

Sprinkler System Design

I. Choice and Placement of Sprinklers

There are a number of conditions that effect the choice of sprinklers. Among the factors that should be considered:

- **The size of bed or lawn** – *What are the distances needed?*
- **Prevailing wind conditions** – *Do you need low angle sprinklers for windy areas?*
- **Angle of slope** – *Do you need a check valve for low sprinklers to prevent puddling?*
- **Soil conditions** – *Heavy clay soil may require low precipitation rates.*
- **Available water pressure and flow** – *Do you have a weak water source or old galvanized iron piping?*
- **Pop-ups, shrub bodies, or fixed risers?** *Plant growth can block spray.*



Sprinkler nozzles have a fixed pattern and screw on to the stem. Stems pop up out of the body 2"-12" high. Body & nozzle sold separately.

Spray Heads (up to 15' throw) Spray heads are made up of two parts; the nozzle which determines the pattern of spray and the body which attaches to the lateral line. Bodies vary from the shrub

type that stays above-ground on a riser, to the pop-up type which is completely hidden until the water is turned on. Pop-ups range from 2" to 12" in pop-up height. Modern pop-up sprinklers are made of high-impact plastic, with stainless steel retraction springs and wiper seals around the pop-up riser. A wide range of nozzles enable different distances and arcs of throw along with rectangular patterns for narrow strips.

Rotors throw farther with less water than sprays which means fewer heads, less trenching, and the ability to cover a larger area with a single valve.



Rotor Heads (15' throw and up) Like spray heads, rotors have body options from shrub (non-pop-up) to 12" pop-ups. But unlike sprays, the nozzles are usually single streams throwing long distances at different volumes and trajectories. The patterns are made by gear adjustment in the sprinkler body. A set of nozzles comes free with each rotary sprinkler to

allow easy adjustment of distance and volume of water from each sprinkler head.

II. Sprinkler Spacing

Sprinklers should be placed so that the spray from one reaches the next. This is called **head to head spacing**. Sprinkler efficiency is greatly reduced when spacing is stretched beyond that point.

Head to head spacing can be achieved with square and triangular patterns. For square spacing the sprinklers are placed in a square pattern, spaced at the radius of the nozzle; this is by far the most common arrangement in small areas. In triangular spacing each row is offset from the other so that the sprinklers are at the corners of equilateral triangles. The distance between rows comes out to .86 of the radius of the sprinklers. This gives more even precipitation rates, but should only be used in larger areas.

III. Determining the Maximum Zone Size (Flow Test)

Measure the water supply available at the place or places you wish to connect your sprinkler systems. This is usually a hose faucet on the outside of your house. If you have more than one location for possible connection, check them all, as there can be big differences between water sources in the same yard.

To measure the flow, turn the faucet on full and place a bucket of known volume beneath the stream. Measure the time it takes to fill the bucket. For example, if a 5 gallon bucket fills in 30 seconds then your flow is 10 gallons per minute.



The Urban Farmer Store®

The Bay Area's Leader in Drip Irrigation since 1981

urbanfarmerstore.com



2833 Vicente St • San Francisco, CA 94116 • (415) 661-2204 • Fax (415) 661-7826
653 East Blithedale • Mill Valley, CA 94941 • (415) 380-3840 • Fax (415) 380-3848
2121 San Joaquin Street • Richmond, CA 94804 • (510) 524-1604 • Fax (510) 524-9797

Sprinkler System Design

Sprinkler systems should be designed to use no more than 75% of total available flow. In the example above the maximum zone should use 7.5 gallons per minute.

IV. Determining the Number of Zones (Valves)

First break the system up into sections that will have specific requirements defined by:

- Different sprinkler types with different precipitation rates (standard sprays vs. rotors)
- Different plant types (turf vs. shrubs)
- Different exposures to sun and wind
- Different soil types
- Different elevations: (top of a slope, low or level areas, or plants in containers)

Each section will need a minimum of one valve. Then add up the total gallons per minute required by the sprinkler heads in each section and divide by the **maximum zone size** determined by the flow test. This tells you which sections need to be broken down into multiple zones. Other factors are mechanical limitations such as barriers (buildings, driveways) that are hard to cross.

V. Determining Pipe Size

Pipes in an irrigation system should be sized so that they allow water to flow through without much pressure loss. Flow is measured in GPM (gallons per minute), friction loss is measured in PSI (pounds per square inch), and velocity is measured in FPS (feet per second).

There are two goals:

- 1) **To have almost the same pressure at each sprinkler in a zone, and**
- 2) **To have low water velocity which reduces the chance of water hammer (the violent movement of water can damage pipes, fittings, and valves) .**

**There are numerous charts that assist in making these calculations. However, in residential and small commercial applications, a simple chart listing the maximum flow that a size and type of pipe will carry will suffice. The chart below takes both into consideration.

VI. Effects of Different Static Pressures

Also check static pressure with a pressure gauge or by calling the Water Department. Very high pressure (over 100 PSI) requires the use of a pressure regulator to protect the irrigation valves; pressure between 60-100 PSI may require some pressure or flow regulation to prevent misting at the sprinkler nozzles; low pressures (below 50PSI) limit the types of sprinklers that you can choose. Always test the pressure; it's easy with a \$12.25 gauge.(ORGAUGE)

VII. Precipitation Rate

It is important to know the precipitation rate of each sprinkler zone to decide appropriate watering schedules. Precipitation rate is expressed in inches per hour and determined by this formula:

$$\frac{96.25 \times \text{gpm of water falling on an area}}{\text{Area (square feet)}} = \text{Inches per hour}$$

Authorized distributor...

Hunter® RAIN BIRD® TORO®

Maximum** Flow Rates in GPM (Gallons Per Minute)						
Pipe Type/Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Schedule 40	4	8	13	22	30	50
Schedule 80	3	6	11	20	26	46
Type L Copper	5	7	12	19	26	48
P.E. (Drip)*	4 (240 GPH)	8 (480 GPH)	13 (780 GPH)	NA	NA	NA

* 1/8 P.E. 10 G.P.H., 1/4 P.E. 20 G.P.H., 3/8 P.E. 100 G.P.H. The flow of a drip system is generally expressed in GPH (gallons per hour). To convert GPM to GPH, simply multiply GPM by 60. (GPM X 60=GPH)

** These flow rates are the maximum before water hammer becomes apparent. That means you can, if you choose, get more water through the pipes than shown, but you lose pressure and cause vibration in the lines if you do.



The Urban Farmer Store®

The Bay Area's Leader in Drip Irrigation since 1981

urbanfarmerstore.com

2833 Vicente St • San Francisco, CA 94116 • (415) 661-2204 • Fax (415) 661-7826

653 East Blithedale • Mill Valley, CA 94941 • (415) 380-3840 • Fax (415) 380-3848

2121 San Joaquin Street • Richmond, CA 94804 • (510) 524-1604 • Fax (510) 524-9797

© The Urban Farmer Store is a Registered Service Mark of the Urban Farmer Store, Inc. All others are the service marks or trademarks of their respective holder, and may be registered. © Copyright 2003 The Urban Farmer Store, Inc. SprinklerSystemDesign2003