Landscape Dripline Design Guide

Learn more at: **www.toro.com**

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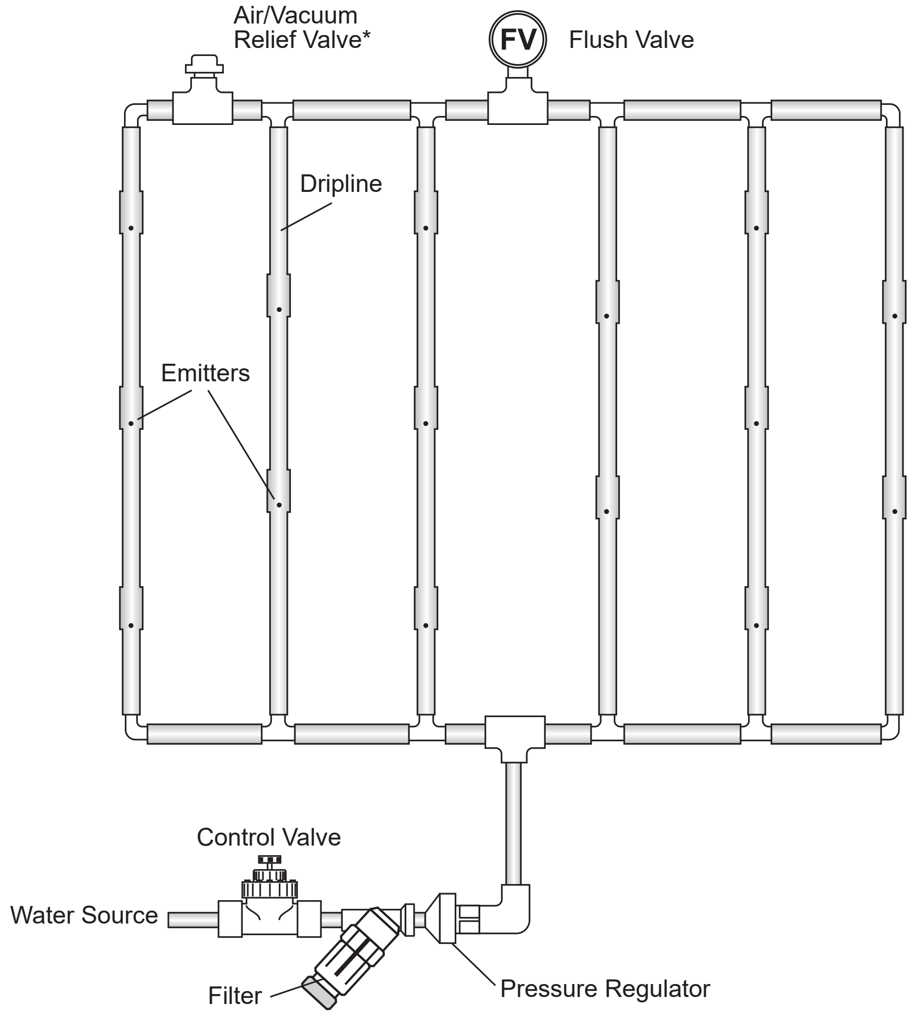
Introduction

Toro is a leading manufacturer in quality landscape drip irrigation products. In addition to Drip In® PC Brown Dripline for at-grade installations, Toro also offers a complete below-grade dripline system, DL2000®, designed specifically for residential and commercial markets. Through revolutionary ROOTGUARD® technology, DL2000 prevents emitter clogging while delivering optimal water application directly to the root zone. DL2000 is perfect for odd-shaped designs, median strips, public recreation areas and residential property — any place where sprinklers don't fit the application.

Whether installing dripline at-grade or below-grade, Toro has the perfect solution to fit your needs.

Typical Dripline Layout



**Only Required on Subsurface Installations*

Terminology

Application Rate — the rate at which a dripline grid applies water to a specific zone, over a given period of time, usually measured in inches per hour.

Backflow Prevention Device — the device, often required by local plumbing codes, on an irrigation system that prevents water from re-entering the potable water lines once it flows into the irrigation pipes.

Blackwater — wastewater from toilet, latrine, and agua privy flushing and sinks used for food preparation or disposal of chemical or chemical-biological ingredients.

BOD — the abbreviation for "Biochemical Oxygen Demand;" a measure or the amount of oxygen required to neutralize organic wastes.

Controller — the device that sends timing commands to remote control valves for actuation.

Design Operating Pressure — the pressure a designer uses to determine spacing distances and flow for driplines. The design 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.

Effluent Water — any substance, particularly a liquid, that enters the environment from a point source. Generally refers to wastewater from a sewage treatment or industrial plant.

Emitter — a device used to control the rate at which water is applied to a specific area. Emitters are usually injection molded out of chemical-resistant plastics and come in both inline and online configurations.
Toro dripline is manufactured with factory-installed, inline emitters.

Evapotranspiration — the combined rate at which water evaporates into the atmosphere and/or is consumed by plants.

Flow — the movement of water through the irrigation piping system.

Flush Cap — a device used to automatically flush sediment and debris from driplines within a grid. Flushing occurs at the beginning of each irrigation cycle and ends as soon as the system operation pressure reaches 10 PSI.

Flush Manifold — the end line or pipe in a subsurface grid that connects to all the driplines. A flush valve and/or cap is installed in the manifold to flush debris and sediment from the grid during each irrigation cycle.

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.

GPH — the abbreviation for "gallons per hour;" unit of measure for water flow.

GPM — the abbreviation for "gallons per minute;" unit of measure for water flow.

Greywater — wastewater from washing machines, showers, bathtubs, lavatories and sinks that are not used for disposal of chemical or chemical-biological ingredients.

I.D. — the abbreviation for "inside diameter."

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

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.

O.D. — the abbreviation for "outside diameter."

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.

Reclaimed Water — domestic wastewater that has been treated to a quality suitable for a beneficial use and is under the direct control of a treatment plant.

Remote Control Valve — the component in the irrigation system that regulates the on/off of water from the main line to the driplines; activated by the controller.

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

Spacing — the distance between the emitters or the driplines.

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

Subsurface Grid — a group of parallel, inline driplines that are connected to supply manifolds and flush manifolds.

Supply Manifold — the pipe connected to the remote control valves that supplies water to the driplines within a subsurface grid.

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

TDS — the abbreviation for "total dissolved solids." The sum of all inorganic and organic particulate material within a given amount of water. TDS is an indicator test used for wastewater analysis and is also a measure of the mineral content of bottled water and groundwater.

TSS — the abbreviation for "total suspended solids." The sum of all non- dissolved inorganic and organic material within a given amount of water. The other component of Total Solids (TS) in water are Total Dissolved Solids, so generally TSS + TDS = TS.

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

Wastewater — water containing waste including grey water, black water or water contaminated by waste contact, including process-generated and contaminated rainfall runoff.

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 the irrigation system when all friction losses are subtracted from the static pressure.

Zone — a subsurface grid or area of dripline that is controlled by the same remote control valve.

Design Parameters

Design Parameters

Toro dripline is designed for use in applications using the grid concept, with supply and flush manifolds at each end to create a closed-loop system. The result of the grid design is a completely subsurface-wetted area that is ideal for plant growth and root development. Toro dripline can also be installed on both sides of tree and shrub rows when the grid installation is not justified.

Product Selection

Pressure-compensating dripline is available in different nominal flow rates with different emitter spacings. Please consult performance charts for actual flows. Product choice is dependent on site conditions and soil types. The choice of dripper spacing, dripline lateral spacing and depth is dependent on the types of soil and plants used.

Water Availability and Quality

The allowable water flow (75% of available flow) and pressure are the determining factors for the maximum allowable zone flow. This is determined by the capacity at the point of connection and supply restrictions beyond the point of connection. Available flow and pressure can be obtained from the following sources:

- Physical pressure and volume tests (most reliable)
- Your local water district office
- Engineered calculations based on the size of the point of connection, meter and static pressure

Always make these determinations during the time of day at which the water pressure is at its lowest point.

Water quality determines the type of filter used, any necessary treatment and, in the case of reclaimed or effluent water, which drip emitter prod-uct to use. Water quality varies significantly according to the source which can be classified generally as:

- Potable water
- Irrigation district water
- Greywater or industrial recycled water
- Effluent water
- Recycled water
- Well water

Potable water, the most common type of water used in landscape applications, has relatively little debris and chemical contamination. Therefore, it only needs to be filtered with a screen or disk filter. With other water sources, it is advisable to obtain a water analysis prior to designing and installing the system. Some of the important parameters are:

- Total dissolved solids (TDS)
- Iron content
- Calcium, magnesium, sulfates, bicarbonates and hardness
- Chemical compounds present, BOD and TSS (grey water, industrial treated water and recycled water)
- The types and amount of sediment present (irrigation district water and well water)

Soil Types and Preparation

For design purposes, soil classifications of clay (heavy), loam (medium) and sand (light) are used in conjunction with plant types to determine the emitter and lateral spacings necessary to provide a uniform subsur-face soil moisture regime for the plant material.

As with all types of landscape irrigation systems, properly prepared soil is necessary to provide a homogenous bed for proper plant establishment, plant growth and uniform water distribution. Heavily compacted and layered soils should be ripped and tilled at a uniform eight- to twelve-inch depth to improve the consistency and tilth of the soil.

Soil and water analyses are recommended when the soil texture, soil Ph and water quality are in doubt. This is necessary in order to recommend soil amendments and water treatment when required. If possible, pre-irrigate the installation site when the soil is too dry to till and trench.

Plant Material Classification and Planting Layouts

Emitter and lateral spacings are determined by soil and plant material classifications. For design purposes, two general plant classifications are used: 1) trees, shrubs and ground cover, and 2) turf. Turf plantings have a much more intense and compact root structure, thus requiring a closer emitter and lateral spacing to efficiently irrigate these areas.

Planting layouts determine the size and type of irrigation design necessary to provide uniform moisture distribution. Individual or isolated planting areas separated by large expanses of unplanted areas or hardscapes require individual grids that provide moisture within the foliage canopy of the landscaped area.

Narrow, linear tree and shrub plantings require narrow, linear subsurface grids consisting of two to four laterals. More intense plantings that provide a complete foliage canopy at maturity require a grid design that applies uniform moisture levels within the foliage canopy (turf, groundcover, and dense shrub and tree plantings). Use the Spacing Guidelines Table (Table 1.2) to determine the proper emitter and lateral spacing.

Emitter and Dripline Selection

Toro offers the following types of dripline products:

Dripline	Tubing Dia.	Flow Rate	Pressure Comp.	Emitter Spacing	ROOTGUARD® Protected	Installation Type	
						Below-Grade	At-Grade/ Mulched Over
DL2000®	18mm	0.5 & 1.0 GPH	Yes	12", 18"	Yes	✓	✓
Drip In®	17mm	0.58 & 0.92 GPH	Yes	12", 18"	No		✓
Soakerline™	4mm	0.5 GPH	No	6", 12"	No		✓

Table 1.1

Dripline Placement From Edges

Consideration of dripline location is necessary when laying out zone edges. Hardscape materials act as heat collectors and cause landscape edges to dry out before the center of the landscape, making it essential to compensate by placing the first driplines no more than two to four inches from the landscape edge. In uncontained landscape areas, start the first dripline two to four inches outside of the planted area. In subsurface applications specifically watering turf, add dripline over the supply and flush manifolds to ensure that these edges have adequate moisture coverage.

Wind

As with all total-coverage irrigation systems, attention must be given to windward turf edges in high-wind areas to prevent browning. Place the first dripline no more than two to four inches from the edge of hardscaped areas or two to four inches outside the turf edge in uncontained landscape areas. Add an extra dripline six inches from the first line between the first and second lateral lines on the windward lateral edge.

Slopes

Driplines should be located parallel to the contour of slopes whenever possible. Since dripline runoff occurs on areas with a slope of greater than 3%, consideration must be given to dripline density from the top to the bottom of the slope. The dripline on the top two-thirds of the slope should be placed at the recommended spacings for the soil type and plant material in use. On the lower one-third, the driplines should be spaced 25% wider. The last drip-line can be eliminated on slopes exceeding 5%. For areas exceeding ten feet in elevation change, zone the lower one-third of the slope separately from the upper two-thirds to help control drainage.

Elevation Differences

When utilizing non-pressure-compensating dripline, elevation differences of five feet or more require separate zones or individual pressure regulators for each six-foot difference on uniform slopes.

When working with rolling landscapes with elevation differences of five feet or more within a zone, it is best to use pressure-compensating dripline to equalize pressure differentials created by the elevation differences.

Though vacuum relief valves aren't necessary when installing Toro dripline at-grade all subsurface irrigation zones must have a vacuum relief valve at the highest point in order to eliminate the vacuum created by low-line drainage, which causes soil ingestion. This is especially crucial when the dripline laterals are placed perpendicular to the contour of the slope as in street medians. All subsurface dripline laterals within the elevated area must be connected with an air relief lateral. In-line spring-check or swing-check valves should be used on slopes where low-line drainage could cause wet areas in the lowest areas of an irrigation zone.

Using 1/4" Dripline

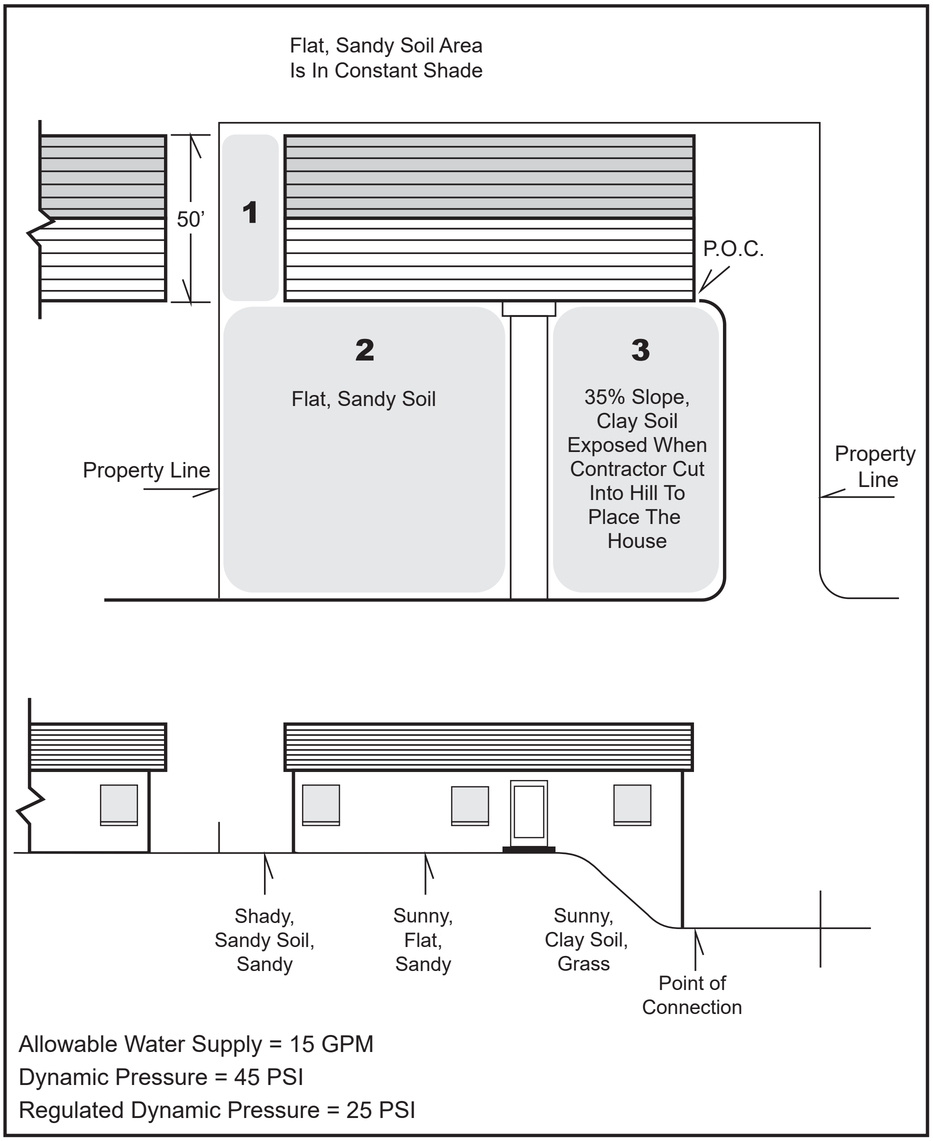
Toro's 1/4" Soakerline is ideal for small, tight areas because of its flexibility. It can also be used to loop around trees and bushes, and is often used to retrofit sprinkler risers and bubblers because it easily attaches to a ½" threaded multi-outlet manifold (Toro model T-PR25-9).

Design Procedures

Designing a System

Try designing your own dripline system using the diagram shown below and the tables and information provided in the remainder of this section. When you have finished the design worksheet, check your answers on page 15 at the end of this section.

Design a typical dripline installation for zone #1 where the width is 5' and the length is 50' and the dripline is below grade.



Design Worksheet

Use this worksheet to determine the type and quantity of product required for the system.

DW1 Allowable Water Supply____________ GPM

DW2 Dynamic Pressure __________________PSI

	Zones*					
	1	2	3	4	5	6
DW3 Soil Texture						
DW4 Plant Type						
DW5 Slope %						
DW6 Dripline Product						
DW7 Emitter Spacing						
DW8 Max. Dripline Lateral Spacing						
DW9 Nominal Flow Rate						
DW10 Actual Flow Rate						
DW11 Max. Run Length						
DW12 Exact Lateral Spacing						
DW13 Zone Flow (GPM)						

**The number of zones may vary depending on the specic needs of each installation.* *TABLE 2.1*

Typical Design Steps

Step 1: Obtain or draw a scaled plan of the area to be irrigated.

Step 2: Locate the point of connection on the scaled plan.

- Determine the water meter size and/or allowable volume of the water source: ___________ GPM (DW1)
- Verify the regulated dynamic water pressure: _______ PSI (DW2)

At this point in a typical installation, it would be necessary to select a pressure regulating device to establish/control the pressure in the system. Since there's a number of factors that can apply to a design (slope, length of run, dripline type), a regulated dynamic pressure of 25 PSI has been chosen for this example.

Step 3: Note the site and environmental parameters.

- Soil texture (clay, loam or sand): ____________ (DW3)
- Plant material(s) (trees, shrubs, ground cover or turf): ____________________(DW4)
- Direction and degree of slope:____________ % (DW5)

Step 4: Lay out the laterals.

- Use Table 2.2 below to determine the type of dripline product necessary to fit the irrigation needs of the site.
- Dripline product ________________________ (DW6)

Dripline	Tubing Dia.	Flow Rate	Pressure Comp.	Emitter Spacing	ROOTGUARD® Protected	Installation Type	
						Below-Grade	At-Grade/ Mulched Over
DL2000®	18mm	0.5 & 1.0 GPH	Yes	12", 18"	Yes	✓	✓
Drip In®	17mm	0.58 & 0.92 GPH	Yes	12", 18"	No		✓
Soakerline™	4mm	0.5 GPH	No	6", 12"	No		✓

TABLE 2.2

Using the Spacing Guidelines Table (Table 2.3) below, determine the maximum recommended spacing between drippers and spacing between driplines based on plant material and soil types.

Soil Type	Emitter Spacing	Row Spacing	Emitter Flow	Burial Depth*
Medium Sand • Trees/Shrubs/Groundcover • Turf*	12" 12"	18" 12"	0.92 - 1.0 GPH	4" 4"
Loam • Trees/Shrubs/Groundcover • Turf*	18" 12"	18" 18"	0.92 - 1.0 GPH	6" 4"
Clay • Trees/Shrubs/Groundcover • Turf*	18" 18"	24" 18"	0.53 - 0.58 GPH	6" 4"

** For Subsurface Only*

TABLE 2.3

- Emitter spacing: ____________________inches (DW7)
- Maximum dripline lateral spacing: ______ inches (DW8)

Step 4: Lay out the laterals: (cont.)

■ Using the Spacing Guidelines Table (Table 2.3), determine the nominal emitter flow rate.

■ Nominal emitter flow rate:_____________ GPH (DW9)*

■ Determine the maximum recommended run length from Table 2.4 below for the selected product and pressure.

■ Maximum length of run: _______________ feet (DW11)

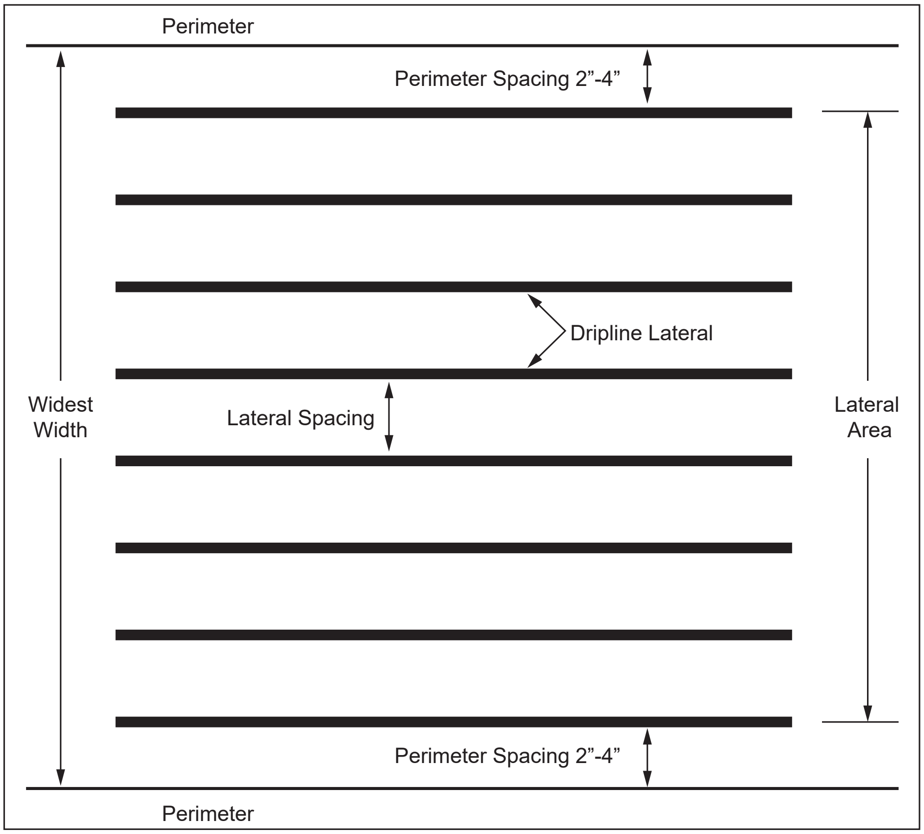
MAXIMUM RECOMMENDED LENGTH OF RUN @ 0% SLOPE

	Tube Dia.	Flow Rate (GPH)	Initial Pressure	Spacing Between Emitters 6"	12"	18"
DL2000®	18mm	0.5	15 PSI	n/a	250'	350'
	18mm	1.0	15 PSI	n/a	160'	240'
	18mm	0.5	25 PSI	n/a	360'	515'
	18mm	1.0	25 PSI	n/a	240'	340'
	18mm	0.5	35 PSI	n/a	400'	565'
	18mm	1.0	35 PSI	n/a	260'	375'
	18mm	0.5	40 PSI	n/a	460'	650'
	18mm	1.0	40 PSI	n/a	300'	430'
Soakerline™	4mm	0.5	20 PSI	19'	33'	n/a
Drip In®	17mm	0.58	15 PSI	n/a	169'	236'
	17mm	0.92	15 PSI	n/a	125'	175'
	17mm	0.58	25 PSI	n/a	270'	379'
	17mm	0.92	25 PSI	n/a	200'	282'
	17mm	0.58	30 PSI	n/a	301'	424'
	17mm	0.92	30 PSI	n/a	222'	314'
	17mm	0.58	40 PSI	n/a	349'	492'
	17mm	0.92	40 PSI	n/a	258'	364'

TABLE 2.4

Step 4: Lay out the laterals: (cont.)

■ Calculate the exact lateral spacing based on the dimensions of the area to be irrigated with dripline.



1. Measure, in inches, the dripline area at its widest width.

   Width:__________________inches

2. The first and last lateral perimeter spacings can be no further than two to four inches from the confining hardscape or two to four inches outside of unconfined landscapes. ***For this example we will use 4" spacing.***

3. Subtract the sum of the perimeter spacings from the width to determine the lateral area to be covered by subsurface driplines.

   Width (in inches) – perimeter spacings (in inches) = Lateral area: ______________ inches

4. Divide the lateral area (as determined in Step 4-3 above) by the recommended lateral spacing (DW8) to obtain the total number of __________________ spaces between laterals. Round to the nearest whole number to determine the exact number of spaces necessary to cover the drip area.

$$\frac{\text{Lateral area}}{\text{Dripline lateral spacing}} = \_\_\_\_\_\_\_\_\_\_\_\_\_ \text{spaces between driplines}$$

5. Add 1 to the number of spaces between driplines (from Step 4-4 above) to determine the total number of driplines across the widest part of the zone.

   1 + Number of spaces between driplines = Total lengths of dripline: ___________

Step 5: For applications exceeding a 3% slope, place the laterals parallel to the slope contour. Increase the calculated lateral spacing by drainage.

For areas exceeding 10 feet in elevation change, zone the lower one-third of the slope separately from the upper two-thirds to help control drainage.

Step 6: Determine the total estimated dripline footage required for each zone. There will always be some waste with each installation. Therefore, you should plan for additional footage by applying an appropriate factor for each dripline footage calculation (10%-25% should suffice).

1. Total dripline footage required: ________________ = length of runs x number of laterals

2. Total dripline footage required x 1.10 (10%) = ________________ total estimated dripline footage required (round to nearest whole number).

Step 7: Calculate the total estimated gallons per minute (GPM) per zone by using one of the two following methods. Be sure to use the total estimated dripline per zone (see Step 6-1 above).

Zone flow: _________ GPM (DW13)

– Determine the total number of drip emitters in each zone, then calculate the flow per zone based on the total flow rate of all drippers.

1.

$$\text{Number of drippers (within the zone)} = \frac{\text{Dripline footage required (6A above) x 12”}}{\text{Dripline emitter spacing (inches)}}$$

2.

$$\text{Total number of drippers} = \frac{\text{Flow per zone in GPM x dripper flow rate (GPH)}}{\text{60 (minutes)}}$$

OR

– Calculate zone flow by multiplying the total footage of dripline in hundreds (footage/100) by the flow per 100 feet obtained from the _________ following table.

FLOW RATE PER 100 LINEAR FEET (@ 20 PSI)

Product	Flow Rate (GPH)	Emitter Spacing	Actual Flow/100 ft.	
			GPH	GPM
DL2000®	0.5	12”	53.00	0.88
	0.5	18”	35.33	0.59
	1.0	12”	102.00	1.70
	1.0	18”	67.99	1.13
Drip In®	0.58	12”	58.00	0.97
	0.58	18”	38.67	0.64
	0.92	12”	92.00	1.53
	0.92	18”	61.33	1.02
Soakerline™	0.5	6”	124.00	2.06
	0.5	12”	62.00	1.03

TABLE 2.5

Step 8: Locate and size both the supply and flush manifolds in each zone. Both manifolds should be sized to accommodate the entire flow of the zone in GPM.

Step 9: Determine the number and location of the flush caps for each zone at a minimum of 10 PSI. One flush cap is required for each 15 gallons per minute of zone flow. Place the flush caps at the hydraulic center of the flush manifold(s).

Step 10: (Subsurface installations only) Calculate the total number of air/vacuum relief valves from the following table:

1/2” AIR VACUUM RELIEF VALVE (ITEM NO. T-YD-500-34)

Nominal Flow	12” Emitter Spacing	18” Emitter Spacing
0.5 GPH	750’	1,125’
1.0 GPH	390’	585’

TABLE 2.6

One air vacuum relief valve is required per footage length indicated in the chart above. For example, two air vacuum relief valves are needed for 1,500’ of dripline with 0.5 GPH flow and 12” emitter spacing.

Place air vacuum relief valve(s) at the highest point(s) of each zone. Using an air vacuum relief lateral, connect the air vacuum relief valve to all dripline laterals within the elevated area. If the supply and flush manifolds are at the same depth as the dripline, and are at the highest point in the zone, they can be used as the air relief lateral.

Step 11: Size pressure regulators based on the total zone flow using the table below.

PRESSURE REGULATORS

Product	Flow Range (GPM)	Pre-Set Operating Pressure (PSI)	Inlet Size (NPT)	Outlet Size (NPT)
T-PMR30	0.1 - 35	30	1” FPT	1” FPT
T-PMR40	0.1 - 35	40	1” FPT	1” FPT

TABLE 2.7

Step 12: Size the zone filter according to the total zone flow (see DW13) using the Filter Sizing Table below. To eliminate the chance of debris contamination in the event of a main or sub-main break, use one filter per zone close to the dripline.

FILTERS

Item Number	Size (MIPT)	Maximum Flow	Element	Mesh	Body
T-ALFS75150-S	¾”	18 GPM	Screen	150	small
T-ALFS75150-L	¾”	25 GPM	Screen	150	large
T-ALFS10150-S	1”	25 GPM	Screen	150	small
T-ALFS10150-L	1”	35 GPM	Screen	150	large
T-ALFS15150-L	1½”	80 GPM	Screen	150	large

TABLE 2.8

ANSWERS FOR ZONE 1, TABLE 2.1, PAGE 10

DW1: 15 GPM
DW2: 25 PSI
DW3: SAND
DW4: GRASS
DW5: 0%
DW6: PC
DW7: 12”
DW8: 12”
DW9: 1.0
DW10: 1.02
DW11: 234’
DW12: 13”
DW13: 4.25 GPM

Irrigation Scheduling

Irrigation scheduling with dripline uses the same methods of calculation as with sprinklers. The dripline grid system is designed to wet the irrigated area completely by methods similar to those used with sprinklers, supplying water in inches per hour. For efficient water application, it is necessary to apply water rates equal to or less than the rate at which the plants use water (evapotranspiration rate; ET). The ET rate is expressed in inches per unit of time, thus our application rates are expressed in inches per hour.

The following formula is used to determine application rates for dripline irrigation.

$$\text{Application rate (inches per hour)} = \frac{231.1 \times \text{Emitter flow (GPH)}}{\text{Dripper spacing} \times \text{Dripline spacing (in inches)}}$$

For example:

Dripline row spacing = 12”
Dripline emitter spacing = 12”
Emitter flow rate = .53 GPH
231.1 x .53 GPH = .85 inches per hour
12 (inches) x 12 (inches)

Or, use the Water Application Rate Table below to determine application rates.

	Emitter Spacing	Flow Rate (GPH)	Dripline Spacing		
			12”	18”	24”
DL2000®	12”	0.5	0.85	0.57	0.43
	18”	0.5	0.57	0.38	0.28
	12”	1.0	1.64	1.09	0.82
	18”	1.0	1.09	0.73	0.55
Drip In	12”	0.58	0.93	0.62	0.47
	18”	0.58	0.62	0.41	0.31
	12”	0.92	1.48	0.98	0.74
	18”	0.92	0.98	0.66	0.49
	Emitter Spacing	**Flow Rate**	**Dripline Spacing**		
			6”	**12”**	**18”**
Soakerline™	6”	0.5 GPH	3.98	1.99	1.33
	12”	0.5 GPH	1.99	1.00	0.66

TABLE 3.1

Zone Run Time Scheduling Worksheet

To determine zone run times, obtain the following information:

- monthly evapotranspiration value for the location
- irrigation application rate

The following formulae can be used to determine run times.

$$\text{Run time per week} = \frac{\text{Weekly evapotranspiration rate}}{\text{Application rate}}$$

$$\text{Run time per day} = \frac{\text{Run time per week}}{\text{Days per week}}$$

MONTH						
Zones						
DAY	1	2	3	4	5	6
SUNDAY						
MONDAY						
TUESDAY						
THURSDAY						
FRIDAY						
SATURDAY						

**The number of zones may vary depending on the specic needs of each installation.* *TABLE 3.2*

Installation Procedures

Special Considerations for Subsurface Installations

1. The typical recommended pipe depth for dripline is 4” below finished grade.
2. For turf areas where aerification is part of normal maintenance operations, tubing must be buried below the reach of aerification equipment.
3. It is imperative that DL2000 dripline is installed at a uniform depth and width according to specifications.
4. When possible, pressure test the system before covering trenches or, when plowing, pre-test for leaks prior to planting.

DRIPLINE CAN BE INSTALLED USING ONE OF THE FOLLOWING METHODS		
INSERTION METHOD	**ADVANTAGES**	**DISADVANTAGES**
Hand trenching or backfilling	–Handles severe slopes and confined areas –Uniform depth	–Slow –Labor intensive –Disrupts existing turf and ground
Oscillating or vibrating plow (cable or pipe pulling type)	–Fast in small-to-medium installations –Minimal ground disturbance –No need to backfill the trench	–Depth must be monitored closely –Cannot use on steeper slopes (20%) –Requires practice to set and operate adequately –Tends to “stretch” pipe
Trenching machine	–Faster than hand trenching –May use 1” blade for most installations –Uniform depth	–Slower, requires labor –Disrupts surface of existing turf –Backll required
Tractor-mounted 3-point hitch insertion implement	–Fastest method, up to four plow attachments with reels –Packer roller compacts soil over pipe	–Only suitable for areas large enough to maneuver a small tractor

**The number of zones may vary depending on the specic needs of each installation.* *TABLE 3.3*

Planting Guidelines

1. Pre-irrigate to ensure that the soil is hydrated to field capacity before planting begins. This is especially important when planting sod or hydroseeding.
2. When planting container plants with pot sizes wider than the dripline lateral spacing, there are two options:
   - Plant the oversized plants prior to installing the dripline laterals and plant the smaller plants after installing the dripline laterals.

     OR
   - Plant all plants after installing the dripline, taking care to pre-cut and tape the open ends of the dripline when planting the oversized plants. Reconnect the severed dripline after planting.
3. As with all types of irrigation, it is critical that the root balls are not allowed to dry out during the plant-establishment period. Initial postplanting irrigation is critical, so it is necessary to over-irrigate to ensure water transfer between the landscape soil medium and container plant root balls.
4. When planting sod or hydroseeded grasses, establishment can be accomplished without supplemental overhead watering by:
   - Making sure the soil is hydrated to field capacity prior to planting.
   - Thoroughly rolling the sod to ensure optimum contact between the sod and the soil medium. Use multiple-start run times (up to 10 times per day) until the sod has knit into the soil. Take care not to let the sod dry out during this period.
   - Using multiple start times as described above to establish seeded or hydroseeded grasses.

Installation Steps

1. Assemble and install filter, remote control valve and pressure regulating valve assembly(ies).
2. Assemble and install supply header(s). Tape or plug all open connections to prevent debris contamination.
3. Assemble and install exhaust header(s). Tape or plug all open connections to prevent debris contamination.
4. Install dripline laterals. Tape or plug all open ends while installing the dripline to prevent debris contamination.
5. Install air vacuum relief valve(s) at the highest point(s) of the zone(s) (only required on subsurface installations).
6. Thoroughly flush supply header(s) and connect dripline laterals while flushing.
7. Thoroughly flush dripline laterals and connect to exhaust header(s) or interconnecting laterals while flushing.
8. Thoroughly flush exhaust header(s) and install line flushing valves.

Preventative Maintenance

System Inspection

Physical inspections are necessary in the following circumstances:

- At the beginning of each irrigation season
- After any landscape planting operation or renovation
- For subsurface dripline installations, after any maintenance function requiring digging at or below the dripline depth

Physically inspect system components (remote control valves, filters, automatic flush caps and flush-end pressure checks) on a routine basis as determined by historical experience.

Base zone-flow readings, supply manifold pressures, and flush-end pressure readings should be recorded with all system components operating at their optimum capacity. Baseline readings after installation should be determined during the final system inspection upon initial startup. However, they can be determined at any time as long as all system components are operating properly. Record this data on the System Data Record below as a permanent reference record.

System Data Record

■ Station Number: _______
■ Dripline Model Number: ___________________
■ Emitter Spacing: _______ inches
■ Emitter Flow:_______ GPH
■ Dripline Spacing: ________ inches
■ Initial Supply Manifold Pressure: __________ PSI
■ Initial Flush Valve Pressure: _________ PSI
■ Application Rate: ________ inches per hour
■ Evapotranspiration Rate (inches per week):
Jan. __________ May ____________ Sept. ___________
Feb. ____________ June ____________ Oct. ___________
Mar. ____________ July ____________ Nov. ___________
Apr. ____________ Aug. ____________ Dec. ___________

Routine Inspections Checklist

- Turn on each zone for 5 to 10 minutes and walk the area, looking for excessively wet areas that might indicate leaks.
- Inspect air/vacuum relief valves (subsurface installations only) and automatic flush caps for proper operation.
- Check pressures at the supply manifold and flush ends of each zone, and compare them with the base information on the System Data Record. For proper flushing, the flush-end pressure should be at least 10 PSI.
- Check the operational flow of each zone and compare it with the design flows or the flows on the System Data Record. High flows could indicate leaks or malfunctioning automatic flush caps. Flows lower than expected could indicate clogged drippers, drippers with excessive salt build-up, kinked dripline or a clogged filter. Low flows might also indicate that the capacity of the installed remote control valves, filters or pressure regulators are too low, thus restricting the flow to the zone.

Component Maintenance Checklists

Remote Control Valves

- Upon initial inspection, check to see if the valve is properly sized for the zone flow. Refer to the manufacturer's specication. Oversized valves may not close properly and undersized valves will restrict flow and cause excessive pressure loss.
- Follow the manufacturer's recommended procedures for repair and general maintenance.
- Inspect for proper operation when opening or closing. A weeping valve can cause excessively wet areas at low points in the zone.

Filters

- Filters must be inspected and cleaned periodically. The frequency of inspection is dependent on the water source. Municipal potable water may require less frequent cleaning than irrigation district water, pond water or well water. The frequency is determined by historical experience as new systems are operated.
- Commercial installations should include pressure gauges, or facilities to connect pressure gauges, immediately upstream and downstream of each filter. Filters should be cleaned when the pressure drop across the filter is 8 PSI or greater, or when the downstream pressure falls below the designed working pressure of the system.
- Filters without pressure gauges should be inspected monthly until the necessary frequency is determined.
- Filters should always be inspected when any system break occurs ahead of the filter.
- If filters are plugging too frequently, a larger filter (two times the highest zone flow) may need to be installed upstream of the zone filters to pre-filter the water supply.

Pressure Regulators

- Annually check the pressure output just downstream of the regulators to ensure that the valve is operating at designed pressures.

Dripline

- Inspect driplines at the air vent (subsurface installations only) and/or flush cap locations for salt build-up after the first year of operation. If necessary, inject commercially available cleansing solutions through the system at the recommended rates and continue with annual treatment. Consult with local fertilizer distributors for recommended materials and rates.
- Prior to digging in planted areas with subsurface dripline present, turn on the system long enough to create wet areas on the surface to locate the driplines.
- After cultivation or maintenance activities, turn on the system for five to ten minutes to inspect for leaks that might have been caused by these operation

Flush Caps

- Automatic flush caps operate by automatically flushing a small amount of water each time the system is activated. Observe the flush operation annually to ensure that flushing is occurring properly.
- The system must be ushed thoroughly after repairs or alterations are made to the irrigation components. Automatic flush caps do not allow enough water to pass through excessive debris and, therefore, must be removed in order to effect a manual flush.
- Manual flush caps should be flushed three times each irrigation season for a period of 30 to 60 seconds or until the flush water is visibly clean. More frequent flushing may be required under extremely dirty water conditions. Flushing is also necessary any time the system is repaired.

Troubleshooting

Excessively Wet Soil Areas

- Determine if the wet area is caused by damaged dripline. Carefully dig up the area and expose the dripline. Make a clean cut when cutting through the damaged area. If the system is a subsurface grid system, water will flow from both sides of the cut, automatically flushing any debris that may have worked its way into the dripline. While the water is running, flush both sides of the cut and repair it with the appropriate coupling.

- If the wet area is at the low side of a slope or mound and a leak is not found, the wet area is probably caused by subsurface runoff. To remedy the problem, expose the lowest line in the area. Cut the line and plug it at both the inlet and flush manifolds.

- Localized wet areas are sometimes caused by differences in soil depth or uneven dripline depths. If uneven dripline depth is the problem, the line must be excavated and re-installed at a uniform depth. If it is caused by shallow soil conditions, it will be necessary to correct the shallow condition or wrap some of the dripper outlets in the area with electrical tape to cut off flow.

- Localized wet areas also can be caused by leaky fittings. If this is the case, the fittings are either the incorrect size or not properly secured.

- Area-wide wet areas are probably due to improper scheduling. Set the controller to apply water at rates that correspond to local evapotranspiration data. Use the Application Rate Table and the Scheduling Form provided in this manual.

Excessively Dry Soils

- Check system flows and pressures to determine if the system is operating at designed pressures. If excessively low pressures are detected, follow the standard procedures for determining the cause of a pressure drop (i.e., a clogged filter).

- Localized dry soil conditions are sometimes caused by kinked or pinched dripline, or upstream leaks. Dig up the dry area and correct the situation.

- Massive dry areas can be caused by improper scheduling. Set the controller to provide the application rate that corresponds to the local evapotranspiration data. Use the Application Rate Table and Scheduling Form provided in this manual.

System Components

DL2000® Dripline
Specifications
- Minimum operating pressure: 15 PSI
- Maximum operating pressure: 60 PSI
- Emitter outlet: Dual/opposing
- Emitter flow @ 20 PSI:
  - RGP-2XX-XX: 0.53 GPH
  - RGP-4XX-XX: 1.0 GPH
- Emitter spacing:
  - RGX-X12-XX: 12”
  - RGX-X18-XX: 18”
- Maximum length of run:
  - RGP-212-XX @ 25 PSI: 360’
  - RGP-412-XX @ 25 PSI: 240’
  - RGP-218-XX @ 25 PSI: 515’
  - RGP-418-XX @ 25 PSI: 340’
  - RGP-212-XX @ 40 PSI: 460’
  - RGP-412-XX @ 40 PSI: 300’
  - RGP-218-XX @ 40 PSI: 650’
  - RGP-418-XX @ 40 PSI: 430’
- Dimensions (L x I.D x O.D.):
  - RGP-XXX-01: 100’ x .620” x .710”
  - RGP-XXX-05: 500’ x .620” x .710”
  - RGP-XXX-10: 1000’ x .620” x .710”
- Weight:
  - RGP-XXX-01: 4 lbs.
  - RGP-XXX-05: 20 lbs.
  - RGP-XXX-10: 45 lbs.

Drip In® Dripline
Specifications
- Minimum operating pressure: 15 PSI
- Maximum operating pressure: 60 PSI
- Emitter outlet: Dual/opposing
- Emitter flow @ 20 PSI:
  - PCB-4XX-XXX: 0.92 GPH
  - PCB-2XX-XXX: 0.58 GPH
- Emitter spacing:
  - PCB-X18-XXX: 18”
  - PCB-X12-XXX: 12”
- Maximum length of run:
  - PCB-X18-XXX @ 25 PSI: 379’
  - PCB-X12-XXX @ 25 PSI: 270’
  - PCB-X18-XXX @ 40 PSI: 282’
  - PCB-X12-XXX @ 40 PSI: 200’
- Dimensions (L x I.D x O.D.):
  - PCB-XXX-010: 100’ x .560” x .660”
  - PCB-XXX-025: 250’ x .560” x .660”
  - PCB-XXX-050: 500’ x .560” x .660”
- Weight:
  - PCB-XXX-010: 4 lbs.
  - PCB-XXX-025: 9 lbs.
  - PCB-XXX-050: 20 lbs.

Plastic Y-Filters
Specifications
- Screen mesh size: 150 mesh
- Screen material: Stainless steel
- Maximum pressure: All models 120 PSI
- Maximum flow rate:
  - T-ALFS75150-L: 25 GPM
  - T-ALFS10150-L: 35 GPM
- Body dimensions (L x W x D):
  - T-ALFS75150-L: 9” x 7.32” x 4.29”
  - T-ALFS10150-L: 9” x 7.32” x 4.29”
- Inlet/outlet size:
  - T-ALFS75150-L: 3⁄4” MIPT
  - T-ALFS10150-L: 1” MIPTDL

Flush Cap
Specifications
- Part Number: T-CEFCH-H
- Sealing pressure: 2 PSI
- Flush rate: 0.8 GPM
- Maximum operating pressure: 50 PSI
- Outlet size: .710” O.D. compression
- Body dimensions (L x W x D):
  3.425” x 1.340” x 1.340
- Weight: 0.8 oz.

Pressure Regulators
Specifications
- Flow rate:
  - T-PMR30: 1/10 - 35 GPM
  - T-PRM40: 1/10 - 35 GPM
- Pressure regulation:
  - T-PMR30: 30 PSI
  - T-PRM40: 40 PSI
- Maximum pressure:
  - T-PMRXX: 120 PSI
- Body dimensions (L x W x D):
  - T-PMR30: 5.75” x 2.70” x 2.70”
  - T-PRM40: 5.75” x 2.70” x 2.70”
- Inlet/outlet size:
  - T-PMR30: 1” FIPT
  - T-PRM40: 1” FIPT
- Weight:
  - T-PMR30: 4.85 oz.
  - T-PRM40: 4.85 oz.

DL2000 Air Vent/Vacuum Relief Valve
Specifications
- Part Number: T-YD-500-34
- Vent closing pressure: 4 PSI
- Vacuum relief pressure: 4 PSI
- Maximum operating pressure: 100 PSI
- Inlet thread size: 1⁄2” MIPT
- Body dimensions (L x W x D): 1.460” x .980” x .980”
- Weight: .25 oz.

Tri-Loc Coupling
Specifications
- Part Number: TL-C
- Minimum operating pressure: 5 PSI
- Maximum operating pressure: 50 PSI
- Connection size: Accepts .52 - .62” I.D. tubing (0.045” - 0.055” wall thickness)
- Body dimensions (L x W x D): 2.100” x .720” x .720”
- Weight: .25 oz.

1/4” Dripline
Specifications
- Congurations/Part Numbers: Soakerline
  - 6”: T-SDB252-6-100
  - 12”: T-SDB252-12-100
- Emitter flow: .53 GPH
- Emitter spacing: 6” and 12”
- Emitter outlet: Dual/opposing
- Minimum operating pressure: 15 PSI
- Maximum operating pressure: 60 PSI
- Maximum length of run: 19’ and 33’
- Dimensions (L x I.D x O.D.): 100’ x .170” x .250”
- Weight: .75 lbs.

1/4” Barbed Fittings
Specifications
- Congurations/Part Numbers:
  - Tee: T-FTT0400
  - Elbow: T-FEE0400
  - Coupling: T-FCC0400
- Maximum operating pressure: 60 PSI
- Connection size:

Accepts .170” I.D. tubing
- Body dimensions (L x W x D):
  - T-FTT0400: 1.410” x .835” x .250”
  - T-FEE0400: .825” x .825” x .250”
  - T-FCC0400: .730” x .435” x .435”
- Weight:
  - T-FTT0400: .9 gram
  - T-FEE0400: .6 gram
  - T-FCC0400: .4 gram

Dual Goof Plug
- Part Number: T-FPG02
- Maximum operating pressure: 60 PSI
- Connection size: Plugs .170” and/or .250”diameter holes
- Body dimensions (L x W x D): .735” x .360” x .360
- Weight: .5 gram

Micro Valve
- Part Number: T-FCV-BB
- Maximum operating pressure: 60 PSI
- Flow rate @ 15 PSI: 0 - .47 GPM (0 - 28.2 GPH)
- Inlet/outlet connection size: .170” I.D. tubing
- Body dimensions (L x W x D): 1.450” x 1.070” x .290”
- Weight: 2 grams

Landscape Dripline Design Guide

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WARNING: Cancer and Reproductive harm – www.P65Warnings.ca.gov.
For more information, please visit www.toro.com/CAProp65.

Patent: www.ttcopats.com

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