)**	Qty_____
	Rigid Riser w/Thread	
_____	8" Riser **(DD-MJRE8)**	Qty_____
_____	12" Riser **(DD-MJRE12)**	Qty_____
_____	18" Riser **(DD-MJRE18)**	Qty_____

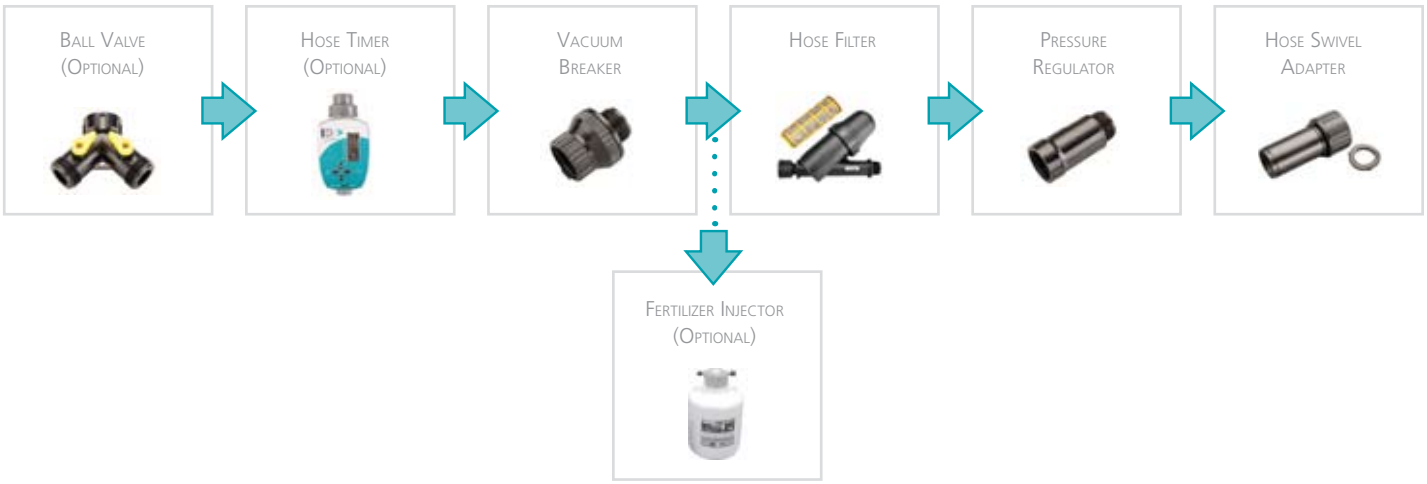
Installing Drip Irrigation Systems

Connecting to Water Source – All Types

Also known as the head assembly, the starting point of your drip irrigation system will consist of assembling your water source connection components. The parts you need will be based on the type of water source connection you have available. The majority of connections will fall into two categories: hose bibb, and irrigation valves.

Connecting to Water Source — All Types, Continued

Hose bibb: For most backyard drip irrigation systems, connecting to a hose bibb is the most common connection. First, determine if this connection will be dedicated solely to your drip system or if you will still need access for a garden hose. Installing a **Y style ball valve** will split you existing connection into two. Be sure to install each component in order and in the proper direction of flow.



Use Teflon tape to make watertight connections between components with pipe threads and o-rings or hose washers with components with hose threads. Hand tighten each part to make a water tight seal. Be sure not to over tighten any hose thread connections, over tightening can cause the threads to strip and become damaged.

Irrigation Valves: For an above ground installation, start with installing anti-siphon valves. An anti-siphon valve combines a valve and vacuum breaker in one device, so there is no need to install a separate vacuum breaker. On the downstream of the valve, you will need to install a filter, pressure regulator and hose tubing adapter. These parts can be installed just below the valves outlet or in a valve box for access to the filter.

Inline valves need to be installed in conjunction with a back flow preventer. Back flow preventers are larger versions of the vacuum breaker and are mainly installed and large residential or commercial installations. Check with your local municipality for any code requirements concerning the use of backflow preventers. Inline valves will require a filter, pressure regulator and tubing adapter. Irrigation Direct offers preassembled drip zone kits.

Installing Drip Irrigation Systems

Layout Main & Branch Lines

Before rolling out your drip tubing, it's best to lay it out in the sun for at least 30 minutes or more. This helps to soften the tubing and makes unrolling it much easier. When laying drip tubing, it's best to roll it out in the same way you would roll a tire. This prevents the tubing from spiraling and kinking.

Begin unrolling by weighting down the end of the tubing with a heavy object or tubing hold down stake to keep it in place. Roll out the tubing in the desired areas according to your design sketch. Keep some slack in your tubing runs to allow for expansion and contraction due to temperature changes in weather. Install tubing hold down stakes every 5 to 10 feet to hold the tubing in place.

If you need to bury your drip tubing, it's best to sleeve it in solid PVC pipe. This will prevent the drip tubing from compressing and reducing or cutting off the flow of water. When you need to make 90° turns in tubing, use an elbow. If you need to branch off mainline tubing, use a tee. When cutting drip tubing, simply use a pair of tubing cutters, garden shears or scissors.

Connecting Hose & Tubing

With your 1/2" drip tubing laid out, it's time to connect all the separate ends together to create one uniformed run of tubing. Make sure you have all your couplings, elbows and tees handy. It helps to order a few extra of each fitting in case you need to add or change your drip tubing layout for any reason.

If you're attaching your tubing with compression fittings, begin by scoring the tubing about an inch up from the end of the tubing. Next, make sure you have a straight cut across your drip tubing, cut tubing if needed. Then take the fitting and place the tubing squarely against the compression opening and press inward. As the compressing fitting bites into the tubing, gently rock the tubing and fitting back and forth until one inch of drip tubing is inserted into the fitting. Repeat this process for all compression fittings. The trick to installing compression fittings is to apply even constant force as your insert the tubing. Compression fittings are designed for a more permanent installation and are not recommended for reuse.

Connecting Hose & Tubing, Continued

Direct-Loc fittings work a bit differently than their compression fitting counterparts. Direct-Loc fittings have a 1/2" barbed end that you place your drip tubing over and a lock nut that spins over the barb which locks the tubing in place, creating a water tight seal. Direct-Loc fittings are perfect if you need to reuse your fittings, remove your drip tubing or reconfigure your drip irrigation system.

Installing 1/4" micro tubing is not unlike installing its bigger brother. But unlike the bigger tubing, the only connectors available are in the 1/4" barbed 250 series. Attach micro tubing end with connectors, elbows and tees. To install, simply place one end of the micro tubing over the barbed end of the fitting and apply firm even pressure the tubing sits against the fittings collar.

To install 1/4" micro tubing as a feeder off of 1/2" solid drip tubing, begin by making a hole in the 1/2" tubing with a hole punch. Then attach one end of the micro tubing onto the end of the 1/4" barbed fitting. Then insert the other end of the 1/4" barbed fitting into the 1/2" drip tubing until it snaps into place.

QUICK TIP: *To help with installation, dip the tubing in warm water for a few minutes to soften the ends before inserting the tubing into the fitting.*

Installing Different Water Devices — All Types

Drip Emitters: Drip emitters are installed using one of two different methods. The first method is installing the emitter's barbed end directly into the 1/2" drip mainline by using a hole punch.

Installing Different Water Devices — All Types, Continued

Another method is to attach the drip emitter into 1/4" micro tubing then attaching the micro tubing to the 1/2" mainline with a barbed connector and hole punch. This method is used when plants are away from the 1/2" mainline. Use a micro tubing stake holder to hold emitters in place.




Soaker Hose Dripline: Install soaker hose dripline as you would your mainline. Before unrolling, it's best to let the tubing sit in the sun for 30 minutes or more. Unroll the tubing as you would unroll a tire down the lengths of your garden rows or through your shrubs and ground cover. For 1/2" size soaker hose, use compression or Direct-Loc fittings to attach the soaker hose to the drip mainline. For 1/4" size soaker hose, use 1/4" barbed fittings to connect the soaker hose to 1/2" drip mainline. Soaker hose dripline can also be used to create drip rings around medium and large shrubs and small to large trees.



Installing Different Water Devices — All Types, Continued

Sprayers and Bubblers: Sprayers and bubblers can be installed using three different methods. The first method is installing sprayers and bubblers with barbed ends directly into 1/2" drip mainline.



The second method is attaching sprayers and bubblers with threaded ends onto fixed stakes with preinstalled vinyl tubing or onto rigid risers with a clip stake to make an adjustable height sprayer.




The third method is installing sprayers and bubblers that come preinstalled on a 6" stake. Each stake comes with a 1/4" barbed inlet that attaches to micro tubing and then attaches to 1/2" drip mainline.



Flushing Out The System

Now that you've rolled out all your drip tubing and installed the drip emitters, soaker hose dripline, sprayers and bubbles, it's time to flush your drip system. This is done to flush out any dirt, dust, insects or debris that may have made its way into your drip tubing during installation. To flush your drip system, simply turn on your water source and let the water run freely for a few minutes.

End of Lines

With your drip lines fully flushed, it's time to install the drip tubing end caps. End caps come in three styles; figure 8, compression and Direct-Loc.

The figure 8 end of line hose clamp simply doubles over the drip tubing to make a water tight seal. It's easily removed if you need to flush your drip system.

Both the Compression and Direct-Loc style end caps have removable threaded cap to aid with flushing your drip tubing.

Final Preparations and Start Up

Before operating your drip system, it's important to do a complete walk through and check all your drip tubing and connections. Verify that the water source connection components are installed and each connection is hand tight. Be sure that all drip lines are securely attached to their fittings and that all drip tubing end caps have been installed.

If everything checks outs, it's time to turn your water on. Begin by turning on you water and letting the system fill up for several minutes. You may hear a hissing sound coming from several locations on your drip system. This is the air that is being expelled from the drip emitters, soaker hose dripline, sprayers or bubblers. Once your drip system is fully filled with water, this hissing will stop. After the system has been running for about 15 minutes, check for any leaks with the water source connection components and with any drip tubing connections. Check that each drip emitter, sprayer or bubbler is working properly. If there is excessive leaking around any installed drip emitters or where any 1/4" barbed connectors are attached to 1/2" drip tubing, remove the emitter/connector from the 1/2" tubing and insert a goof plug to seal the hole. Then use your hole punch and reinstall the drip emitter or 1/4" barbed connector at least 1-1/2" away from the goof plug.

Final Preparations and Start Up, Continued

It's important to remember that some leaking around drip emitters or barbed connections is normal with a system startup. As the tubing fills and expands, the connections will seal over time.

Make any adjustments to sprayers, bubblers or flow control valves that might be needed. Add any drip emitters that may have been missed during the installation or extra emitters, sprayers or bubblers to supply more water to a given area.

System Maintenance & Troubleshooting

Like everything else, a bit of preventive maintenance will go a long way with keeping your drip system in working order. Periodically check your system for any leaks or wear in the drip tubing. Inspect all drip emitters, sprayers and bubblers and verify that each are flowing and not clogged. Clean or replace any components that have become clogged or have stopped flowing water. Check the filter screen each week for the first month for any debris built up. Clean the screen with a soft nylon brush and water. The frequency at which your filter screen needs cleaning will depend upon your water's quality.

Check to see if any drip tubing has been moved or under strain, also check for any nicks or cuts and use couplings to replace and bad sections of tubing. It's best to flush your drip tubing a few times each year. This can help to flush out any minerals that may have built up in the tubing. Over time, it may be necessary to add more emitters, sprayers or bubblers as your landscape matures and its watering needs change.

It helps to keep a small repair kit of parts to deal with any problems that might occur over time. Common parts to have on hand are 1/4" barbed fittings, 1/2" tubing couplings, small lengths of both 1/4" and 1/2" solid drip tubing, extra drip emitters and plenty of goof plugs.

Troubleshooting

- ☐ **Hose timer is not working:** Hose timers tend to fall into two categories, either they work or they don't. Always make sure you have good batteries installed. Be sure to read your timers instructions and thoroughly check the timers program for any missing information. Manually activate your timer to verify the internal mechanism is working properly. To test for automatic operations, set a start time for several minutes from the current time and observe.

Troubleshooting, Continued

☐ **No water from drip emitters, soaker hose dripline, sprayers or bubblers:** Verify that you have water to your drip system. Be sure that proper filtration is installed and that all drip lines have been periodically flushed. Check to see if any flow control valves have been shut off or if any drip lines are cracked or broken. Make sure all end caps are installed and tight.

☐ **Drip emitters and sprayers have uneven or little flow at the end of the dripline:** Verify that you haven't exceeded the dripline maximum flow rate of 240 gph. Remove any excess or unused drip emitters or install lower flow emitters. Turn down any adjustable sprayers and bubblers. Making small adjustments to your system can help with solving this problem

System Winterization

In areas that are prone to freezing or for long periods of inactivity, we recommend winterizing your drip system. Winterizing is the process of removing water from a drip system that would otherwise damage the tubing and components during freezing weather.

Start by shutting off your water faucet or the mainline that supplies water to your drip system. Remove any hose timers, its batteries and store in a dry location. For irrigation valves, removing the internal rubber diaphragm will extend the diaphragms life.

Remove all drip hose end caps and allow the water to drain completely. To "blow out" your drip system, use of an air compressor is recommended as long as the pressure is limited to 30 psi or under. Higher pressures can result in damaging your drip tubing or components. Once the water has been removed, replace the end caps. This will help to keep out any dirt or insects.

In areas of harsh prolonged freezing, we recommend rolling up your drip tubing altogether. Removal of your drip tubing can easily be done by installing Direct-Loc fittings during the initial installation. These fittings make removal and installation of your drip tubing quick and easy.

Spring Start-up

Starting up your drip system for the spring is not unlike the initial walk thru you made during your systems installation, although Murphy's Laws does seem to kick into high gear around this time. As stated before, keep your repair kit close at hand to deal with any problems that might pop up.

Start by installing fresh batteries in your hose timer and reprogram for a spring watering schedule. Install all water source connection components as before, inspect and replace any cracked or worn hose washers. Inspect the filter screen, clean or replace if needed. Reattach any drip lines that were removed, then remove all end caps and flush the lines. Once the drip lines have been flushed, replace the end caps and run your drip system

Inspect all drip emitters, soaker hose dripline, sprayers and bubblers. Clean or replace any parts that have stopped watering. Check the drip tubing for any cracks, splits or for any areas that may have been chewed on by animals or varmints, repair or replace any tubing as needed.

For drip systems using irrigation valves, reinstall rubber diaphragms, reprogram your controller and activate each valve to insure each are working properly.

Option 1 - Threaded Bubblers and Emitters

Replace each sprinkler with pressure compensating drip bubblers or emitters and run 1/4" tubing from the riser to your plants. Single-outlet emitters allow you to run 1/4" drip tubing to individual plants. With a 6-outlet bubbler on top of a 1/2" riser, you can run up to 6 1/4" drip tubes from the bubbler.

The emitters and bubblers operate at 10 psi - 40 psi. Check your water pressure before installing. If your pressure is 40 psi or less, you are good to go. If not, you will need to install a pressure regulator.

Pressure Compensating Emitters

There are three emitters available: 1/2 gph (red inside), 1 gph (black inside), and 2 gph (green inside). The barbed tip accepts 1/4" drip micro tubing. To install, simply remove the sprinkler from the 1/2" threaded riser. You can screw the emitter directly onto the riser or add a Marlex elbow as described in the Quick Tip below.

QUICK TIP: Use a Marlex Elbow for 90 degree turn *- To run the 1/4" tubing parallel to the ground rather than straight up off of the riser, use a Marlex Elbow. This allows the tubing to run flat on the ground and avoids a trip hazard.*

Option 1 - Threaded Bubblers and Emitters, Continued

STEP ONE:
Thread Marlex Elbow onto cut off riser.
Use Teflon tape on pipe threads.

STEP TWO:
Thread Emitter onto Marlex Elbow.

STEP THREE:
Push 1/4" drip micro tubing onto barbed end of Pressure Compensating Emitter.

COMPLETED ASSEMBLY:
1/4" tubing can now be staked next to plant.

Option 1 - Threaded Bubblers and Emitters, Continued

Pressure Compensating Bubblers

There are up to 6 outlets available on each bubbler. Each small outlet distributes 6 gph (black), 10 gph (red), or 20 gph (green). They ship with one outlet open. Cut the tip off of the outlets as you need them (see below). To install, simply remove the sprinkler from the 1/2" threaded riser. You can screw the bubbler directly onto the riser or add a Marlex elbow as described below.

Installing a Marlex elbow and bubbler

Insert filter (included)

Install Bubbler and attach 1/4" micro tubing

Cut tip off of the outlets you want to use.
Run tubing to plants and stake into place.
Use only the outlets you need.

Option 2 - Micro Jet Sprayers

Replace sprinklers with drip micro spray fittings. Swap out the sprinkler with a micro spray adapter. The adapter will accept threaded micro spray fittings.

Micro Spray Adapter

The adapter threads directly onto a 1/2" riser. Micro jet fittings thread into the top.

Micro Jet/Spray fittings operate best between 10 psi - 30 psi. Check your water pressure before installing. If your pressure is 30 psi or less, you are good to go. If not, you will need to install a pressure regulator.

These spray fittings come in a variety of configurations from fixed patterns and outputs to adjustable spray and stream options.

Micro Spray Adapter Threads onto 1/2" Riser

Micro Sprays Thread into Adapter

One-Piece Micro Spray

Adjustable Stream Spray

Adjustable Micro Spray

Adjustable Rotary Spray

Option 3 - Cap Sprinklers & Add Drip Regulator to the Supply Line

Cap off all of the sprinklers and add a standard drip system with 1/2" drip tubing and drip emitters. You can leave your irrigation valve in place. Just add a drip regulator, filter and swivel adaptor to the existing PVC line. From there you can add drip mainline tubing and drippers or emitter tubing. Irrigation Direct carries a selection of adapter fittings (like the one shown) that will help with most connections.

An MH9 adapter elbow (with male hose threads) is glued onto 3/4" PVC pipe. The inline filter, drip regulator, and swivel adapter are then attached.