



TORO[®]

Planning & Installation Guide

Automatic Sprinkler Systems

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Before you start

▶ Check Local Codes and Permits

Call your local water company or the proper municipal authority for information on building codes or permits required for the installation of underground sprinkler systems. They can also tell you about local codes for backflow prevention required to protect your water supply from contamination, as well as advise on where to locate the backflow device in the system. In addition, check with your local utility companies before you dig to identify any buried cables or natural gas lines.

▶ Installation Accessory Checklist

During installation, you will need several accessories and a variety of pipe fittings. Other materials you may need during installation include:

- ✓ PVC pipe cutter
- ✓ Screwdriver
- ✓ Pipe wrenches
- ✓ Hammer
- ✓ Trenching shovel
- ✓ 1" pipe clamps (poly only)
- ✓ Tape measure
- ✓ Solvent, primer, rags (PVC only — do not use pipe dope on plastic-threaded fittings.)

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Atmospheric Vacuum Breaker (AVB) — a backflow prevention device installed between the remote control valve and sprinklers in non-continuous pressure applications.

Backflow Prevention Device — a device, required by law, on an irrigation system that prevents water from re-entering the potable water line once it flows into the irrigation pipes.

Controller — the device that sends timing commands to remote control valves for actuation; same as timer.

Coverage — the pattern of water applied to an area by a sprinkler head.

Designed Operating Pressure — the pressure a designer uses to determine spacing distances and flow for sprinkler heads. The designed operating pressure is determined by subtracting estimated friction losses from the static water pressure.

Dynamic Pressure — the pressure reading in a pipeline system with water flowing.

Evaporation — the change by which any substance is converted from a liquid state to a vapor.

Flow — the movement of water through the irrigation piping system; causing friction loss.

FPS — the abbreviation for “feet per second;” refers to the velocity of water in pipes.

Friction Loss — the loss of pressure (force) as water flows through the piping system.

GPM — the abbreviation for “gallons per minute” (unit of measure for water flow).

Head-to-head Spacing — refers to the spacing distances of sprinklers when they do not exceed the radius of the sprinklers.

In-line Valve — the component in the irrigation system that regulates the On/Off of water from the main line to the sprinkler heads; activated by the controller; same as remote control valve.

Lateral — the pipe in an irrigation system located downstream from the remote control valve. Lateral pipes carry water directly to sprinklers.

Main Line — the pipe in an irrigation system that delivers water from the backflow prevention device to the remote control valves. This is usually the largest pipe on the irrigation system, generally under constant pressure and located upstream from the remote control valves.

Manifold — a group of control valves located together in the same area.

Matched Precipitation Rate (MPR) — the uniform delivery of water across each square foot of an irrigated area. Each sprinkler’s coverage provides every blade of grass with no more — and no less water than the next. The result is high-precision application.

PSI — the abbreviation for “pounds per square inch” (unit of measure for water pressure).

PVC Pipe — Poly Vinyl Chloride pipe; the most common pipe used in irrigation systems.

P.O.C. — abbreviation for “point of connection.” This is the location on the irrigation system where a tap is made for connection of a backflow prevention device or water meter.

Potable Water — water used for drinking purposes.

Precipitation Rate (PR) — the rate at which sprinkler heads apply water to a specific area of coverage, over a given period of time, measured in inches per hour.

Radius — the circular area extending from the center of a circle to the outside curve.

Remote Control Valve — the component in the irrigation system that regulates the On/Off of water from the main line to the sprinkler heads; activated by the controller; same as in-line valve.

Service Line — the pipe supplying water from the city water main to the water meter.

Shut-off Valve — the component in the irrigation system that allows manual shut-off of water to all components downstream.

Spacing — the distance between sprinklers.

Static Water Pressure — the pressure that exists in a piping system when there is no flow; measured in pounds per square inch (PSI).

Station — a group of sprinklers that is controlled by the same remote control valve; same as a zone.

Surge — the build-up of water pressure in a piping system due to certain characteristics of pipe, valves and flow.

Supply Manifold — the pipe connected to the remote control valves that supplies water to the sprinklers.

Timer — the device that sends timing commands to remote control valves for actuation; same as controller.

Velocity — the speed at which water flows through the piping system; measured in feet per second (FPS).

Water Hammer — the impact created by water and air moving through the piping system at high velocities and suddenly stopping.

Water Main — the city water pipe located in the street or right-of-way.

Water Pressure — the force of water that exists in a piping system; measured in pounds per square inch (PSI).

Working Pressure — the remaining pressure in an irrigation system when all friction losses are subtracted from the static pressure.

Zone — a group of sprinklers that operate together and are controlled by the same remote control valve.



Toro Automatic Sprinkler Systems

An automatic sprinkler system gives you the landscape you've always wanted. A thicker, greener lawn. Beautiful gardens. It adds beauty and value to your home while saving time and water.

How many times have you forgotten to water your lawn, then over watered — only to end up with brown spots and muddy puddles? Like many homeowners, you could be using up to 50% more water than your landscape needs, which isn't good for your lawn or your pocketbook. The solution isn't to use more water, but to water more precisely. An automatic sprinkler system can give you a healthy, green lawn — and more free time to enjoy the beautiful results.

An automatic sprinkler system takes the work and worry out of watering your lawn. You can forget about tripping over hoses or sprinklers, fixing leaky faucets and hauling hoses around the yard. While you're enjoying the ball game, your lawn enjoys the right amount of water, in the right spots, at the right time.

Your Toro system can be hard at work even before the paper carrier is up, when your grass receives the most benefit. It adjusts for the different needs of new grass, trees and shrubs. And it can even turn itself off when it rains. So go ahead, take an afternoon nap. Your Toro automatic sprinkler system will take care of your beautiful green lawn. Automatically.



Sprinklers installed in a special pattern for complete and even coverage deliver precise coverage without gaps or runoff. Toro lawn sprinklers are available in several specially engineered designs for residential applications. Fixed-spray sprinklers are ideal for small lawns and concentrated areas like ground cover and shrubs. Multi-stream and multi-range rotary sprinklers cover medium-to-large lawn areas very efficiently.

Valves control water flow to the sprinklers. Toro valves are rigorously tested under extreme pressures and the worst possible water conditions. They're made to deliver years of smooth, trouble-free performance.



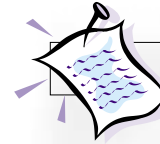
Timers are the brain of your system, telling your sprinklers what day, what time and exactly how much to water. And Toro controllers are as easy to program as an alarm clock.

Professional Products Require Professional Installation

The performance of an automatic sprinkler system is only as good as the professional who installs it. Choosing a quality contractor ensures long-lasting, efficient operation. A good contractor will also minimize ground disturbance during installation.

Look for a licensed professional with an established reputation. Expertise in irrigation planning is critical to the initial design and installation of your system. A solid background in irrigation planning helps you avoid common “do-it-yourself” pitfalls like uneven sprinkler coverage, problems with water pressure and other hassles. You can also rely on a professional for annual inspections and winterization, if needed. It’s important that your contractor understand regulations and code requirements in your area. Look for the following qualities when choosing a contractor:

- Years of experience
- Licensed
- Warranties all projects for defects in materials and workmanship
- Solid references



Notes

Sprinkler Selection

No matter how simple or complex the landscape, Toro has the sprinkler family to cover every angle. The basic sprinkler types include: fixed-spray, multi-stream and medium-range rotary sprinklers.



Select sprinklers with a greater spray radius for large areas so you can use fewer sprinklers and valves, which means you also use less pipe with less trenching and fewer timer zones.

570 Series

Fixed-Spray Sprinklers



Radius: 0'-16'
 Flow: 0.05-5.5 GPM
 Recommended operating pressure: 20-50 PSI
 Maximum operating pressure: 75 PSI

Toro 570 Series fixed-spray sprinklers produce a tight, constant fan of water that's ideal for small lawn, shrub and ground cover areas. Pop-up models pop up above grasses and disappear when not in use. Shrub sprays are mounted above foliage to water ground cover and shrubs. More than 70 different interchangeable and 20 special-application nozzles to choose from give you maximum flexibility.

Flood Bubblers



Flow: 2 GPM adjustable flow
 0.25, 0.50 and 1.0 GPM fixed flow
 Recommended operating pressure: 20-50 PSI
 Maximum operating pressure: 75 PSI

Toro flood bubblers produce a flow of water that soaks the soil, reaching the root zone. They're ideal for tree wells, planters and shrubs. Toro flood bubblers are available in a variety of flows, in both pop-up and riser-mounted models.

Stream Bubblers



Flow: Adjustable
 Recommended operating pressure: 20-50 PSI
 Maximum operating pressure: 75 PSI

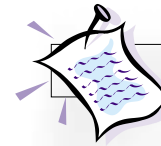
Toro 570 Series stream bubblers are ideal for efficient watering of small flower beds and shrub areas. Stream bubbler nozzles are available in a variety of patterns, in both pop-up and riser-mounted models.

Multi-Stream Sprinklers

300 Series Stream Rotor



Radius: 15'-30'
Flow: 0.57-7.51 GPM
Recommended operating pressure: 35-50 PSI
Maximum operating pressure: 75 PSI



Notes

XP-300 Series Multi-Stream



Radius: 28'-43'
Flow: 1.01-10.81 GPM
Recommended operating pressure: 35-60 PSI
Maximum operating pressure: 75 PSI

Toro's unique gear-driven, multi-stream sprinklers are recognized by their graceful "fingers of water" and effective matched precipitation rate (MPR) technology. These sprinklers slowly rotate to ensure proper water coverage on medium-sized lawn and shrub areas.

Medium-Range Rotary Sprinklers

Super 600 Series Rotor



Radius: 35'-50'
Flow: 1.2-6.71 GPM
Recommended operating pressure: 25-50 PSI
Maximum operating pressure: 75 PSI

Super 700 Series Rotor



Radius: 20'-52'
Flow: 0.80-9.75 GPM
Recommended operating pressure: 35-60 PSI
Maximum operating pressure: 75 PSI

V-1550 Series Rotor

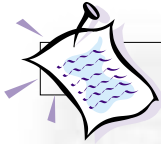


Radius: 15'-55'
Flow: 0.98-11.62 GPM
Recommended operating pressure: 25-75 PSI
Maximum operating pressure: 75 PSI

Toro rotary sprinklers deliver reliable, gear-driven versatility. They provide smooth, even coverage and are ideal for medium-to-large landscape areas.



For detailed performance data, specifications and ordering information, refer to the Toro Irrigation Products Catalog (form no. 490-1809).

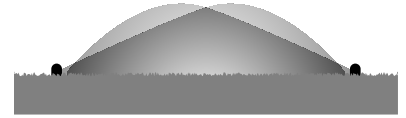


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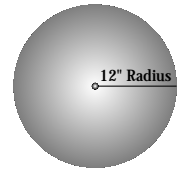
Sprinkler Placement Planning

Head-to-head Spacing

For proper coverage, place sprinklers so that the spray from one sprinkler reaches the next, as shown to the right. For windy areas (winds regularly stronger than 8 mph), place sprinklers closer — at 90% of spray radius or more depending on local wind direction and speed.



Determine spacing by sprinkler radius. For example, if you are using Toro 570 Series sprinklers with a radius of 12', place your sprinklers no more than 12' apart; or closer together if you are in a windy area.



How to Begin Designing Your System

The planning worksheet in the center of this guide will help you plan your design. Draw circles to represent sprinklers, as demonstrated on the following pages. When designing your system, we suggest you use the following planning tools: pencil, scratch paper, drawing compass, 50' tape measure, straight edge or ruler, spray paint for marking trenches and a Toro flow & pressure gauge.



If you do not own a flow & pressure gauge, ask your local Toro distributor if they have one that they loan to customers.

1. Draw Your Property From a Bird's Eye View

Each small square on the planning worksheet should represent one square foot of actual property. Using your tape measure, outline and measure your property accurately according to scale, laying out the locations of your home, sidewalks, grass, etc. The drawings on the following pages show a hypothetical example.

- Outline your house, garage and other structures.
- Show walks, drives, slabs, patios and surfaces.
- Locate and identify trees and major obstacles.
- From the outside of your house, measure outward to define your perimeters.
- Locate ground cover, grass, flower beds and landscaping.
- Identify the size and location of the water meter (or pump) and main line.
- Re-check your measurements at several different points. Make sure your drawing accurately indicates the true dimensions.

2. Section Your Yard

Divide your yard into areas according to type of plant material (grass versus shrubs) and sun exposure (shade versus full sun). Create as many large rectangles as you can, saving small and odd-shaped areas for last.

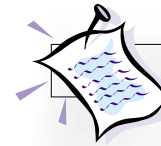
3. Locate Sprinklers in Large, Rectangular Areas First

Locate sprinklers within each area, one area at a time, using sprinklers with a greater radius for larger areas.

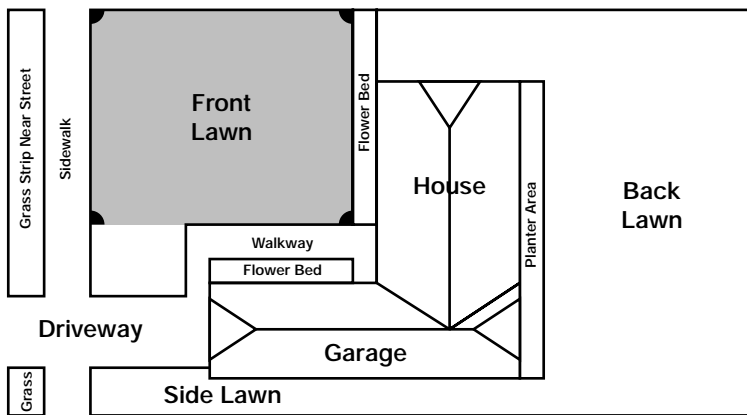
Stay within the allowable spacing range (radius) of sprinkler selected, and remember to space them head-to-head. Spacing sprinklers too far apart will produce dry spots. Always place sprinklers in a way to avoid spraying the side of your house, walls, fences, etc. Also, minimize spraying onto sidewalks, driveways and streets.

Place ◐ half-circle sprinklers on sides and borders; ◑ quarter-circle sprinklers in corners; and ● full-circle sprinklers in the middle.

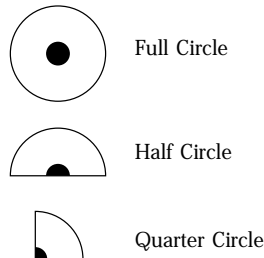
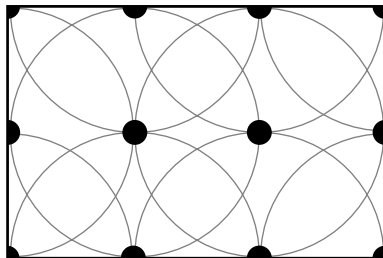
If you use rotary sprinklers in this large, rectangular area (approximately 34' x 34'), only four quarter-circle heads are needed to attain full coverage.



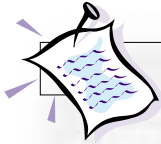
Notes



To make sure you have proper head-to-head spacing, use a compass to draw circles, semi-circles and quarter-circles representing sprinkler coverage, as shown below.

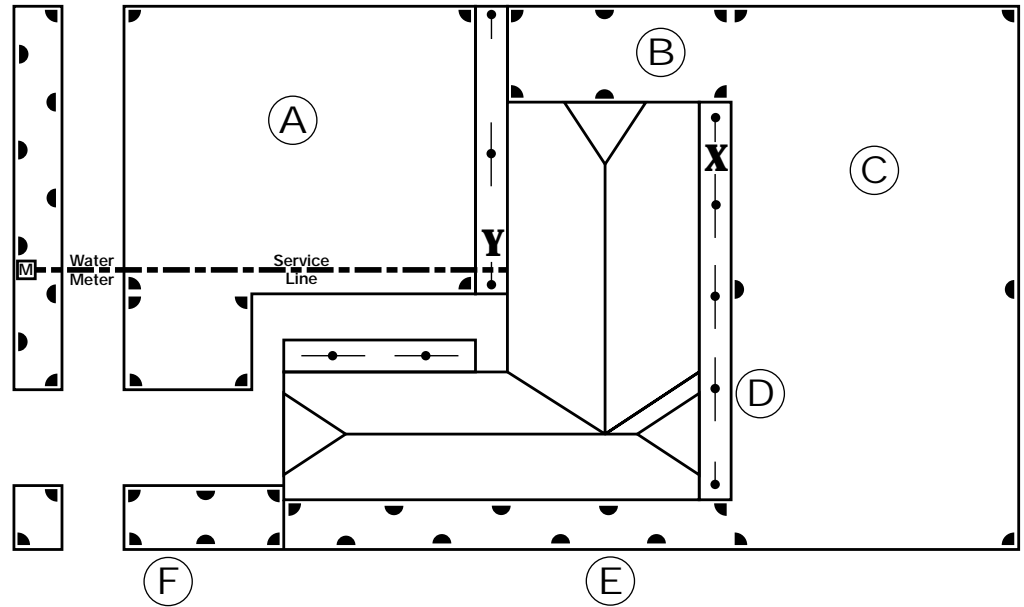


Locating sprinklers is not an exact science. You can locate sprinklers without knowing pressure or the gallons per minute (GPM) flow rate of water. These factors will apply later when we divide the system into zones. For now, work on your layout as described in Step 3 above until you've achieved head-to-head coverage for all areas.



Notes

Completing Your Sprinkler Placement



- (A) Rotary sprinklers, with their large radius range, cover this 34' x 34' lawn area using only four sprinklers, as opposed to needing up to nine smaller-radius fixed-sprays. That means you use a lot less pipe, accessories and trenching.
- (B) 570 Series fixed-spray sprinklers with 12' radius nozzles are used in this area.
- (C) Multi-stream sprinklers with the #03 nozzle provide the most efficient watering pattern for this 30' x 60' area. In addition, the multi-stream delivers even watering to this home's backyard slopes.
- (D) Stream bubblers next to the house and sidewalks keep spray off of surfaces. They are very effective for small planter beds and shrub areas too.
- (E) 570 Series fixed-spray sprinklers with 5' radius nozzles for narrow grass strips are used here.
- (F) In this area, 570 Series fixed-spray sprinklers with 8' radius nozzles are used.

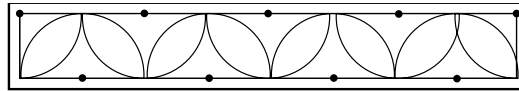


When designing your system, Toro recommends using an operating pressure of 30 PSI for fixed-spray sprinklers, flood bubblers and stream bubblers. Use 50 PSI for multi-stream and medium-range rotary sprinklers. If your system capacity does not fall within these ranges, refer to the Toro Irrigation Products Catalog (form no. 490-1809) for specific operating pressure information.

Three Ways to Locate Sprinklers in Small Areas

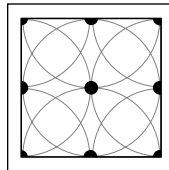
Triangular Spacing

Areas such as narrow strips bordering your driveway or sidewalk can be watered by two offset rows of part-circle sprinklers, as shown here.



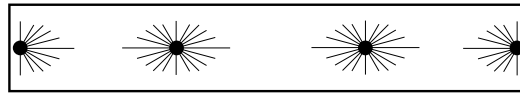
Square Spacing

This layout is best suited for well-defined, geometric spaces such as small, square or rectangle-shaped yards, or sites divided by sidewalks and other paved areas.



Special-Pattern Spacing

You can use special-pattern sprinklers for end-strip and center-strip watering, as shown in the diagram to the right (not recommended for turf applications).



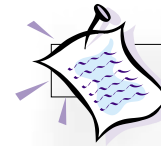
Center-strip sprinklers spray in two directions, end-strip sprinklers spray in one direction only. Both are designed for precise watering of small, rectangular areas.

Locating Sprinklers in Odd-shaped Areas

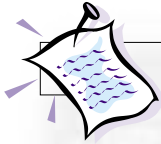
After locating your sprinklers in large, rectangular areas, you can now place sprinklers in small, non-rectangular areas. Although each site is different, following are some handy guidelines.

1. Choose the area on the perimeter with the smallest radius.
2. Place a sprinkler with a small radius at that point.
3. Place sprinklers along the border starting from that area.
4. Adjust the radius of each sprinkler according to the size and shape of the area.
5. If coverage is incomplete, adjust sprinkler location.

When you have defined and placed all of your sprinklers, use a compass to double check your layout.



Notes

**Notes**

Measuring Your Home's Water Capacity

Water pressure can vary from home to home, even on the same street, so it's important that you take a measurement at your own home. If you push your system beyond its capacity, it can create water hammer which will cause costly damage to your piping system or low pressure resulting in poor water application. Conversely, sprinklers operating outside of optimum operating pressures can waste water.

Following are two reliable ways to determining your home's water capacity. We recommend using the flow & pressure gauge method (no. 1) because it's fast and easy.

1. Determine Your Water Capacity and Working Pressure Using a Toro Flow & Pressure Gauge

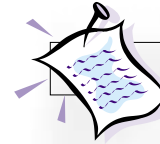
The Toro flow & pressure gauge is a dual-purpose device designed to measure water pressure up to 160 PSI and water flow up to 13 GPM. This flow gauge is not intended for use on lines larger than one inch. The gauge will only measure flow through the outside faucet or hose bib — not in the line.

- a. Ensure that water is not being used in the house.
- b. Attach the gauge to an outside faucet nearest to where the main line enters the house (see Y on diagram, page 12).
- c. Make sure the flow gauge is closed by turning the handle clockwise.
- d. Open the outside faucet slowly to avoid damage to the gauge.
- e. When the outside faucet is fully opened, read the system static pressure (pressure with no water running in the house).
- f. Open the flow gauge slowly by turning the handle counter-clockwise. As the flow gauge opens, the pressure will drop from the static reading and the flow reading will rise. Continue to open the flow gauge until the pressure drops to the designed working system pressure.
- g. If the pressure does not drop to the working pressure (after opening the flow gauge all the way), take the flow and pressure reading at the full, open position.



If rapid fluctuation occurs on the flow gauge, record the average reading. Additional reading of pressure and flow may be helpful to obtain further design information.

2. Determine Your Water Capacity and Working Pressure Using a Five-gallon Bucket and a Standard Pressure Gauge



Notes

- Locate the outside faucet closest to the main line (see Y on diagram, page 12).
- Locate another faucet on your house and attach a pressure gauge (see X on page 12). Open faucet all the way.
- With faucet Y completely open, check the pressure reading on the gauge at faucet X. If it is less than the working pressure, turn down the water flow from faucet Y until the reading reaches the working pressure. If it is greater than the working pressure, record the pressure reading and go to step d.
- Place a five-gallon bucket under faucet Y and time how long it takes to fill it with water. This test tells you how much water is available, measured in gallons per minute (GPM).

Time to Fill a Five-Gallon Bucket	GPM
15 Seconds	20
20 Seconds	15
25 Seconds	12
30 Seconds	10
40 Seconds	7.5

Double check your GPM using the following formula:

$$60 \text{ seconds} \div \text{time to fill the bucket} \times 5 \text{ (bucket size)} = \text{_____ GPM}$$

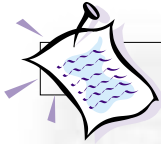
This is how much water is available at the designated working pressure or at the higher reading that you recorded.



The working pressure reading determines how far your sprinklers will spray.

Once you have completed either 1 or 2, record the PSI and GPM on page 16.

Before you go any further, it is important to make sure you are starting off with the right flow and pressure information. Take a moment to note and compare your findings with the Flow Rates Chart on page 16. A few minutes now may save you countless headaches later!



Notes

Determining Your Design Capacity

Enter your answers from page 15 here: PSI GPM

Now that you've recorded your home's water capacity, let's make sure your water meter and service line can handle it. Complete steps ❶, ❷ and ❸ to determine your actual system design capacity.

❶ Water Meter Size*

 = Max. GPM
Size

**Water meter size is stamped or printed on the face of the meter, or shown your water bill.*

Flow Rates for Water Meters

Meter Size	Max. GPM
5/8"	8
3/4"	13
1"	22

❷ Service Line Type/Size

 = Max. GPM
Type & Size

Flow Rates for Service Lines and Sprinkler Lines

Maximum Recommended Flow

Pipe Type	Pipe Size	Maximum GPM
PVC (Plastic) Consider using 1" Schedule 40 PVC pipe upstream of zone valves and at least 3/4" Class 200 PVC pipe downstream of zone valves.	1" Schedule 40	13
	3/4" Schedule 40	8
	1" Class 200	15
	3/4" Class 200	10
Galvanized	3/4" Galvanized Pipe	8
	1" Galvanized Pipe	13
Copper	3/4" Copper Tube	6
	1" Copper Tube	12
Polyethylene (Poly Pipe) In freezing areas, poly pipe may be used downstream of zone valves.	3/4" Poly Pipe	8
	1" Poly Pipe	13

❸ Enter the Lower GPM From Steps ❶ or ❷

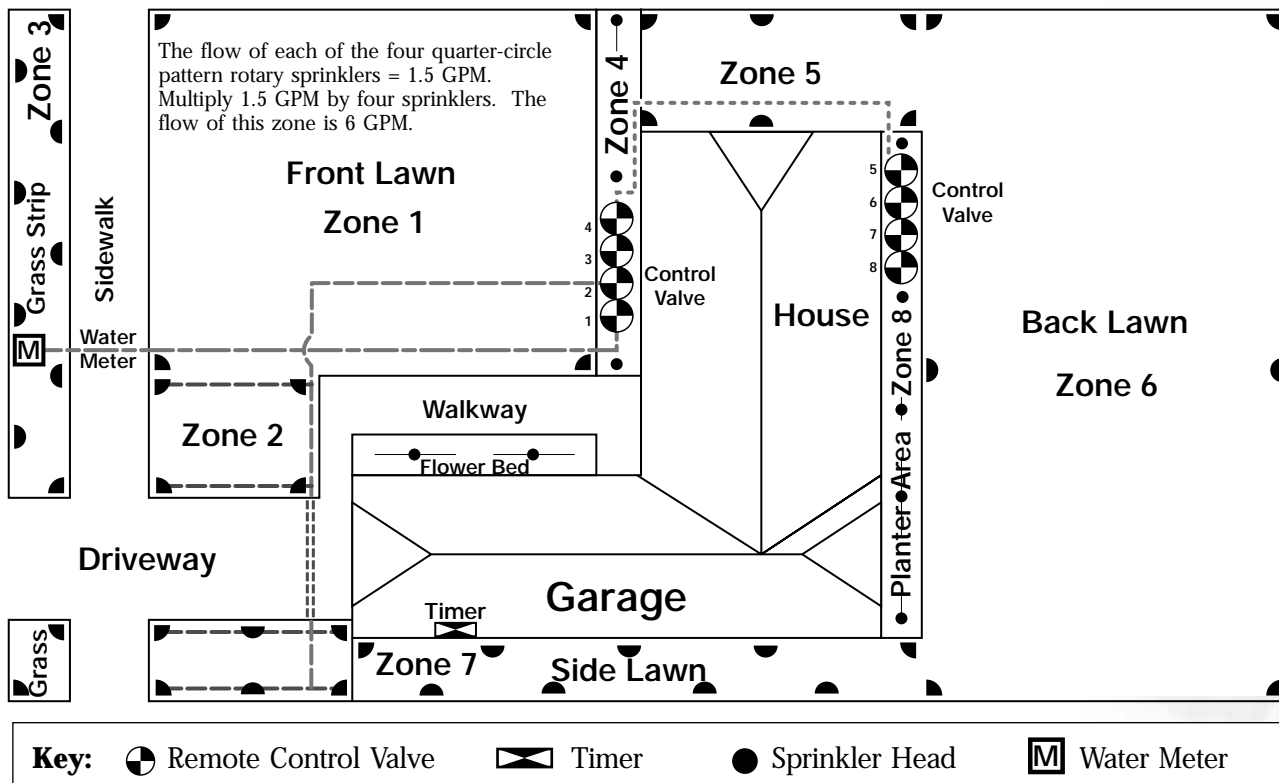
 Max. GPM (this is your design capacity)

Example:

Water Meter Size	Service Line Type/Size	Enter the Lower GPM
1" = 22 GPM	1" Schedule 40 PVC = 13 GPM	13 GPM = design capacity



Use only 80% of the design capacity to allow for future household water consumption demand for domestic purposes (showers, sinks, washing machines, etc.). Using the example above, 80% of 13 GPM is approximately 10 GPM. No group of sprinklers or zones should exceed this amount.



Zoning Your System

A zone is a group of sprinklers that operate together using a common valve. Your system timer controls zones independently of one another.

The capacity of any zone must not exceed the safe design capacity of your home's water system (see page 16).

Divide Your System Into Zones

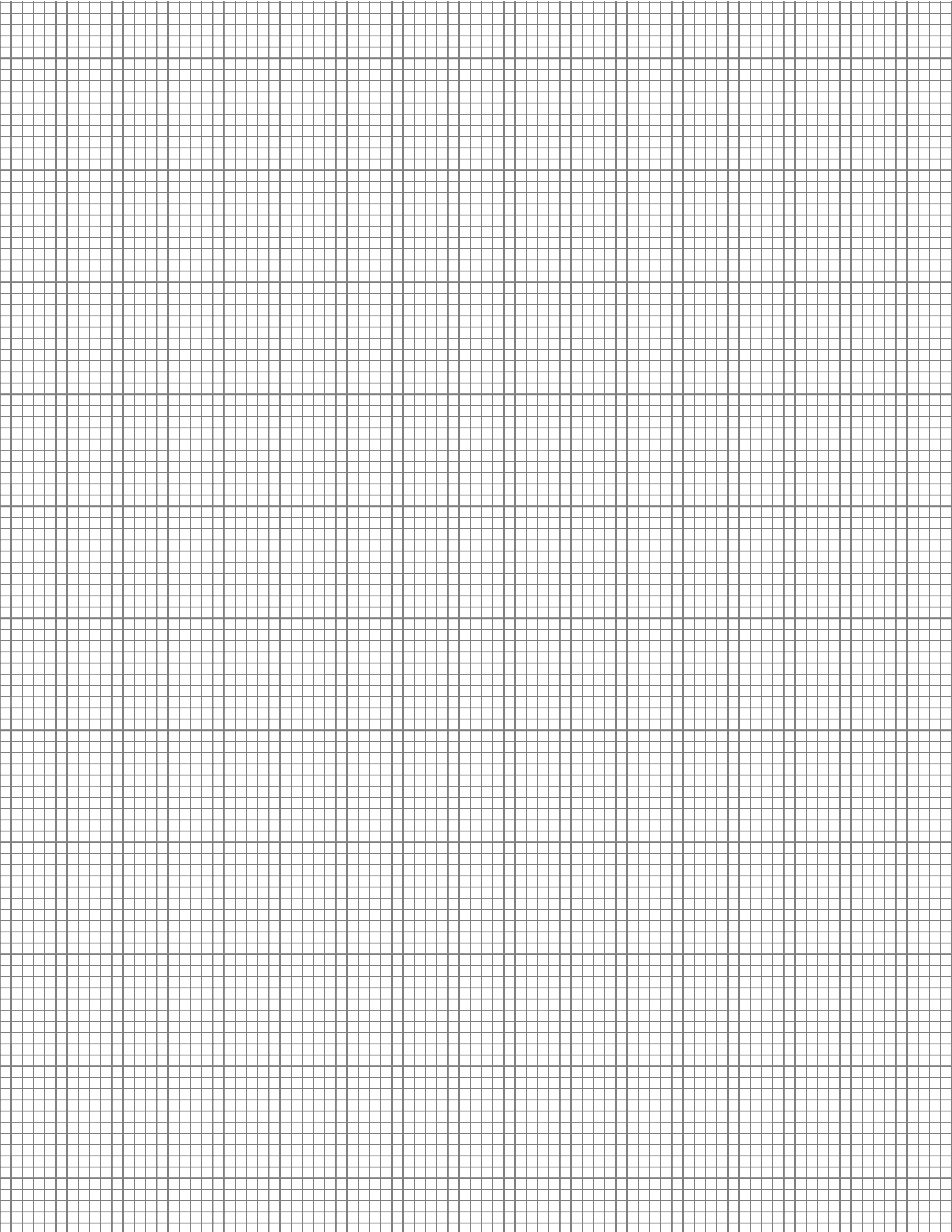
1. Write down the flow capacity (GPM) of each sprinkler on your grid layout.
2. Next, divide similar sprinklers into groups as shown.
3. Add up the sprinkler flow (GPM) for each zone. If the total flow exceeds the safe design capacity, you must split the zone into more zones or put some of the sprinklers into another zone with available capacity. Remember to split zones based on slope, sun or shade.



- Don't mix sprinkler types within a zone. For example, fixed-spray sprinklers should not be grouped with rotary sprinklers.
- Separate lawn and shrub areas.
- Separate shady and sunny areas.

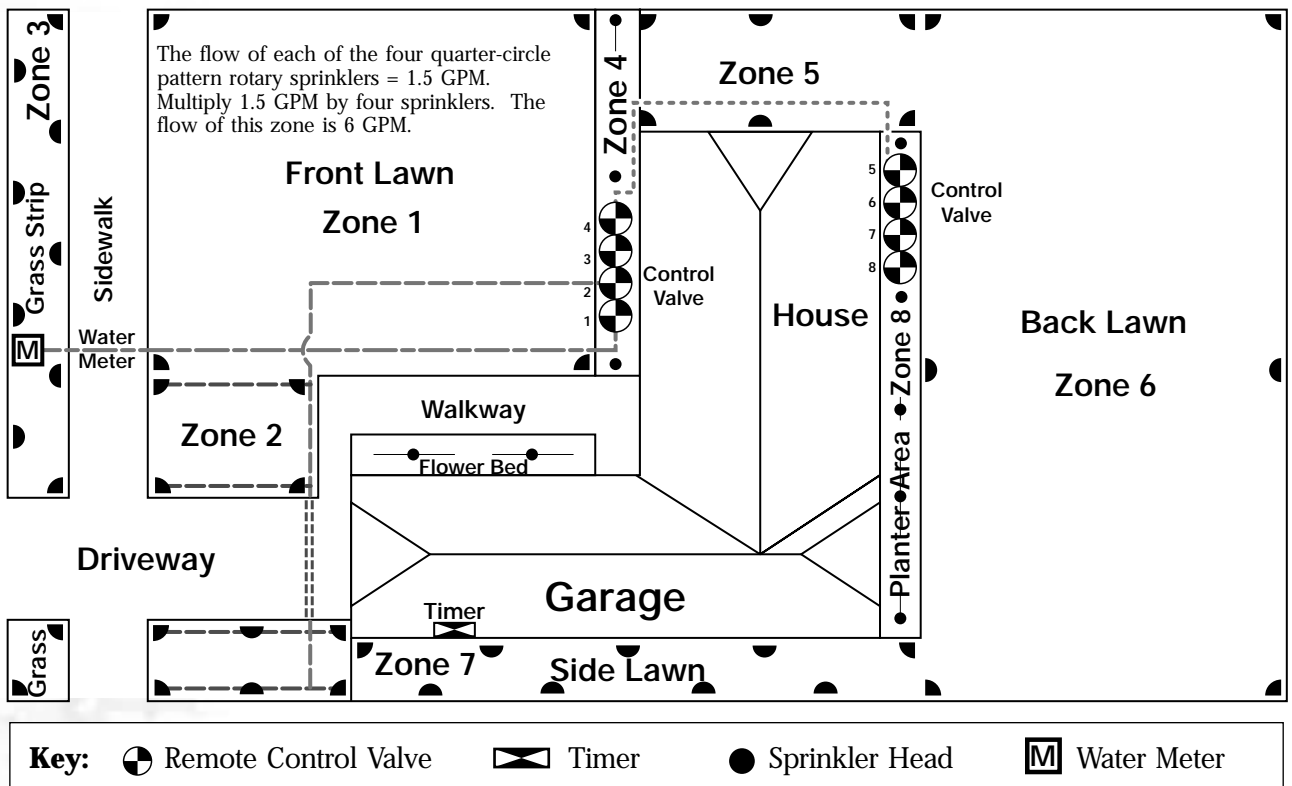
Count Your Zones

Determine the number of valves that you will need, based on the number of zones you have designed. In the example above, we will need eight valves because we have eight zones.



Each small square = one foot
Each large square = ten feet





Group Your Valves

We recommend grouping the valves. For example, one valve location is needed to operate front yard zones, and one to operate the backyard and/or side-yard zones. This symbol represents a valve location.

Locate the first set of valves in a convenient spot near the main water connection. A good location is where the service line enters your house. Also, place valves next to walks or planters for easier access.

In the example above, we show control valve locations. The front location, near the garage, controls zones 1, 2, 3 and 4. The backyard location controls zones 5, 6, 7 and 8.

The number of zones used on your automatic timer should match or exceed the number of zones in your system (plan for potential expansion). The Toro Greenkeeper® timer is ideal to use in this case since it expands up to eight zones.

Lay Out Your Pipe

In this system, piping will run:

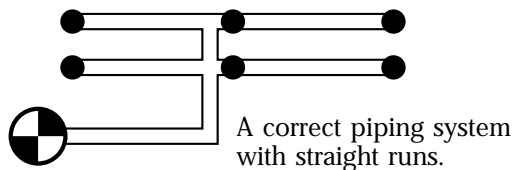
- From the main line to the first set of valves
- From the first set of valves to the second set
- From the valves to the sprinkler heads (shown only for zone 2)
- ===== Under driveway

Draw these connecting pipes on your grid layout (as shown in zone 2) and follow these rules:

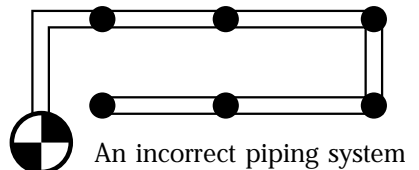
- Use as many straight runs as possible.
- Try to avoid turns, which result in loss of pressure.
- Avoid runs under sidewalks and driveways whenever possible.
- Make connections perpendicular to each other.



You can include more than one pipe in a trench.



A correct piping system with straight runs.



An incorrect piping system with too many turns in the pipe results in reduced flow and pressure to the last sprinkler on the line.



Consider using 1" Schedule 40 PVC pipe upstream of remote control valves and at least 3/4" Class 200 PVC pipe or 1" poly pipe downstream.

Install Your Timer

Install the timer inside your garage, or on an outside wall near a 110V outlet. If you locate the timer outside, be sure to mount it in a weatherproof cabinet such as the one available for the Toro GreenKeeper Timer (see page 28 for timer installation information). Check local electrical codes for connection to outside plugs.

Place zone or valve wires in the same trenches as the pipe. Remember that valves will be wired to the timer, so locate valve wires where they are easily accessible.

Toro recommends 18-gauge solid, multi-strand, direct-burial wire to connect valves to sprinkler timers. You will need one wire per zone, plus the common wire. This eight-zone system requires nine wires. Be sure to waterproof your connections.



Notes