Rain Bird XF-SDI Dripline uses our leading XF dripline and adds patent-pending Copper Shield™ Technology to protect the emitter against root intrusion in sub-surface applications.
RAIN BIRD XF-SDI DRIPLINE WITH COPPER SHIELD™

Product Description

Rain Bird XF-SDI Dripline with Copper Shield™ is a reliable and durable drip solution for turf grass and bed applications. The tubing is made of high quality polyethylene that is unmatched in toughness and flexibility. The tubing contains emitters with Copper Shield™, a non-toxic protection from root intrusion that requires no on-going maintenance.

Once installed, water comes out of the dripline at discreet points, then moves in the soil through capillary action to spread evenly across the entire area irrigated by the grid of subsurface dripline. The grid is made up of buried rows of dripline with pre-installed emitters that are either 12”, 18” or 24” apart. The selected spacing between rows and between emitters depends on the soil type and is discussed on pages 6 and 7. Design steps for trees, slopes, and curves in the turf area are found starting on page 12. Supply and flush manifolds are shown on pages 15 and 17. Precipitation rates and run times are shown on page 19. Equipment selection, installation and maintenance tips are on pages 22-25.

Once the system is designed and installed, successful operation and maintenance comes from standard practice for drip irrigation, including regular filter maintenance and periodic line flushing.
AREAS WHERE OVERSPRAY MUST BE AVOIDED

It is a challenge to avoid overspray in narrow turf areas along a roadway, narrow parking strip, or car dealership. These examples show how subsurface drip irrigation can avoid overspray by irrigating from below grade.

BEST APPLICATIONS

- Curves and edges
- Narrow turf areas
- Large turf areas
- Sub-surface shrub & ground cover areas
- Near buildings
- Adjacent to parking lots
- Small confined area
- Athletic Fields

SOME BENEFITS OF SUB-SURFACE DRIP IRRIGATION

- Increased efficiency
- Uses less water
- Avoids overspray
- Less prone to vandalism
- Healthy plant growth
- Increased watering uniformity
- No damage to fences or trees
- Less water run-off into sewers & drains
- Lower maintenance
- Increased time for field or turf usage
- No wind issues
- Less evaporative loss

Car Dealerships or parking lots

Narrow strips or next to roadways

Adjacent to buildings or hardscapes
COMPONENTS OF THE RAIN BIRD SUB-SURFACE DRIpline SYSTEM

LIST OF BASIC COMPONENTS
- Manifold or Supply Line
- Control Zone
- XF-SDI Series Dripline
- Air Relief Valve
- Manual Flush Valve
- Rain Bird Controller

Install Air / Vacuum Relief Valves at the highest point(s) of the dripline zone.

Low Volume Control Zone
(Refer to Control Zone Pyramid for sizing)

Manual Flush Point installed at the low point of exhaust

Buried dripline 2” from paved edge

Connect to flush manifold

Coils of flexible tubing to direct flush water

XF-SDI Dripline with Copper Shield™ Technology

Top of valve box

DESIGN STEPS FOR RAIN BIRD XF-SDI DRIPLINE with Copper Shield™ UNDER TURF GRASS

Determine the available flow rate of the irrigation water

What is the point of connection information for the overall project site; size, flow rate, static and dynamic pressure?

Choose the emitter flow rate, spacing between emitters, and spacing between rows; then separate the project into zones

What is the predominant soil and subsoil type (sand, loam, or clay)?

Make an initial decision about the number and size of each zone

Is the water supply adequate for one zone? If not, how many zones are needed?

Adjust for trees, slopes, and irregular edges and add more zones if necessary

Should trees be irrigated with a separate zone?
Is there a slope and should the bottom of the slope be on a separate zone?
Are there unusual shapes or curves around the edges?

Lay out the final grid pattern and design the supply and flush manifolds

Is it a small zone that can use polyethylene manifolds, or a large zone that requires larger diameter manifolds?

Determine the precipitation rate, run time and scheduling

What is the precipitation rate and what is the run time to apply the required water?

EASY SOIL TYPE TEST

1. Remove 1 to 2 cups of soil from the zone to be irrigated.
2. Place into a glass jar, like a mason jar.
3. Fill the jar half way with water. Shake and let sit for 2 hours so the particles can settle. The heavier sand particles will settle to the bottom, then silt, then clay on top.
4. Measure the height of all 3 layers of the soil then the height of each layer; divide the height of each layer by the total height to figure out the percentage of each soil in the jar.
5. Apply these figures to the “Soil Classification” chart.
   In the example, now you know the landscape soil is Loam.
Sub-Surface Drip Irrigation
Design, Installation and Maintenance Guide

OVERALL DESIGN PLAN
FOR THE SITE

The objective of a well-designed dripline system is to create an even wetting pattern of water in the soil throughout the planting zone. There are four factors to consider for planting areas to create an even wetting pattern:

- Soil type (Clay, Loam, Sand)
- Dripline emitter flow rate (.6 GPH or .9 GPH)
- Dripline emitter spacing (12", 18" or 24")
- Lateral row spacing of the dripline

What is your soil type?

<table>
<thead>
<tr>
<th>Soil Infiltration Rates in Inches per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Slope</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>0% - 4%</td>
</tr>
<tr>
<td>5% - 8%</td>
</tr>
</tbody>
</table>

Note: As the slope increases, infiltration rates will continue to decrease. These values are derived from USDA information.

Choose the emitter flow rate, spacing between emitters, and spacing between rows

What is the predominant soil and subsoil type (sand, loam, or clay)?

Rain Bird SDI specified under turf grass should be designed in a grid pattern, with supply and flush manifolds so that the individual drip emitters will be set out in a pattern with uniform spacing from one emitter to the next.

Driplines should be specified to lie a minimum of 4 inches below finished grade. If the turf area will be aerated, the driplines may be specified to lie 6 inches below grade and the drawings should be clearly labelled with a warning to aerate only with tines that are less than 4 inches long. All of the rows in the grid should be collected together into a flush manifold so that the system can be regularly purged to get rid of accumulating particles that could impact the system in the long term. Connecting the rows to a common flush manifold also ensures a looped system. A looped system is much safer in case of a line break because it provides positive pressure on both sides of the break to stop dirt from entering the drip line.

The table at the top of this page gives recommended emitter flow rates and spacing for three basic soil types. If the soil type is not known, or if there is a good chance that there will be many different types of soil at the site, use the shortest distance between emitters and rows from the table to be sure that the root zone is well irrigated. If there is heavy loam or clay subsoil, this will help reduce the downward flow of water in the soil and allow for wider spacing between rows.

### XF™-SDI Series Dripline Selection Guidelines

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Clay</th>
<th>Clay Loam</th>
<th>Sandy Loam</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emitter Flow Rate (gallons per hour)</td>
<td>0.6 gph</td>
<td>0.6 gph</td>
<td>0.9 gph</td>
<td>0.9 gph</td>
</tr>
<tr>
<td>Emitter Spacing</td>
<td>24&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>XF™-SDI Dripline Lateral Spacing</td>
<td>18&quot; - 24&quot;</td>
<td>18&quot; - 24&quot;</td>
<td>18&quot; - 24&quot;</td>
<td>12&quot; - 18&quot;</td>
</tr>
<tr>
<td>Application Rate (inches per hour)</td>
<td>0.32 - 0.24</td>
<td>0.43 - 0.32</td>
<td>0.64 - 0.48</td>
<td>1.44 - 0.96</td>
</tr>
<tr>
<td>Number of Minutes to apply 1/4” of water</td>
<td>47 - 62</td>
<td>35 - 47</td>
<td>23 - 31</td>
<td>10 - 16</td>
</tr>
</tbody>
</table>

Note: These are general guidelines, field conditions may require modification to emitter flow rate, emitter spacing and lateral spacing.

Burial Depth

- Turfgrass Applications:
  - Recommended consistent burial depth of 4, 5, or 6”
- Shrub and Groundcover Applications:
  1. On-surface under mulch
  2. Sub-surface to a consistent depth of 4, 5, or 6”
LATERAL ROW SPACING

XF Series Grid Layout with End Feed

Design Considerations

- Space the tubing 2"-4" from hardscape and other planting zones.
- Lateral spacing is a design consideration and can be calculated as shown in Example 1: How to Calculate Equal Lateral (Row) Spacing.
- Because water is split into two separate paths that meet in the middle, the total continuous loop length of dripline should not exceed twice the maximum lateral length.
- Installations using dripline without a check valve should use an air/vacuum relief valve at a high point in the system to avoid back siphoning material into the emitters.
- Manual flush should be installed at the mid point of the Lite Layout.

LATERAL (ROW) SPACING

A range of lateral row spacing (Ex. 18"-24", loam soil) is provided in the table on page 6. But to calculate equal lateral row spacing for the design application, you need to know the width of the application and then use the calculation as shown in Example 1.

Example 1: How to Calculate Equal Lateral (Row) Spacing

- Application width = 8'
- Convert into inches: 8' x 12" = 96"
- It is recommended to space dripline 2" from hardscapes and 4" from separate planting zones. In this example there are hardscapes on each side of the planting zone. Remove the hardscape: spacing on each side from the total width: 96" - 4" = 92".
- From the previous example, the range of lateral row spacing is 18"-24". Use the low end of the range (in this case 18") and calculate the number of spaces between rows: 92" ÷ 18" = 5.1. Round to get whole spaces. Round up if the decimal is 0.5 or higher, round down if it is less than 0.5. In this case you should round down to 5 whole spaces between rows.
- Calculate the equal lateral row spacing: 92" ÷ 5 = 18.4".
- Calculate the number of dripline rows by adding 1 to the number of spaces between rows: 5 + 1 = 6 dripline rows.
The application rate is the rate that the XF-SDI Series Dripline applies water to the soil. This is used to determine run times for the zone based on the plants watering requirements. Table is provided to make it easy to determine application rates for every model of XF-SDI Series Dripline when using common row spacing (12” – 24”). The table is divided into two sections, a 0.6 GPH emitter flow section and a 0.9 GPH emitter flow section.

Go to the section for the specified emitter flow rate and find in the left hand column the specified emitter spacing. Now find the lateral row spacing across the top of the table. Follow the lateral row spacing column down and the emitter spacing row across until the two meet. This is the application rate in inches per hour. For example, a 0.6 GPH emitter flow rate with 18” lateral row spacing has an application rate of 0.43 inches per hour.

### DETERMINE MAXIMUM LATERAL LENGTHS (FEET)

You need to know the operating pressure and the emitter spacing to determine the maximum lateral run length.

### CALCULATING ZONE WATER REQUIREMENTS

At this point the emitter flow rate and spacing between emitters and rows has been selected. Use the tables below to determine the overall water application rate for the turf area, and this will lead to the maximum size of each zone. The tables show the total water applied per 100 square feet of turf area for various emitter flow rates and spacing. Converting water application rate into gallons per minute for each 100 square feet gives a quick way to determine the maximum size of each zone from the available water source. Be prepared to add more zones if required for trees and slopes.
CALCULATING ZONE WATER REQUIREMENTS (CONTINUED)

After the dripline layout design is complete, you will need to identify total zone flow. This is used to help determine mainline, supply and exhaust header, and control zone (valve, filter, and regulator) selection.

- Calculating zone water requirements can be done by adding up the total dripline line in the zone. Convert the total dripline to hundreds of feet (650 feet would be 6.5 in hundreds of feet).
- Multiply total dripline in hundreds of feet by the flow per 100 feet for your specified dripline. This can be found in Table 3.
  To read the table, select the emitter flow rate in the row across the top (0.6 GPH or 0.9 GPH) and then select the emitter spacing in the left column (12”, 18” or 24”). Follow emitter flow rate down and emitter spacing across to find the flow per 100 feet for the XF Series dripline specified.
- For example, for a zone that has 650 feet of 0.9 GPH emitters an 18” emitter spacing, the calculation would be 6.50 x 1.02 gpm = 6.6 gpm for the zone.
- Supply lines and headers should be sized to provide the flow to the zone without exceeding 5 feet per second velocity. This can be done using the zone water requirement and referencing information on the appropriate piping located at www.rainbird.com/reference or in the back reference section in the Rain Bird catalog.

SPECIFYING PRODUCTS IN THE ZONE

After completing the dripline layout design, you’ll need to determine the other remaining products that will be in the zone. The products that make up a dripline zone are normally the control zone (an assembled unit that provides a valve, filter, and regulator), fittings that connect the dripline, and flush and air relief valves that allow for flushing water or bleeding off trapped air.

FITTINGS

The design for a dripline system will use fittings for various connections. If you choose a Grid layout, you may need a transition fitting from the supply piping to the XF Series Dripine. Within the dripline grid there will be fittings to connect lateral rows to the header. If you are using a Lite Layout, you will also use a transition fitting from the supply piping, as well as a fitting at the end or midpoint of the zone so that a flush point can be installed.

Rain Bird offers a full line of fittings in two types: 17mm insert fittings are designed for use with XF Series dripline. Rain Bird’s Easy Fit compression fittings handle XF Series and other dripline and tubing sizes from 16mm to 18mm OD.

Rain Bird 17mm insert fittings have a barbed end that is raised and sharp providing a strong connection. This fitting is rated for operating pressures up to 50 psi without using clamps. If operating pressures exceed 50 psi, a clamp is recommended. To install, the fittings are pressed into the tubing with no need for special tools. It is important you do not heat the polyethylene tube before inserting to make installation easier, as it will weaken the connection and can damage the tubing. For the full line of insert fittings, refer to our website at www.rainbird.com/drip/fittings or consult a Rain Bird product catalog.

Rain Bird patented Easy Fit compression fittings go together with half the force as insert fittings and can be used on dripline and tubing with diameters from 16 to 18mm OD. This provides the versatility to eliminate the inventory of over 160 combinations of connections. The Easy Fit compression fittings provide a stronger connection and can be used with operating pressures up to 60 psi. For the full line of Easy Fit fittings, refer to our website at www.rainbird.com/drip/fittings or consult a Rain Bird product catalog.
A control zone provides the proper water flow to a zone, filtration to assure containments are removed that can plug emitters, and pressure regulation for optimum performance of the dripline system. With the broadest product line in the industry and easy installation and maintenance that will save time, Rain Bird control zones are the choice for any project.

Features and benefits include:

- Durable and reliable low, medium, and high flow rates. Rain Bird’s low flow valve leads the industry handling flows down to 0.2 gpm without weeping. See video at www.rainbird.com/lowflow.
- 200 mesh high capacity stainless steel filters that will catch grit and debris that could clog emitters causing a reduction in water flow that could damage plants.
- Filters that are simple to remove from the body and are easily cleaned under a faucet or in a pail of clean water.
- Commercial high capacity filter that has a maintenance indicator that tells you when it needs cleaning.
- Pressure regulators that reduce operating pressure to 30 psi or 40 psi.
- Compact size with the filter and regulator combined in the same housing to reduce parts an potential leaking problems. Compact size makes the control zone easier to install and it can allow for fitting more control zones in a valve box.

### Control Zone Selection Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Flow Range (gpm)</th>
<th>Inlet Pressure (psi)</th>
<th>Valve</th>
<th>Filter</th>
<th>Outlet Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMMERCIAL HIGH FLOW: 15–40 gpm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XCZ-PRB-150-COM</td>
<td>1 1/2” x 2” @ 1”</td>
<td>15-40</td>
<td>20-150</td>
<td>150-PESB</td>
<td>1&quot; PR Quick-Check Basket Filter (2)</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COMMERCIAL MEDIUM PLUS FLOW: 3–20 gpm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XCZ-PRB-100-COM</td>
<td>1” x 1”</td>
<td>3-20</td>
<td>20-150</td>
<td>100-PESB</td>
<td>1&quot; PR Quick-Check Basket Filter</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RESIDENTIAL / LIGHT COMMERCIAL MEDIUM FLOW: 3–15 gpm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XCZ-100-PRF **</td>
<td>1” x 1”</td>
<td>3-15</td>
<td>20-120</td>
<td>100-DV</td>
<td>* 1” PR RBY</td>
<td>40</td>
</tr>
<tr>
<td>XACZ-100-PRF</td>
<td>1” x 1”</td>
<td>3-15</td>
<td>20-120</td>
<td>100-ASVF</td>
<td>* 1” PR RBY</td>
<td>40</td>
</tr>
<tr>
<td><strong>RESIDENTIAL / LIGHT COMMERCIAL LOW FLOW: 0.2–5 gpm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XCZ-075-PRF</td>
<td>3/4” x 3/4”</td>
<td>0.2-5</td>
<td>20-120</td>
<td>LFV-075</td>
<td>* 3/4” PR RBY</td>
<td>30</td>
</tr>
<tr>
<td>XACZ-075-PRF</td>
<td>3/4” x 3/4”</td>
<td>0.2-5</td>
<td>20-120</td>
<td>ASV-LF-075</td>
<td>* 3/4” PR RBY</td>
<td>30</td>
</tr>
<tr>
<td>XCZ-LF-100-PRF</td>
<td>1” x 3/4”</td>
<td>0.2-5</td>
<td>20-120</td>
<td>LFV-100</td>
<td>* 3/4” PR RBY</td>
<td>30</td>
</tr>
</tbody>
</table>

* Pressure-Regulating RBY Filter  
** Available with BSP threads
TIE-DOWN STAKES

XF Series tie-down stakes (TDS-050) are used to hold dripline in place. Designed with notch sides for better hold down strength, they are made of long lasting corrosion resistant 12-gauge galvanized steel. Use stakes to hold dripline on-surface or under a mulch cover. For best results, stagger stakes every 3 feet in sand, 4 feet in loam, and 5 feet in clay. At fittings where there is a change of direction such as tees or elbows, use tie-down stakes close to the fitting on each leg of the change of direction.

AIR/VACUUM RELIEF VALVES

Air/Vacuum Relief Valves are used for two reasons:
- To freely allow air into a zone after sundown. This ensures a vacuum doesn’t draw debris into the dripline. (Back siphoning)
- To ensure a means of releasing air from the dripline when the zone is turned on, thus eliminating air pockets and speeding up dripline operation.

Install Air/Vacuum Relief Valves correctly by:
- Locating at the highest point(s) of the dripline zone.
- Install the valve in an exhaust header or a line that runs perpendicular to the lateral rows to ensure all rows of the dripline can take advantage of the air/vacuum relief valve.

MANUAL LINE FLUSH POINT

A manual flush is used when flushing lines in the system or when emptying the system when preparing for winter.
- Install the manual flush at a low point in the exhaust header of a Grid layout, or at the mid point of a Lite Layout.
- Install a flush port with a threaded plug or a manual flushing valve in a valve box with a gravel sump adequate to drain approximately one gallon of water.
- Manual flush points are normally installed as far away from the water source as possible.

CONTROLLERS

Rain Bird Controllers offer the most advanced features to help you efficiently manage all your irrigation needs.

SYSTEM CHECK OUT & TEST

It is important that after a zone is installed that it be tested to ensure it is operating properly. Walk along the dripline to make sure each emitter is functioning and there are no breaks. Test the pressure as far away from the water source as possible to verify that the rest of the zone is at acceptable pressures. If readings are lower than they should be, a line, break, clogged, filter, clogged pressure regulating valve, or reduced line pressure are possible causes. Checking the flow of each zone with a flow meter can also be a good test to verify water supply.
Trees. With any irrigation strategy, it is recommended that trees planted in grassy areas should be irrigated on a different zone and with a separate system than the turf grass. This is particularly true with subsurface drip because over time, tree roots could push the buried subsurface drip lines up to the surface. Also, trees are more valuable than grass, so if the system for the grass area needs to be turned off to avoid water consumption, then a separate system for the trees can still be operated to maintain health.

Curved Edges. Rain Bird XF-SDI Dripline with Copper Shield™ is flexible to follow curves that are 3 inch radius and larger. When there are curved shapes in the landscape, avoid showing dripline rows that follow the curved edges of the design. Instead, lay out as many straight lines as possible to simplify the installation, then fill-in missed areas with additional straight lines if possible. When the design layout is finished, make a grid pattern overlay to scale with the selected emitter and row spacing (for example, a grid that is 12 inches by 18 inches). Place the overlay on top of the design and check to be sure that at least one row and not more than two rows are found in each grid. This procedure ensures good uniformity in the design and avoids creating areas that may receive too much or too little water.

When installed on bare ground, specify Rain Bird stakes (LD16STK or TDS-050) to hold tubing in place and pin the dripline with stakes every 5 feet on straight runs; and every foot when following a curve of 4 foot radius or less. Stakes are not required if the dripline is installed directly in the ground with mechanical equipment.
Establish the overall grid concept. Generally, the least cost grid design is to place the manifold along the short dimension and design rows to run the length of the long dimension. This reduces the manifold material cost and will have fewer connections.

A. Identify the zone boundaries and show the direction of the dripline row.
B. Determine the maximum row length from the chart below. The chart gives the maximum length for a given pressure at the lateral inlet (not the pressure available at the water source).
   1. To choose the maximum row length at this step, estimate the inlet pressure available at the row that is farthest away from the water source.
   2. Perform a pressure loss calculation from the water source to the farthest end of the manifold to confirm that all driplines will have adequate pressure. Be sure to account for changes in elevation.
C. Specify the distance from the edge of the zone to the first row in the grid.
   1. For turf that is planted against a hardscape edge or curb, the first row should be 2 inches away from the edge.
   2. For turf that is adjacent to a planted area, the first row should be 4 inches away from the edge.
D. Measure the widest part of the zone and specify the number of rows.
   1. Find the widest zone dimension (in inches).
   2. Subtract the specified distance from both edges.
   3. Divide by the spacing between rows, and round up to the nearest whole number.
   4. Add 1 to this number to find the exact number of rows in the grid.
E. Design a manifold system that provides the pressure that was assumed in step B above to each of the rows.
   1. For small areas with less than 8 GPM total flow, the manifold can be made of polyethylene tubing, either with or without emitters.
   2. For larger confined areas, divide the zone into subsections with no more than 8 GPM flow and design a polyethylene header system for each of these subsections.
F. Repeat the process at the opposite end of the zone to design flush manifolds and connect the flush manifolds to a manual or automatic valve so that the entire grid can be flushed regularly.
**SLOPES**

Irrigation water may move through the soil and accumulate at the low points. Slopes that are less than 3% (3’ of fall in 100’) do not require any special design consideration. For slopes greater than 3%, the driplines should be installed perpendicular to (or across) the slope. This places each drip lateral at a uniform elevation and does not allow irrigation water to follow the dripline in the ground.

When the slope is steeper than 5%, water flow in the soil can be significant. To simplify design and installation, the spacing between rows and emitters can remain the same everywhere in the slope. The area at the bottom 1/3 of the slope, however, should be controlled as a separate zone. Run time on the separate bottom zone can then be reduced in case water migration from higher elevations causes the lower area to get too much water.

**ELEVATION CHANGES - SLOPE LAYOUT**

Adjust for slopes

The design of the dripline system should account for the slopes, berms, banks, or depressions on the site since runoff may occur with slopes of 3% or greater.

- Dripline laterals should run perpendicular to the slope whenever possible.
- Lateral row spacing should be normal spacing within the top two-thirds of the slope.
- Lateral row spacing should be 25% greater within the bottom one-third of the slope.
**DESIGN FOR A CONFINED AREA**

Lay out the final grid pattern and design the supply and flush manifolds.

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### Manifold Design

**Example 1: Small System**  
(Total Flow 2.7 gpm)

**Dripline rows are 30 feet long with 0.6 gph emitters that are 12 inches apart**  
Flow = 0.6 gph x 30 emitters = 18 gph  
= 0.3 gpm each row

---

**PIPE SIZING**

<table>
<thead>
<tr>
<th>PIPE SIZE (INCH)</th>
<th>INSIDE DIAMETER (INCH)</th>
<th>MAXIMUM FLOW (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>0.62</td>
<td>4</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>0.82</td>
<td>8</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1.05</td>
<td>12</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>1.38</td>
<td>22</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>1.61</td>
<td>30</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2.07</td>
<td>50</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>2.47</td>
<td>70</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3.07</td>
<td>110</td>
</tr>
</tbody>
</table>

---

**Recommendations for Manifold Materials**

1. Use Dripline if there is a hardscape edge and the total flow rate is less than 8 GPM.
2. Use blank poly tubing or PVC if the flow rate is higher than 8 GPM. If there is a hardscape, add a dripline lateral next to the manifold.
LARGE AREAS

Design for a large area where zones are not naturally defined

Lay out the final grid pattern and design the supply and flush manifolds

Establish the overall grid concept. For the most cost-effective design, the maximum row length determines the long dimension of the zone and the total available water flow determines the number of rows. Most large systems use a supply manifold in the middle of a zone and rows are installed in opposite directions from the center of the zone to reduce friction loss.

A. Determine the maximum row length from the chart below. Estimate the inlet pressure at the row that is farthest away from the water source.
B. Calculate the flow rate of the longest row by multiplying the number of emitters by the flow rate of each emitter.
C. Divide the flow rate available at the water source by the flow rate of the longest row and round down to find the maximum number of rows that can be irrigated in one zone.
D. Design water supply and flush manifolds to supply the rows, using the spacing between rows as selected for the soil type. In large systems, large diameter PVC or poly pipe is often used to supply water to a riser that feeds rows in opposite directions.
   1. Manifold designs should be specified with minimal friction loss to be sure of adequate pressure at the inlet of each lateral.
   2. Manifolds should be designed to limit the water velocity to no more than 5 feet per second to reduce friction loss, reduce long-term wear and hydraulic water hammer.
   3. Perform a pressure loss calculation from the water source to the farthest end of the manifold to confirm that all driplines will have adequate pressure. Be sure to account for changes in elevation.
E. Specify air vents as per standard design practice for the large diameter water supply piping.
Manifold Design
Example 2: Large System
(Total Flow 37 gpm)

Driplines rows are 230 feet long with 0.9 gph emitters that are 12 inches apart.

\[
\text{Flow} = 0.9 \text{ gph} \times 230 \text{ Emm} = 207 \text{ gph} = 3.5 \text{ gpm each row}
\]

Use a row of Dripline next to the manifold when near a hardscape edge.

PIPE SIZING
MAXIMUM FLOW (GPM) TO MAINTAIN WATER VELOCITY BELOW 5 FEET PER SECOND

<table>
<thead>
<tr>
<th>PIPE SIZE (INCH)</th>
<th>INSIDE DIAMETER (INCH)</th>
<th>MAXIMUM FLOW (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>0.62</td>
<td>4</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>0.82</td>
<td>8</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1.05</td>
<td>12</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>1.38</td>
<td>22</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>1.61</td>
<td>30</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2.07</td>
<td>50</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>2.47</td>
<td>70</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3.07</td>
<td>110</td>
</tr>
</tbody>
</table>

PVC SCHEDULE 40
• When branching out from a supply header with XF Series dripline, maximum lateral run length should be considered. Add up all the “branched out” dripline and check it against the maximum lateral run length listed in the table on page 8.
• When joining lateral rows from a supply header, check only the longest lateral against the maximum lateral run length listed in the table on page 8.
The amount of water applied depends on the emitter flow rate and spacing. The precipitation rate in inches per hour and the time required to apply 1/4 inch of water are shown in the tables below.

0.9 GPH EMITTER FLOW
(Values are inches of water applied per hour)

<table>
<thead>
<tr>
<th>DISTANCE BETWEEN ROWS (INCHES)</th>
<th>DISTANCE BETWEEN EMITTERS (INCHES)</th>
<th>DISTANCE BETWEEN ROWS (INCHES)</th>
<th>DISTANCE BETWEEN EMITTERS (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1.44</td>
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</tr>
<tr>
<td>16</td>
<td>1.08</td>
<td>18</td>
<td>0.96</td>
</tr>
<tr>
<td>20</td>
<td>0.87</td>
<td>22</td>
<td>0.79</td>
</tr>
<tr>
<td>24</td>
<td>0.72</td>
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</tr>
</tbody>
</table>

Example: 0.9 GPH emitters are 12 inches apart and 12 inches between rows apply 1.44 inches per hour.

0.6 GPH EMITTER FLOW
(Values are inches of water applied per hour)

<table>
<thead>
<tr>
<th>DISTANCE BETWEEN ROWS (INCHES)</th>
<th>DISTANCE BETWEEN EMITTERS (INCHES)</th>
<th>DISTANCE BETWEEN ROWS (INCHES)</th>
<th>DISTANCE BETWEEN EMITTERS (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0.96</td>
<td>14</td>
<td>0.83</td>
</tr>
<tr>
<td>16</td>
<td>0.72</td>
<td>18</td>
<td>0.64</td>
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<tr>
<td>20</td>
<td>0.58</td>
<td>22</td>
<td>0.53</td>
</tr>
<tr>
<td>24</td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example: 0.6 GPH emitters are 12 inches apart and 18 inches between rows apply 0.64 inches per hour.

An important goal of any turfgrass irrigation plan is to meet the plant water needs while promoting deep roots at the same time. To promote deep roots, it is best to wait as long as possible between irrigations so that roots do not multiply near the surface, but instead will thrive at all levels in the soil profile. With subsurface drip irrigation, however, water spreads out in the soil through capillary forces, and this spreading works best if the soil is not allowed to dry out between irrigations.

Irrigation Efficiency: The irrigation efficiency of subsurface dripline will be over 90% for a well designed and properly installed system. This is because water applied by a grid of subsurface driplines is transferred directly into the soil without any evaporation loss. Also, the points of water application are close together and each point of water distribution has virtually the same flow rate because the emitters are pressure compensating. The run times to apply 1/4 inch of water from the tables above are already adjusted to include 90% irrigation efficiency.

“Cycle and Soak” or “Pulse” Irrigation: Clay soil has very small pores, or capillaries between the clay particles, and these small capillaries simply cannot fill with water quickly. If emitters have a high flow rate or are installed too close together, the water may quickly come to the surface and eventually run off the turf area. The best ways to avoid this are:

- Use the recommended flow rate emitter and spacing for the soil type.
- Use “Cycle and Soak” or pulse irrigation with short run times, separated by at least one hour.

As a general rule for clay soils, schedule the total irrigation run time over at least two applications of water, separated by a soak time of 3 to 4 hours. For clay soil, use two applications of water, separated by at least one hour. Local site conditions such as slopes or non-uniform soils may require more cycles that are shorter, or a longer soak interval.
SPECIFICATIONS

The flexible polyethylene tubing shall have factory installed pressure-compensating, inline emitters spaced evenly per listed spacing. The flow rate from each installed inline emitter shall be 0.6 or 0.9 gallons per hour when inlet pressure is between 8.5 and 60 psi.

The inline emitter diaphragm shall have a pressure-regulating diaphragm with a spring action allowing it to self-rinse if there is a plug at the outlet hole. The flexible tubing allows for easy non-linear installations.

The inline emitter shall have Copper Shield™ technology installed to protect the emitter from root intrusion.

The inline emitter inlet shall be raised off the inside tube wall to minimize dirt intrusion. The XF Series Dripline inline tubing shall be manufactured by Rain Bird Corporation, Azusa, California.
### Sub-Surface Drip Irrigation Design, Installation and Maintenance

**MODEL NUMBERS**

<table>
<thead>
<tr>
<th>Model ID</th>
<th>Description</th>
<th>Color</th>
<th>Flow Rate (GPH)</th>
<th>Emitter Spacing (Inches)</th>
<th>Coil Length (Feet)</th>
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<tbody>
<tr>
<td>XFS-06-12-100</td>
<td>XF-SDI 0.6GPH 12” SPC 100FT</td>
<td>Copper</td>
<td>06</td>
<td>12</td>
<td>100</td>
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<tr>
<td>XFS-06-12-250</td>
<td>XF-SDI 0.6GPH 12” SPC 250FT</td>
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<td>250</td>
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<tr>
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<td>XF-SDI 0.6GPH 12” SPC 500FT</td>
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<td>06</td>
<td>12</td>
<td>500</td>
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<tr>
<td>XFSP-06-12-500</td>
<td>XF-SDI-P 0.6GPH 12” SPC 500FT</td>
<td>Purple*</td>
<td>06</td>
<td>12</td>
<td>500</td>
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<tr>
<td>XFS-06-18-100</td>
<td>XF-SDI 0.6GPH 18” SPC 100FT</td>
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</tbody>
</table>

*Purple for Non-Potable
**RECOMMENDED PRACTICES**

**INSTALLATION & OPERATION**

**OPTION A**

- Remove the soil to a depth of at least 4 inches; place the dripline on the soil surface and backfill. A second method is to create a trench for each dripline row.
- These methods work well in small areas, but are labor-intensive over a large zone.
- Place the dripline grid on a uniform grade that is free of sharp rocks or other objects that may damage the dripline.
- Make all connections to the supply manifold, flush manifold, flush valve, and Control Zone Kit, then check for leaks before backfill.
- Be sure to compact the backfilled soil with rubber-tired machinery or a heavy roller. Some amount of compaction is required for water to move through the capillaries in the soil.

**OPTION B**

- To insert driplines into the soil or existing turf with a single shank insertion plow.
- This machine can be used in new installations on bare soil, or to retrofit into existing turf.
- These smaller machines can work in tight spaces near existing buildings, wall or curved applications.
- This type installation method is less destructive to existing turf grass.
- Be sure to cover the ends of the driplines after each pass to keep soil and debris from entering the lines before they are connected to the manifolds.
**OPTION C**

- Use a tractor with fixed shanks to lay in driplines in bare soil.
- This option is best for new, larger installations where the soil is well tilled and free of rocks.
- A tractor with a strong engine and "caterpillar" treads may be required to overcome the resistance of heavy soils.
- Be sure to cover the ends of driplines after each pass to keep soil and debris from entering the lines before they are connected to the manifolds.

**OPTION D**

- Rotary trenching unit that cuts a narrow trench approximately 1 inch wide by 4 to 6 inches deep.
- Suitable for installations in narrow or small existing turf grass applications. Also, for shrub and groundcover installations where it is desired that the XF-SDI dripline be installed sub-surface.

**OPTION E**

- Hand trenching maybe be utilized in areas too small for mechanical installation.
- Establish finish grade.
- Ideal for loamy and sandy soil sub-surface applications in turf grass and shrub bed installation.
- Establish finish grade.
- Hand dig trenches 4” – 6” deep to install XF-SDI dripline.
- Cover trenches and rake level.
- If installing shrubs or groundcover, maintain flags to identify dripline location during planting.
1. Keep all driplines, manifolds, and mainline piping free of dirt during installation because any contamination in these lines could plug the dripline emitters.

2. Check manifolds for leaks before covering with soil.

3. Check pressure at the site and be sure to operate below the maximum rated pressure of 60 PSI. Check and record pressure at the supply manifold and discharge manifold. Any changes in pressure can be used in future troubleshooting.

4. If core aeration is expected to be done in the turf where sub-surface dripline is installed, be sure the tine depth is less than the depth of the buried dripline. Depth of dripline is recommended to be 6” while tine depth should not be set greater than 4”.

5. When using machinery for the installation:
   a. Do not drive over the dripline; always keep a layer of soil between the dripline and machinery tires.
   b. To help keep driplines in place, drive in the same direction as the dripline, not across the lines.
   c. Avoid driving in the same places at the site or you will be creating heavily compacted areas.

6. Be sure there is uniform soil compaction all over the site after installation.

7. After installation, open the flush valves (one at a time) and collect some of the water to check to be sure that the installation is clean.

8. After installation and backfill, observe the first wetting pattern. Rapid puddling could indicate a leak or might mean that the driplines are not buried at the specified depth.
1. Flush the system every two weeks for the first 6 weeks and check the water that is flushed out for cleanliness. Establish a regular flush schedule for the future after these initial checks.

2. Flush the system well after any repairs are made.

3. Check the pressure at the supply and flush manifolds on a regular basis and compare with the pressure readings taken right after installation.

4. Drain the system during winter if there is a chance of freezing. Compressed air may be used but only with the flush valve open and with the air pressure at 40 PSI or less. Be sure to close the flush valve after evacuating with compressed air.

5. Check the manufacturer’s instructions for winterizing the valves, filters and backflow prevention devices.

6. Winterizing an irrigation system involves enough water to ensure that components are not damaged due to freezing weather.

**Winterizing**

**If compressed air is used to blowout the lines:**
- XF Series Dripline fittings are rated to 50 psi, so the air pressure must be adjusted to below this pressure. It is air volume, not pressure that is effective when blowing out the lines.
- The pressure regulating valve that is part of the control zone and is installed in the valve box regulates water, not air pressure.
- With all drain ports open, compressed air should be applied until no water is seen exiting the ports.
- All drain ports should be left open.

**If compressed air is not used to blowout the lines:**
- A drain port should be installed at all low points in the zone. These ports may be a tee or elbow with a threaded plug or a manual flush valve.
- If the zone is in a grid or closed loop system, the headers may contain a significant amount of water because they are either blank XF Series tubing, PVC, or poly pipe. It is important to provide drain ports for these components.
- If the zone has laterals that dead-end and are not connected to an exhaust header, the lateral ends should be opened to drain at the lowest point(s).
- Follow manufacturer instructions for automatic zone valves.
Sub-Surface Drip Irrigation
Design, Installation and Maintenance Guide

Rain Bird XF-SDI Dripline with Copper Shield™ – Drip tubing that is specifically designed to be buried and to deliver small amounts of water directly to the soil.

Emitter – The device inside the drip tubing that controls the amount of water flow out of each outlet hole.

Supply Manifold – The combination of flexible or rigid pipe plus fittings that supplies water to many rows of dripline (also known as “header”).

Flush Manifold – Flexible or rigid pipe and fittings connecting a group of dripline rows and found at the opposite end of the Supply Manifold (also known as “footer”).

Application Rate – A measurement of the amount of water added to a zone over a certain amount of time, often reported in inches per hour.

Run Time – The amount of time that the valve is open and water is delivered to an irrigated area.

Backsiphoning – The reverse flow of water from the soil and back into the emitter outlet hole. This can happen when there are no check valves and the water that drains out of low-elevation emitters will create a vacuum that pulls water into the emitters at higher levels.

Capillary Action – The movement of water through the soil where the water sticks to the sides of very small passages or capillaries between soil particles.

Precipitation Rate - A measurement of the amount of water added to a zone over a certain amount of time, often reported in inches per hour (same as Application Rate).

Zone – A part of the landscape that gets irrigated at the same time.

Flow Rate – The amount of water that travels through the pipes or the emitters in a given amount of time. Flow rate is normally measured in gallons per minute (gpm) or gallons per hour (gph).

Static Pressure – The pressure as measured when there is no flow in the system.

Dynamic Pressure – The pressure as measured when water is flowing in the system.

Aerated (aeration) – The act of creating holes in the turfgrass to loosen the soil and get oxygen to the underground roots.

Friction Loss – The reduction in pressure caused by water flowing in a pipe because of friction created when the flowing water slides against the inside walls of the pipe or tubing.

Pores – The small spaces between soil particles that water can move into (see Capillary Action).

Riser – A pipe or tube that carries water upward from a buried water supply pipe to a fitting or sprinkler.

Flush Valve – A valve that can be opened automatically or manually to discharge the water that is in the system of dripline rows and manifolds to remove any accumulated dirt or debris.

www.rainbird.com
At Rain Bird, we believe it is our responsibility to develop products and technologies that use water efficiently. Our commitment also extends to education, training and services for our industry and our communities.

The need to conserve water has never been greater. We want to do even more, and with your help, we can. Visit www.rainbird.com for more information about The Intelligent Use of Water™.