

TORO®

Residential/Commercial Irrigation Specification Catalog 2015-2016



The Toro logo is a red rounded rectangle with the word "TORO" in white, bold, serif capital letters. A registered trademark symbol (®) is located to the right of the word.

TORO®

Our purpose is to help our customers enrich the beauty, productivity and sustainability of the land. This is our legacy, our purpose, our commitment to both the customers we serve and the generations to come.



More than ever people are realizing how precious water is. At Toro, we could not agree more, and have dedicated our resources to developing innovative irrigation solutions that are able to sustain our customer's landscapes using less water. We call these products WaterSmart®. Look for this logo when looking for efficient watering solutions.



Toro Technical Support

Our technical support staff is truly extraordinary at what they do. They have over 100 years of combined irrigation experience that you can depend on. For an excellent support experience, call: **1-877-345-TORO (8676)** or email: irrigation.support@toro.com. For more helpful tips, visit our YouTube site at www.youtube.com/toro.



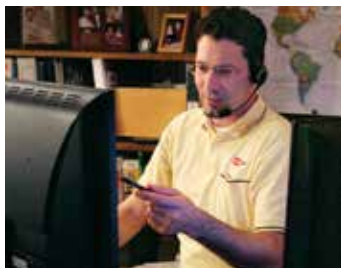
Toro Controller Repair

Did you know that with Toro's Board Exchange Program you can get the replacement controller boards you need immediately? Through your distributor, controller repair provides controller boards ready for immediate board exchange to assure that controller downtime is minimal and your landscape and reputation stay protected. For immediate assistance call **1-877-345-TORO (8676), Monday – Friday, 6:00 AM – 3:30 PM PST**. Visit our Controller Repair website at www.toro.com/controller-repair.



Toro Training

Toro offers its customers training and education on new product technology, water management best practices, and provides world-class business skills training for professional contractors to help them increase productivity and improve their bottom line. To learn more about other educational opportunities in your area and nationwide, call **1-877-345-TORO (8676)**.



Toro National Support Network (NSN®)

Toro's National Support Network (NSN) is a team of A+ certified technicians and licensed irrigators dedicated to the daily operations and maintenance of computerized central control systems. Every new Toro computerized central irrigation control system includes Toro NSN support, as well as convenient classroom, web and computer-based training. For assistance call: **1-888-676-TORO (8676)** or visit www.toronsn.com.



Toro Online Information

We offer a complete listing of all irrigation products at (www.toro.com/irrigation) along with links to Distributor locator, CAD Details, and product literature. Specialty sites for our contractor partners (www.torocontractor.com) and water management highlights (www.torowatersmart.com) are full of great information at your fingertips.



TORO WATERSMART® SYSTEM SOLUTIONS

All the parts of an irrigation system—controller, valves, sprinklers—work together to ensure your customer's landscape is watered properly. Toro WaterSmart® products can be retrofitted or added to any system to provide more efficient use of that water while maintaining healthy landscapes. Incorporate WaterSmart solutions throughout the whole system to ensure optimum water savings.

**WATER
SMART®**



Wireless ET Sensor
Page 71



**EVOLUTION®
Controller with
Smart Connect®**
Page 70



**RainSensor™ Series
with Patented Water
Conservation Modes**
Page 92



TPV Series Valves
Page 54



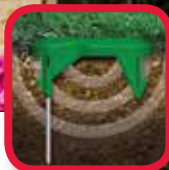
**P-220 Series Valve
with EZReg®
Pressure Regulation**
Page 60



**TFS Series
Flow Sensor**
Page 94



TPV Drip Zone Kit
Page 128



**Precision™ Soil
Sensor Kit**
Page 86



TOOLS

**T5 RapidSet®
Series Rotor**
Page 36



Fits:
Toro®, Irritrol®, Rain Bird®
and Hunter® Spray Bodies

**Pressure Compensating Device (PCD)
Precision™ Series Spray Nozzles with
Patented H²O Chip Technology**
Page 14



**570ZXF Sprays
with Patented X-Flow®
Valve-In-Stem Shutoff**
Page 10



**Precision™ Series
Rotating Nozzles with
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**DL2000™ Subsurface
Dripline with Patented
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SPRAYS

Whether you need a spray solution for turf lawns, slopes, medians, high traffic, or high wind locations, Toro® spray bodies provide the options you are looking for. Traditional MPR to high efficiency water management solutions, Toro nozzles provide reliable easy-to-use products with the latest in water saving technology.





Efficient, Versatile & Reliable



Model	Radius	Arcs	Flow Range	Recommended Operating Pressure
Pressure-Compensating Precision™ Series Spray Nozzles Page 14	5'-15'	90°, 120°, 180°, 240°, 270°, and 360°	0.04-2.4 gpm	50 psi
Precision™ Series Spray Nozzles Page 14-19	5'-15' 4'x9' 4'x15' 4'x18' 4'x30'	60°, 90°, 120°, 150°, 180°, 210°, 240°, 270°, 360° and Specialty	0.04-2.68 gpm	30 psi
Precision™ Series Rotating Nozzles Page 20-21	14'-26'	45° to 270°, Full-circle	.38-3.78 gpm	40-50 psi
MPR Plus Spray Nozzles Page 22-23	5'-15' Specialty Patterns 2'-30'	90°, 120°, 180°, 240°, 270°, 360° and Specialty	0.05-4.58 gpm	30 psi
TVAN Variable Arc Nozzles Page 24	8'-17'	0°-360°	0.58-4.71 gpm	30 psi
Stream Spray Nozzles Page 25	13'-22'	90°, 180°, and 360°	0.6-2.70 gpm	30 psi
Stream Bubbler Nozzles Page 25	1.5'-18'	90°, 180°, 360° 2x180°, 4x180°	0.49-2.02 gpm	20-30 psi
Pressure-Compensating Flood Bubblers Page 26	Circle	Flood	0.25-2.0 gpm	20-30 psi
500 Series Bubblers Page 26	6'-17'	2/60°, 4/60°, 6/60°, 2/180°	1.08-3.70 gpm	20-30 psi





Toro® 570Z Series spray heads provide everything needed for residential and commercial contractors to satisfy all installation and retrofit requirements. In combination with Toro spray and rotating nozzles, 570Z Series spray heads can be configured in hundreds of combinations and present an unparalleled range of flexibility. Available in 2", 3", 4", 6" and 12" models with both bottom and side inlet thread options, Toro 570Z Series spray heads are further available with patented in-stem X-Flow® Technology and Pressure Regulating water-saving features. Trusted for over 25 years, Toro's 570Z Series spray heads are the ideal choice.

FEATURES & BENEFITS

Zero Flush Wiper Seal

The elimination of flushing on pop-up allows for more sprinklers to be installed per zone.

Patented X-Flow® Technology

The X-Flow in-stem flow shut-off device is built into the riser and restricts water loss by 99% should the nozzle be removed or damaged. The exclusive X-Flow device greatly reduces water waste, landscape erosion, and wet hardscape safety concerns. Furthermore, X-Flow allows for 'dry' nozzle and filter replacement or system maintenance while the system is running.

One-Piece Check Valve

Pre-installed from the factory or easily installed in the field, Toro's one-piece check valve prevents low-head drainage on elevation changes of up to 10 feet.

Ratcheting Riser

Quick and precise arc adjustment on all pop-up models.



Effluent
Options
Available



Check
Valve
Options
Available

WATER MANAGEMENT HIGHLIGHT



No Water Wasted at System Start
System start up is a critical time when water waste can occur. The Toro 570Z Series spray head's wiper seal is pressure-activated and prevents flow-by at start up, meaning no water is wasted and more heads can be installed on the same line.



Enhanced Zero Flush Seal

X-Flow® Technology Cuts Off Water Waste

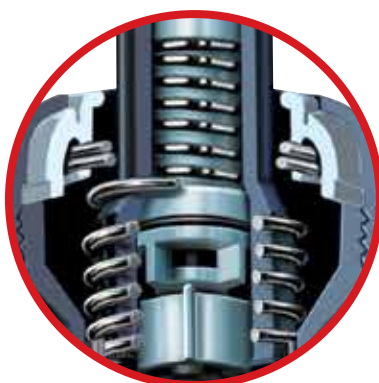
Up to 40 gallons of water per minute can escape through a spray head that has a missing or damaged nozzle. This wasted water can lead to landscape erosion, property damage, or unsafe conditions due to wet hardscapes. The patented X-Flow device is factory-installed in the riser and holds back over 99% of the water that would otherwise be wasted in cases where the nozzle has been compromised through unintentional accidents or vandalism. Furthermore, X-Flow Technology allows for spray head maintenance or component replacement without the need to turn off the system.



Patented X-Flow®
Shut-off Device

Reliability thanks to Built-in Pressure Regulation

Toro's factory-installed pressure regulator eliminates water misting and fogging at the nozzle that can lead to rapid evaporation or water being blown away from the intended irrigation area. From the first to the last head, the in-stem pressure regulator provides a steady outlet pressure of 30 PSI and consistent spray head performance across the zone.



Pressure Regulator



Without X-Flow



With X-Flow



Without Pressure Regulation



With Pressure Regulation





570Z &
570ZLP

570Z (STANDARD SPRAY HEADS)

570Z-2P	2" spray head
570Z-3P	3" spray head
570Z-4P	4" spray head
570Z-4P COM	4" spray head with Check Valve
570Z-6P	6" spray head
570Z-6P SI	6" spray head, Side Inlet Body
570Z-6P COM	6" spray head with Check Valve
570Z-12P	12" spray head
570Z-12P SI	12" spray head, Side Inlet Body
570Z-12P COM	12" spray head with Check Valve
570S	Shrub adapter

570ZLP (LOW PRESSURE SPRAY HEADS)

570Z-2LP	570Z, 2", Low Pressure
570Z-3LP	570Z, 3", Low Pressure
570Z-4LP	570Z, 4", Low Pressure
570Z-6LP	570Z, 6", Low Pressure
570Z-6LP SI	570Z, 6", Low Pressure, Side Inlet Body
570Z-12LP	570Z, 12", Low Pressure
570Z-12LP SI	570Z, 12", Low Pressure, Side Inlet Body



570ZXF

570ZXF (SPRAY HEADS WITH X-FLOW[®] TECHNOLOGY)

570Z-4P XF	4" spray head with X-Flow
570Z-4P XF COM	4" spray head with X-Flow and Check Valve
570Z-6P XF	6" spray head with X-Flow
570Z-6P XF SI	6" spray head with X-Flow, Side Inlet Body
570Z-6P XF COM	6" spray head with X-Flow and Check Valve
570Z-12P XF	12" spray head with X-Flow
570Z-12P XF SI	12" spray head with X-Flow, Side Inlet Body
570Z-12P XF COM	12" spray head with X-Flow and Check Valve
570S-XF	Shrub adapter with X-Flow



570ZPR

570ZPR (SPRAY HEADS WITH PRESSURE REGULATION)

570Z-4P PR	4" spray head with Pressure Regulation
570Z-4P PR COM	4" spray head with Pressure Regulation and Check Valve
570Z-6P PR	6" spray head with Pressure Regulation
570Z-6P PR COM	6" spray head with Pressure Regulation and Check Valve
570Z-12P PR	12" spray head with Pressure Regulation
570Z-12P PR COM	12" spray head with Pressure Regulation and Check Valve
570S-PR	Shrub adapter with Pressure Regulation



570ZPRX

570ZPRX (SPRAY HEADS WITH PRESSURE REGULATION AND X-FLOW[®])

570Z-4P PRX	4" PRX spray head
570Z-4P PRX COM	4" PRX spray head with Check Valve
570Z-4P PRX E	4" PRX spray head with Effluent cap
570Z-4P PRX COM E	4" PRX spray head with Check Valve and Effluent cap
570Z-6P PRX	6" PRX spray head
570Z-6P PRX COM	6" PRX spray head with Check Valve
570Z-6P PRX E	6" PRX spray head with Effluent cap
570Z-6P PRX COM E	6" PRX spray head with Check Valve and Effluent cap
570Z-6P SI PRX	6" PRX spray head, Side Inlet Body
570Z-12P PRX	12" PRX spray head
570Z-12P PRX E	12" PRX spray head with Effluent cap
570Z-12P PRX COM E	12" PRX spray head with Check Valve and Effluent cap
570Z-12P SI PRX	12" PRX spray head, Side Inlet Body
570S-PRX	PRX Shrub adapter



Specifying Information—570Z Series

570X-XXP-SI-COM-E				
Model	Pop-Up Height	Optional	Optional	Optional
570X	XXP	SI	COM	E
S—Shrub Z—Lawn Pop-up & High pop	2—2" 3—3" 4—4" 6—6" 12—12"	SI—Side Inlet*	COM—Check- O-Matic**	E—Effluent
Example: A 570ZLP Series Sprinkler (low pressure) with a pop-up height of 6" and a check valve, you would specify: 570Z-6LP COM				

*Available for 6" and 12" models.
**Available with non-side inlet models except 2" and 3".

Specifying Information—570ZLP Series

570X-XXLP-XX-COM-E				
Model	Pop-Up Height	Optional	Optional	Optional
570X	XXLP	SI	COM	E
Z—Lawn Pop-up & High Pop	2—2" 3—3" 4—4" 6—6" 12—12"	SI—Side Inlet*	COM—Check- O-Matic**	E—Effluent
Example: A 570ZLP Series Sprinkler (low pressure) with a pop-up height of 6" and a check valve, you would specify: 570Z-6LP COM				

Specifying Information—570ZXF Series

570X-XXP-SI-XF-COM-E				
Model	Pop-Up Height	Optional	Optional	Optional
570X	XXP	SI	COM	E
S—Shrub Z—Lawn Pop-up & High-pop	4—4" 6—6" 12—12"	SI—Side Inlet*	COM—Check- O-Matic**	E—Effluent
Example: A 570Z XF Series Sprinkler with a pop-up height of 6" and a check valve would be specified as: 570Z-6P XF COM				

*Available for 6" and 12" models.
**Available with non-side inlet models.

Specifying Information—570ZPR & 570ZPRX Series

570X-XXP-SI-PRX-COM-E					
Model	Pop-Up Height	Optional	X-flow™	Optional	Optional
570X	XXP	SI	PRX	COM	E
S—Shrub Z—Lawn Pop-up & High-pop	4—4" 6—6" 12—12"	SI—Side Inlet*	PR—Pressure Reg. Only PRX—Pressure Reg. w/- X-flow	COM—Check-O-Matic**	E—Effluent
Example: A 570Z PRX Series Sprinkler with a pop-up height of 6" with a side-inlet option, would be specified as: 570Z-6P SI PRX					

*Available for 6" and 12" models.
**Available with non-side inlet models.

SPECIFICATIONS

Operational

- Radius: 2 feet to 26 feet
- Operating pressure range: 20-75 psi (15-75 psi for Low Pressure models)
- Recommended operating pressure for spray nozzles: 30 psi
- Recommended operating pressure for rotating nozzles: 40-50 psi
- Flow rate: 0.5 – 4.5 gpm

Warranty

- Five years on 570ZPR and 570ZPRX models
- Two years on 570Z, 570ZLP and 570ZXF models

Dimensions

- Body diameters:
 - 1 3/8" on 2", 3", 4", 6" and 6"
- Side Inlet
 - 1 5/8" on 12"
- Cap diameter: 2"
- Inlet thread: 1/2" Female
- Side inlet location: 4 3/4" (measured from the top of spray head to center of the side inlet port)

Additional Features

- ✓ Corrosion-resistant stainless steel retraction spring
- ✓ All models shipped with installed flush plug

Options Available

- ✓ Serviceable Check Valve (570CV) prevents low-head drainage on elevation changes of up to 10 feet (not compatible with Side Inlet models)
- ✓ Replacement Zero-Flush seal (570SEAL)
- ✓ Effluent water indicators:
 - Effluent Shrub Adapter (102-1231)
 - Effluent snap-on cap cover (89-9752)
 - Effluent Cap with seal (102-1211)
- ✓ 6" Riser Extender (570-6X)
- ✓ 6" Stationary Riser (570-SR-6) [1/2" male-threaded inlet]
- ✓ 18" Stationary Riser (570-SR-18) [1/2" male-threaded inlet]
- ✓ Riser Pull-up Tool (89-6395)
- ✓ Nozzle Adjustment Key (89-7350)





Toro® Precision™ Series Spray Nozzles are the most efficient spray nozzles available and feature proprietary H₂O Chip Technology. With a precipitation rate of 1" per hour, Precision™ Series Spray Nozzles help irrigation professionals better manage water usage, eliminate runoff, and reduce their customers' water bills. These nozzles are available in a wide variety of arcs and radii, as well as Toro (male) and female-threaded bodies, making them ideal for large scale installations and retrofits. In addition, the best-in-class Precision™ Series Spray nozzles are available with factory-installed Pressure Compensating Discs (PCD).

FEATURES & BENEFITS

Patented H₂O Chip Technology

Each nozzle contains one or more H₂O chips that create a high frequency oscillating stream and deliver a precipitation rate of 1" per hour – an industry first – while using up to 35% less water than a standard MPR nozzle.

Pressure-Compensating Versions Available

At a fraction of the cost of a pressure-regulating spray head, pressure-compensating Precision™ Series Spray Nozzles maintain a 1" per hour precipitation rate and minimize misting and water waste that results from higher pressure systems.

Design and Retrofit Effectiveness

The lower flow rate of Precision™ Series Spray Nozzles maximizes design efficiency and helps reduce overall material costs based on the need for fewer valves and controller stations.

Third-Party Performance Validation

Precision™ Series Spray Nozzles* have been tested and validated in the field and at the Center for Irrigation Technology (CIT).

* non-PCD models only



Pressure Compensating Disc (PCD)

The elastomeric PCD adjusts in response to changes in inlet pressure to maintain optimal nozzle performance. Recommended for use on systems operating above 40 psi, PCD models can easily be identified by the red Toro lettering across the top of the nozzle.



WATER MANAGEMENT HIGHLIGHT



Patented H₂O Chip Technology

Water expands and collapses inside the H₂O chip, creating a high frequency oscillating stream that meets the desired distance of throw using 35% less water.

SPECIFICATIONS

Operational

- Radius: 5'-15'
- Operating pressure range: 20-75 psi
- Recommended operating pressure: non-Pressure Compensating—30 psi, Pressure Compensating—50 psi
- Flow Rate: 0.04-2.4 gpm
- Nozzle trajectory:
 - 5': 5°
 - 8': 10°
 - 10': 15°
 - 12': 20°
 - 15': 27°
 - Corner and Side Strips: 20°

Warranty

- Two years

Additional Features

- ✓ Specialty Arcs available (60°, 120°, 150°, 210°, 240°)
- ✓ Radius reduction capability of 25%
- ✓ Matched precipitation rate after radius adjustment

PRECISION™ SERIES SPRAY NOZZLE MODEL LIST

5' NOZZLE (RED)			8' NOZZLE (GREEN)		
Male	Female	Descrip.	Male	Female	Descrip.
O-T-5-60	O-5-60	60° Arc	O-T-8-60	O-8-60	60° Arc
O-T-5-Q	O-5-Q	90° Arc	O-T-8-Q	O-8-Q	90° Arc
O-T-5-T	O-5-T	120° Arc	O-T-8-T	O-8-T	120° Arc
O-T-5-150	O-5-150	150° Arc	O-T-8-150	O-8-150	150° Arc
O-T-5-H	O-5-H	180° Arc	O-T-8-H	O-8-H	180° Arc
O-T-5-210	O-5-210	210° Arc	O-T-8-210	O-8-210	210° Arc
O-T-5-TT	O-5-TT	240° Arc	O-T-8-TT	O-8-TT	240° Arc
O-T-5-TQ	O-5-TQ	270° Arc	O-T-8-TQ	O-8-TQ	270° Arc
O-T-5-F	O-5-F	360° Arc	O-T-8-F	O-8-F	360° Arc
10' NOZZLE (BLUE)			12' NOZZLE (BROWN)		
O-T-10-60	O-10-60	60° Arc	O-T-12-60	O-12-60	60° Arc
O-T-10-Q	O-10-Q	90° Arc	O-T-12-Q	O-12-Q	90° Arc
O-T-10-T	O-10-T	120° Arc	O-T-12-T	O-12-T	120° Arc
O-T-10-150	O-10-150	150° Arc	O-T-12-150	O-12-150	150° Arc
O-T-10-H	O-10-H	180° Arc	O-T-12-H	O-12-H	180° Arc
O-T-10-210	O-10-210	210° Arc	O-T-12-210	O-12-210	210° Arc
O-T-10-TT	O-10-TT	240° Arc	O-T-12-TT	O-12-TT	240° Arc
O-T-10-TQ	O-10-TQ	270° Arc	O-T-12-TQ	O-12-TQ	270° Arc
O-T-10-F	O-10-F	360° Arc	O-T-12-F	O-12-F	360° Arc
15' NOZZLE (BLACK)			SPECIAL PATTERNS (GREY)		
O-T-15-60	O-15-60	60° Arc			
O-T-15-Q	O-15-Q	90° Arc			
O-T-15-T	O-15-T	120° Arc			
O-T-15-150	O-15-150	150° Arc			
O-T-15-H	O-15-H	180° Arc			
O-T-15-210	O-15-210	210° Arc			
O-T-15-TT	O-15-TT	240° Arc			
O-T-15-TQ	O-15-TQ	270° Arc			
O-T-15-F	O-15-F	360° Arc			
			Male	Female	
			O-T-4X9-RCS	O-4X9-RCS	Right corner
			O-T-4X9-LCS	O-4X9-LCS	Left Corner
			O-T-4X18-SST	O-4X18-SST	Side Strip
			O-T-4X15-RCS	O-4X15-RCS	Right Corner
			O-T-4X15-LCS	O-4X15-LCS	Left Corner
			O-T-4X30-SST	O-4X30-SST	Side Strip

PRESSURE-COMPENSATING

PRECISION™ SERIES SPRAY NOZZLE MODEL LIST

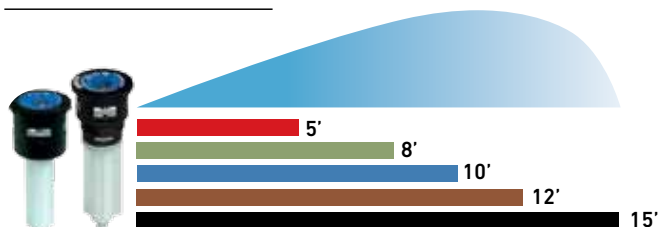
5' NOZZLE (RED)			8' NOZZLE (GREEN)		
Male	Female	Descrip.	Male	Female	Descrip.
O-T-5-QP	O-5-QP	90° Arc	O-T-8-QP	O-8-QP	90° Arc
O-T-5-TP	O-5-TP	120° Arc	O-T-8-TP	O-8-TP	120° Arc
O-T-5-HP	O-5-HP	180° Arc	O-T-8-HP	O-8-HP	180° Arc
O-T-5-TTP	O-5-TTP	240° Arc	O-T-8-TTP	O-8-TTP	240° Arc
O-T-5-TQP	O-5-TQP	270° Arc	O-T-8-TQP	O-8-TQP	270° Arc
O-T-5-FP	O-5-FP	360° Arc	O-T-8-FP	O-8-FP	360° Arc
10' NOZZLE (BLUE)			12' NOZZLE (BROWN)		
O-T-10-QP	O-10-QP	90° Arc	O-T-12-QP	O-12-QP	90° Arc
O-T-10-TP	O-10-TP	120° Arc	O-T-12-TP	O-12-TP	120° Arc
O-T-10-HP	O-10-HP	180° Arc	O-T-12-HP	O-12-HP	180° Arc
O-T-10-TTP	O-10-TTP	240° Arc	O-T-12-TTP	O-12-TTP	240° Arc
O-T-10-TQP	O-10-TQP	270° Arc	O-T-12-TQ	O-12-TQP	270° Arc
O-T-10-FP	O-10-FP	360° Arc	O-T-12-FP	O-12-FP	360° Arc
15' NOZZLE (BLACK)			SPECIAL PATTERNS (GREY)		
O-T-15-QP	O-15-QP	90° Arc			
O-T-15-TP	O-15-TP	120° Arc			
O-T-15-HP	O-15-HP	180° Arc			
O-T-15-TTP	O-15-TTP	240° Arc			
O-T-15-TQP	O-15-TQP	270° Arc			
O-T-15-FP	O-15-FP	360° Arc			
			Male	Female	
			O-T-4X9-RCSP	O-4X9-RCSP	Right Corner
			O-T-4X9-LCSP	O-4X9-LCSP	Left Corner
			O-T-4X18-SSTP	O-4X18-SSTP	Side Strip
			O-T-4X15-RCSP	O-4X15-RCSP	Right Corner
			O-T-4X15-LCSP	O-4X15-LCSP	Left Corner
			O-T-4X30-SSTP	O-4X30-SSTP	Side Strip

Specifying Information-Precision™ Series Spray Nozzle

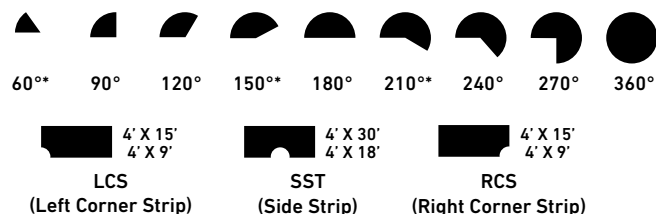
O-X-XXXX-XXXX-P				
Nozzle	Thread	Radius	Arc	PCD
O	X	XXXX	XXXX	P
O—1" Per Hour	T—Toro Male-Threaded Nozzle Blank—Female-Threaded Nozzle	5—5' 8—8' 10—10' 12—12' 15—15' 4X15—4'X15' (PCD models only) 4X30—4'X30' (PCD models only) 4X9—4'X9' 4X18—4'X18'	60—60° Q—90° T—120° 150—150° H—180° 210—210° TT—240° TQ—270° F—360°—Full-circle LCS—Left Corner RCS—Right Corner SST—Side Strip	P—Pressure Compensating
Example: A female-threaded Precision™ Series Spray with a spray radius of 12' and a 90° arc would be specified as: O-12-Q Example 2: A male-threaded Pressure-Compensating Precision™ Series Spray with a spray radius of 10' and a 180° arc would be specified as O-T-10-HP				

*Not available with Pressure Compensating.

Five Radii Available in Toro (Male) & Female Threads



Nine Arcs, Plus Side and Center Strips Available



* Not available with Pressure-Compensation



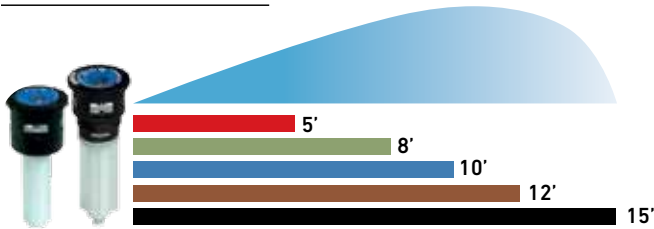
PERFORMANCE DATA PRESSURE COMPENSATING – PRECISION™ SERIES SPRAY NOZZLES

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.06	4.6	1.0	1.2
	50	0.08	5.1	1.2	1.4
	60	0.09	5.6	1.3	1.5
	70	0.11	6.2	1.5	1.7
	40	0.07	4.4	1.0	1.1
	50	0.11	4.9	1.3	1.5
	60	0.15	5.5	1.7	2.0
	70	0.19	6.0	2.0	2.4
	40	0.10	4.4	1.0	1.2
	50	0.13	4.9	1.1	1.3
	60	0.16	5.4	1.3	1.5
	70	0.19	6.0	1.4	1.6
	40	0.14	4.3	1.1	1.3
	50	0.20	4.9	1.3	1.5
	60	0.25	5.4	1.4	1.7
	70	0.31	6.0	1.6	1.8
	40	0.15	4.3	1.0	1.2
	50	0.21	4.9	1.2	1.4
	60	0.26	5.6	1.4	1.6
	70	0.32	6.2	1.5	1.7
	40	0.17	4.0	1.0	1.2
	50	0.24	4.8	1.1	1.3
	60	0.31	5.5	1.2	1.4
	70	0.38	6.3	1.3	1.5

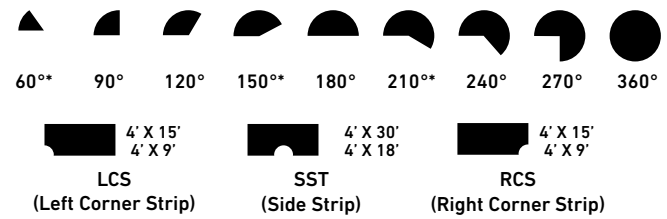
Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.14	7.0	1.1	1.3
	50	0.17	7.7	1.2	1.3
	60	0.20	8.4	1.2	1.4
	70	0.23	9.1	1.3	1.4
	40	0.20	7.6	1.0	1.2
	50	0.24	8.0	1.1	1.3
	60	0.27	8.5	1.2	1.4
	70	0.31	8.9	1.3	1.5
	40	0.26	7.0	1.0	1.2
	50	0.33	7.6	1.1	1.3
	60	0.39	8.1	1.2	1.4
	70	0.46	8.7	1.3	1.4
	40	0.34	7.0	1.0	1.1
	50	0.43	7.8	1.1	1.2
	60	0.52	8.5	1.2	1.4
	70	0.61	9.3	1.3	1.5
	40	0.41	7.2	1.0	1.1
	50	0.48	7.9	1.1	1.2
	60	0.55	8.6	1.1	1.3
	70	0.62	9.3	1.2	1.4
	40	0.55	7.0	1.1	1.2
	50	0.65	7.5	1.1	1.2
	60	0.74	8.0	1.1	1.3
	70	0.84	8.5	1.1	1.3

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.26	9.5	1.0	1.1
	50	0.28	10.0	1.1	1.2
	60	0.29	10.5	1.1	1.3
	70	0.31	11.1	1.2	1.4
	40	0.31	9.5	1.0	1.1
	50	0.36	10.0	1.1	1.2
	60	0.41	10.5	1.2	1.4
	70	0.46	11.0	1.3	1.5
	40	0.48	9.7	1.0	1.1
	50	0.53	10.1	1.1	1.2
	60	0.57	10.4	1.1	1.3
	70	0.62	10.8	1.2	1.4
	40	0.63	9.6	1.0	1.1
	50	0.70	9.9	1.1	1.2
	60	0.77	10.3	1.1	1.3
	70	0.84	10.6	1.2	1.4
	40	0.71	9.5	1.0	1.1
	50	0.77	9.9	1.0	1.2
	60	0.82	10.3	1.1	1.2
	70	0.88	10.7	1.1	1.3
	40	0.95	9.6	1.0	1.1
	50	1.06	10.0	1.1	1.2
	60	1.16	10.5	1.1	1.3
	70	1.27	10.9	1.2	1.4

**Five Radii Available in Toro
(Male) & Female Threads**



Nine Arcs, Plus Side and Center Strips Available



* Not available with Pressure-Compensation



PERFORMANCE DATA PRESSURE COMPENSATING – PRECISION™ SERIES SPRAY NOZZLES

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.34	12.0	1.0	1.2
	50	0.39	12.2	1.1	1.3
	60	0.43	12.5	1.2	1.3
	70	0.48	12.7	1.2	1.4
	40	0.46	11.5	1.0	1.2
	50	0.50	11.8	1.0	1.2
	60	0.54	12.0	1.1	1.3
	70	0.58	12.3	1.1	1.3
	40	0.70	11.5	1.0	1.2
	50	0.75	11.8	1.0	1.2
	60	0.80	12.2	1.1	1.2
	70	0.85	12.5	1.1	1.2
	40	0.90	11.4	1.0	1.2
	50	1.03	11.5	1.1	1.3
	60	1.16	11.5	1.2	1.3
	70	1.29	11.6	1.2	1.4
	40	1.05	11.4	1.0	1.2
	50	1.14	11.7	1.0	1.2
	60	1.23	12.0	1.1	1.3
	70	1.32	12.3	1.1	1.3
	40	1.35	11.5	1.0	1.1
	50	1.49	11.8	1.0	1.2
	60	1.63	12.2	1.1	1.3
	70	1.77	12.5	1.1	1.3

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.53	14.2	1.0	1.2
	50	0.59	14.5	1.1	1.2
	60	0.64	14.8	1.1	1.3
	70	0.70	15.1	1.2	1.3
	40	0.72	14.3	1.0	1.2
	50	0.77	14.8	1.0	1.2
	60	0.82	15.2	1.1	1.2
	70	0.87	15.7	1.1	1.2
	40	1.10	14.5	1.0	1.2
	50	1.20	14.3	1.1	1.2
	60	1.29	14.0	1.1	1.3
	70	1.39	13.8	1.2	1.3
	40	1.45	14.5	1.0	1.2
	50	1.57	14.8	1.0	1.2
	60	1.68	15.0	1.1	1.2
	70	1.80	15.3	1.1	1.3
	40	1.60	14.0	0.9	1.0
	50	1.70	14.4	1.0	1.1
	60	1.80	14.8	1.0	1.2
	70	1.90	15.1	1.1	1.2
	40	2.20	14.5	1.0	1.2
	50	2.36	14.8	1.0	1.2
	60	2.52	15.1	1.1	1.2
	70	2.68	15.4	1.1	1.3

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
	40	0.62	4x30	1.0	1.1
	50	0.65	4x30	1.0	1.2
	60	0.67	4x30	1.1	1.3
	70	0.70	4x30	1.1	1.3
	40	0.32	4x15	1.0	1.2
	50	0.33	4x15	1.1	1.2
	60	0.34	4x15	1.1	1.3
	70	0.35	4x15	1.2	1.3
	40	0.32	4x15	1.0	1.2
	50	0.33	4x15	1.1	1.2
	60	0.34	4x15	1.1	1.3
	70	0.35	4x15	1.2	1.3
	40	0.36	4X18	1.0	1.1
	50	0.37	4X18	1.0	1.2
	60	0.38	4X18	1.0	1.2
	70	0.39	4X18	1.0	1.2
	40	0.18	4X9	1.0	1.1
	50	0.19	4X9	1.1	1.2
	60	0.20	4X9	1.1	1.2
	70	0.21	4X9	1.2	1.3
	40	0.18	4X9	1.0	1.2
	50	0.19	4X9	1.1	1.2
	60	0.20	4X9	1.1	1.2
	70	0.21	4X9	1.2	1.3



PRECISION™ SERIES SPRAY NOZZLES



PERFORMANCE DATA – PRECISION™ SERIES SPRAY NOZZLES

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
5-60° ▲	20	0.04	4.7	1.0	1.15
	30	0.04	5.0	1.0	1.15
	40	0.04	5.0	1.0	1.15
	50	0.05	5.3	1.0	1.14
5Q ■	20	0.06	4.6	1.0	1.18
	30	0.06	5.0	1.0	1.14
	40	0.07	5.0	1.0	1.16
	50	0.07	5.0	1.0	1.17
5T ■	20	0.07	4.4	1.0	1.17
	30	0.09	5.0	1.0	1.20
	40	0.09	5.2	1.0	1.15
	50	0.10	5.4	1.0	1.13
5-150° ■	20	0.07	4.0	1.0	1.18
	30	0.11	5.0	1.0	1.19
	40	0.12	5.2	1.0	1.20
	50	0.13	5.4	1.0	1.20
5H ■	20	0.10	4.4	1.0	1.15
	30	0.13	5.0	1.0	1.16
	40	0.14	5.1	1.0	1.15
	50	0.14	5.2	1.0	1.14
5-210° ■	20	0.10	4.4	1.0	1.15
	30	0.15	5.2	1.1	1.23
	40	0.16	5.3	1.1	1.27
	50	0.17	5.5	1.1	1.25
5TT ■	20	0.14	4.3	1.1	1.26
	30	0.17	5.0	1.0	1.13
	40	0.19	5.0	1.1	1.23
	50	0.19	5.0	1.1	1.25
5TQ ■	20	0.15	4.3	1.0	1.17
	30	0.20	5.0	1.0	1.16
	40	0.21	5.0	1.1	1.21
	50	0.22	5.0	1.1	1.27
5F ●	20	0.17	4.0	1.0	1.18
	30	0.26	5.0	1.0	1.16
	40	0.26	5.0	1.0	1.16
	50	0.26	5.0	1.0	1.16

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
8-60° ▲	20	0.10	7.6	1.0	1.2
	30	0.11	8.0	1.0	1.1
	40	0.12	8.1	1.1	1.2
	50	0.13	8.3	1.1	1.3
8Q ■	20	0.14	7.0	1.1	1.3
	30	0.17	8.0	1.0	1.1
	40	0.18	8.2	1.0	1.2
	50	0.18	8.4	1.0	1.1
8T ■	20	0.20	7.6	1.0	1.2
	30	0.22	8.0	1.0	1.1
	40	0.23	8.2	1.0	1.1
	50	0.24	8.3	1.0	1.1
8-150° ■	20	0.25	7.5	1.0	1.2
	30	0.27	8.0	1.0	1.1
	40	0.28	8.1	1.0	1.1
	50	0.29	8.2	1.0	1.2
8H ■	20	0.26	7.0	1.0	1.2
	30	0.33	8.0	1.0	1.1
	40	0.34	8.0	1.0	1.2
	50	0.34	8.0	1.0	1.2
8-210° ■	20	0.33	7.6	1.1	1.3
	30	0.36	8.0	1.1	1.3
	40	0.37	8.1	1.1	1.3
	50	0.38	8.2	1.1	1.3
8TT ■	20	0.34	7.0	1.0	1.2
	30	0.44	8.0	1.0	1.1
	40	0.46	8.0	1.0	1.2
	50	0.46	8.0	1.0	1.2
8TQ ■	20	0.41	7.2	1.0	1.1
	30	0.49	8.0	1.1	1.1
	40	0.54	8.0	1.1	1.2
	50	0.55	8.0	1.1	1.2
8F ●	20	0.55	7.0	1.1	1.2
	30	0.66	8.0	1.0	1.1
	40	0.68	8.0	1.0	1.2
	50	0.71	8.0	1.1	1.2

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
10-60° ▲	20	0.16	9.5	1.0	1.2
	30	0.17	10.0	1.0	1.1
	40	0.18	10.0	1.0	1.2
	50	0.19	10.0	1.1	1.3
10Q ■	20	0.26	9.5	1.0	1.1
	30	0.23	10.0	1.0	1.2
	40	0.28	10.2	1.0	1.2
	50	0.28	10.3	1.0	1.2
10T ■	20	0.31	9.5	1.0	1.1
	30	0.34	10.0	1.0	1.1
	40	0.36	10.0	1.0	1.2
	50	0.37	10.0	1.1	1.2
10-150° ■	20	0.41	9.8	1.0	1.1
	30	0.43	10.0	1.0	1.1
	40	0.44	10.2	1.0	1.1
	50	0.46	10.4	1.0	1.1
10H ■	20	0.48	9.7	1.0	1.1
	30	0.51	10.0	1.0	1.1
	40	0.55	10.3	1.0	1.2
	50	0.56	10.4	1.0	1.2
10-210° ■	20	0.56	9.8	1.1	1.3
	30	0.58	10.0	1.1	1.3
	40	0.60	10.4	1.1	1.2
	50	0.62	10.5	1.1	1.3
10TT ■	20	0.63	9.6	1.0	1.1
	30	0.69	10.0	1.0	1.2
	40	0.73	10.3	1.0	1.1
	50	0.74	10.4	1.0	1.1
10TQ ■	20	0.71	9.5	1.0	1.1
	30	0.79	10.0	1.0	1.1
	40	0.84	10.3	1.0	1.1
	50	0.86	10.4	1.0	1.1
10F ●	20	0.95	9.6	1.0	1.1
	30	1.03	10.0	1.0	1.1
	40	1.08	10.3	1.0	1.1
	50	1.12	10.4	1.0	1.2



PERFORMANCE DATA – PRECISION™ SERIES SPRAY NOZZLES

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
12-60° ▲	20	0.24	11.5	1.0	1.2
	30	0.25	12.0	1.0	1.2
	40	0.26	12.1	1.0	1.2
	50	0.28	12.2	1.1	1.3
12Q ■	20	0.34	12.0	1.0	1.2
	30	0.37	12.1	1.0	1.1
	40	0.39	11.4	1.0	1.2
	50	0.39	12.0	1.0	1.1
12T ■	20	0.46	11.5	1.0	1.2
	30	0.49	12.0	1.0	1.1
	40	0.51	12.2	1.0	1.1
	50	0.52	12.3	1.0	1.1
12-150° ■	20	0.60	11.6	1.0	1.2
	30	0.62	12.0	1.0	1.2
	40	0.63	12.2	1.0	1.1
	50	0.64	12.3	1.0	1.1
12H ■	20	0.70	11.5	1.0	1.2
	30	0.74	12.0	1.0	1.1
	40	0.79	12.3	1.0	1.2
	50	0.80	12.4	1.0	1.2
12-210° ■	20	0.76	11.6	1.1	1.3
	30	0.82	12.0	1.1	1.3
	40	0.84	12.3	1.1	1.2
	50	0.85	12.4	1.1	1.2
12TT ■	20	0.90	11.4	1.0	1.2
	30	0.99	12.0	1.0	1.1
	40	1.04	12.3	1.0	1.1
	50	1.05	12.4	1.0	1.1
12TQ ■	20	1.05	11.4	1.0	1.2
	30	1.15	12.0	1.0	1.2
	40	1.19	12.2	1.0	1.2
	50	1.22	12.3	1.0	1.2
12F ●	20	1.35	11.5	1.0	1.1
	30	1.48	12.0	1.0	1.1
	40	1.59	12.4	1.0	1.1
	50	1.60	12.5	1.0	1.1

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
15-60° ▲	20	0.35	14.0	1.0	1.2
	30	0.39	15.0	1.0	1.2
	40	0.40	15.1	1.0	1.2
	50	0.42	15.3	1.0	1.2
15Q ■	20	0.53	14.2	1.0	1.2
	30	0.58	15.0	1.0	1.1
	40	0.60	15.1	1.0	1.2
	50	0.61	15.3	1.0	1.2
15T ■	20	0.72	14.3	1.0	1.2
	30	0.77	15.0	1.0	1.1
	40	0.81	15.3	1.0	1.2
	50	0.82	15.4	1.0	1.2
15-150° ■	20	0.92	14.7	1.0	1.2
	30	0.96	15.0	1.0	1.2
	40	1.00	15.2	1.0	1.2
	50	1.10	15.3	1.1	1.3
15H ■	20	1.10	14.5	1.0	1.2
	30	1.16	15.0	1.0	1.1
	40	1.25	15.4	1.0	1.2
	50	1.28	15.5	1.0	1.2
15-210° ■	20	1.15	14.5	1.1	1.2
	30	1.20	15.0	1.0	1.2
	40	1.30	15.5	1.0	1.2
	50	1.40	15.6	1.1	1.3
15TT ■	20	1.45	14.5	1.0	1.2
	30	1.54	15.0	1.0	1.1
	40	1.58	15.2	1.0	1.1
	50	1.61	15.3	1.0	1.1
15TQ ■	20	1.72	14.5	1.0	1.2
	30	1.78	15.0	1.0	1.1
	40	1.82	15.0	1.0	1.2
	50	1.90	15.3	1.0	1.2
15F ●	20	2.20	14.5	1.0	1.2
	30	2.31	15.0	1.0	1.1
	40	2.35	15.2	1.0	1.1
	50	2.40	15.3	1.0	1.1

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
4X30 SST ■	20	0.62	4x28	1.0	1.1
	30	0.66	4x30	1.1	1.2
	40	0.67	4x30	1.1	1.2
	50	0.68	4x30	1.1	1.3
4X15 LCS ■	20	0.32	4x15	1.0	1.2
	30	0.33	4x15	1.1	1.2
	40	0.34	4x15	1.1	1.3
	50	0.34	4x15	1.1	1.3
4X15 RCS ■	20	0.32	4x15	1.0	1.2
	30	0.33	4x15	1.1	1.2
	40	0.34	4x15	1.1	1.3
	50	0.34	4x15	1.1	1.3
4X18 SST ■	20	0.36	4X18	1.0	1.1
	30	0.37	4X18	1.0	1.1
	40	0.38	4X18	1.0	1.2
	50	0.38	4X18	1.0	1.2
4X9 LCS ■	20	0.18	4X9	1.0	1.1
	30	0.19	4X9	1.0	1.2
	40	0.20	4X9	1.1	1.2
	50	0.20	4X9	1.1	1.1
4X9 RCS ■	20	0.18	4X9	1.0	1.2
	30	0.19	4X9	1.0	1.2
	40	0.20	4X9	1.1	1.2
	50	0.20	4X9	1.1	1.2





Making use of the same patented gear drive technology found in Toro's world-leading Golf rotors, Toro® Precision™ Series Rotating Nozzles are powered by a planetary drive system that delivers a pattern of multiple wind resistant, multi-trajectory streams. The full circle and adjustable arc models deliver a radius range of 14 to 26 feet with exceptional uniformity and close-in watering characteristics at a precipitation rate of 0.6 inches per hour.

FEATURES & BENEFITS

Consistent, Gear-Driven Performance

Precision™ Series Rotating Nozzles are uniquely powered by a patented planetary gear drive, variable stator and turbine. Unlike competing rotating nozzles, the Precision™ Series Rotating Nozzle's gear drive is not system pressure dependent and delivers consistent rotation speed and performance across a wide range of operating pressures. The entire drive system is protected by the factory-installed fine mesh filter screen.

Fewer Models

Two Toro-threaded models and two female-threaded models are all that are required to cover radius requirements of 14 to 26 feet and infinitely adjustable arcs between 45° and 270° or 360°. Fewer models allow for less inventory and more flexibility.

Matched Precipitation Rate

These nozzles deliver water more slowly and evenly than standard spray nozzles, which helps prevent runoff and water waste. Moreover, the 0.6" per hour precipitation rate better positions users to meet watering window requirements than competing rotating nozzles.

EZ ARC™ Visual Arc Indicators

Toro Precision™ Series Rotating Nozzles are the only rotating nozzles available that allow the user to dial in the nozzle's arc setting before installation. Further, the nozzle features a right edge call-out on adjustable models that assists in quick and effective installations.



Female-threaded
PRN-A



Male-threaded
PRN-TA

ADJUSTABLE



Female-threaded
PRN-F



Male-threaded
PRN-TF

FULL CIRCLE

WATER MANAGEMENT HIGHLIGHT



Precision™ Series Rotating Nozzles supply matched precipitation with any arc and radius from 14 to 26 feet. Water is applied slowly and evenly to reduce runoff and wasted water.

PERFORMANCE DATA

PRECISION™ SERIES ROTATING NOZZLES

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
45°	20	0.17	14.0	0.67	0.77
	30	0.19	15.0	0.65	0.75
	40	0.25	17.0	0.67	0.77
	50	0.31	18.5	0.70	0.81
	60	0.35	19.5	0.71	0.82
	75	0.43	22.0	0.68	0.79
90°	20	0.43	16.0	0.65	0.75
	30	0.49	17.5	0.62	0.71
	40	0.62	20.5	0.57	0.66
	50	0.75	22.5	0.57	0.66
	60	0.82	23.5	0.57	0.66
120°	75	0.92	25.0	0.57	0.65
	20	0.48	16.4	0.69	0.79
	30	0.57	17.5	0.72	0.83
	40	0.78	20.2	0.55	0.64
	50	0.97	22.5	0.55	0.64
180°	60	1.07	23.5	0.56	0.65
	75	1.18	25.0	0.55	0.63
	20	0.83	15.0	0.71	0.82
	30	0.94	17.0	0.63	0.72
	40	1.22	20.5	0.56	0.65
240°	50	1.46	22.5	0.56	0.64
	60	1.61	24.0	0.54	0.62
	75	1.81	26.0	0.52	0.60
	20	1.12	15.0	0.72	0.83
	30	1.27	17.0	0.63	0.73
270°	40	1.56	20.0	0.56	0.65
	50	1.80	21.5	0.56	0.65
	60	1.95	22.5	0.56	0.64
	75	2.20	24.0	0.55	0.64
	20	1.08	14.0	0.71	0.81
360°	30	1.23	16.0	0.62	0.71
	40	1.62	19.0	0.57	0.66
	50	2.00	21.5	0.55	0.64
	60	2.26	23.0	0.55	0.63
	75	2.60	25.0	0.53	0.61
	20	1.81	15.0	0.77	0.89
	30	2.00	17.2	0.65	0.75
	40	2.56	20.9	0.56	0.65
	50	3.09	22.9	0.57	0.65
	60	3.34	23.8	0.57	0.66
	75	3.68	25.6	0.54	0.62

Nozzle data subject to change.

PRECISION™ SERIES ROTATING NOZZLE MODEL LIST

Toro (male)-threaded	Description
PRN-TA	14-26 feet, Adjustable from 45°-270°
PRN-TF	14-26 feet, Full circle
Female-threaded	Description
PRN-A	14-26 feet, Adjustable from 45°-270°
PRN-F	14-26 feet, Full circle

SPECIFICATIONS

Operational

- Radius: 14'-26'
- Operating pressure range: 20-75 psi
- Recommended operating pressure: 45 psi
- Flow Rate: 0.17-3.68 gpm

Warranty

- Five years

Additional Features

- ✓ Maximum trajectory height of 20° to help fight wind
- ✓ Threads onto nearly all manufacturers' spray heads and shrub adapters
- ✓ Pre-attached screen for easy installation
- ✓ Radius reduction up to 25% by turning set screw
- ✓ Color-coded to easily identify adjustable and full circle models



Step-Up™ Technology

Enables the delivery of a highly uniform pattern of water all the way out to the furthest point of the radius. The unique steps create fifteen streams, each designed to cover an area of the pattern.



Precision™ Series Rotating Nozzle Visual Arc Adjustment

The unique arc adjustment ring dial allows for pre-setting the arc by hand or with the PRNTOOL before the nozzle is installed or quickly after the nozzle is threaded onto the spray head and under pressure.

Specifying Information—Precision™ Series Rotating Nozzle

PRN-XX		
Model	Thread	Arc
PRN	X	X
PRN—Precision™ Rotating Nozzle	T—Toro (male)-thread Blank—Female-thread	A—Adjustable F— Full circle
Example: A male threaded Precision™ Series Rotating nozzle with a 24' radius and a 180° arc would be specified as: PRN-TA A female threaded Precision™ Series Rotating nozzle with a 20' radius and 360° arc would be specified as: PRN-F		

Note: For optimal performance in dirty water applications, a minimum of 120 mesh primary filtration is recommended.





SPECIFICATIONS

Operational

- Operating pressure range: 20-75 psi
- Recommended operating pressure: 30 psi
- Flow Rate: 0.05 – 4.58 gpm
- Nozzle trajectory:
 - 5': 5° - 8': 10° - 10': 17° - 12': 24° - 15': 28°
 - Corner and Side Strips: 17°
 - 8' Flat Spray: 0°

Warranty

- Two years

Toro® MPR Plus nozzles make system design and installation easier than ever. Simply select the needed radius and arc—the nozzle does everything else.

FEATURES & BENEFITS

Matched Precipitation Rates

Ensures all nozzles with a common radii apply water at approximately the same rate.

Pre-installed Pressure Compensation Disc

Eliminates excessive misting, conserves water and provides precise flow rates.

Additional Features

- ✓ Customized screens for each nozzle
- ✓ Fine-mesh snap-in filter screens for lower flow nozzles
- ✓ Convenient nozzle packaging – nozzles and screens packed separately
- ✓ Adjustment screw allows up to 25% reduction in radius and complete shutoff

MPR PLUS SPRAY NOZZLES MODEL LIST

Model	Description	Model	Description
5' MPR PLUS NOZZLE—RED		8' MPR PLUS NOZZLE—GREEN	
5Q	90° Arc	8Q	90° Arc
5T	120° Arc	8T	120° Arc
5H	180° Arc	8H	180° Arc
5TT	240° Arc	8TT	240° Arc
5TQ	270° Arc	8TQ	270° Arc
5F	360° Arc	8F	360° Arc
8' FLAT SPRAY—BLACK		10' MPR PLUS NOZZLE—BLUE	
FSQ	90° Arc	10Q	90° Arc
FSH	180° Arc	10T	120° Arc
FSF	360° Arc	10H	180° Arc
FSQ-LG	90° Arc, low flow	10TT	240° Arc
FSH-LG	180° Arc, low flow	10TQ	270° Arc
FSF-LG	360° Arc, low flow	10F	360° Arc
12' MPR PLUS NOZZLE—BROWN		15' MPR PLUS NOZZLE—BLACK	
12Q	90° Arc	15Q	90° Arc
12T	120° Arc	15T	120° Arc
12H	180° Arc	15H	180° Arc
12TT	240° Arc	15TT	240° Arc
12TQ	270° Arc	15TQ	270° Arc
12F	360° Arc	15F	360° Arc
SPECIAL PATTERNS—ORANGE			
4SST	Side Strip 4'x30'		
4EST	End Strip 4'x15'		
4CST	Center Strip 4'x30'		
9SST	Side Strip 9'x18'		
4S5ST	Side Strip 4'x18'		
2SST	Side Strip 2' x 6'		

Specifying Information—MPR Plus

XX-XXX-PC		
Radius	Arc	Optional
XXX	XXX	PC
5—5' 8—8' 10—10' 12—12' 15—15'	Q—90° T—120° H—180° TT—240° Q—270° F—360° EST—End Strip CST—Center Strip SST—Side Strip	PC—Pressure Compensation
Example: A 570 MPR Plus Nozzle with a spray of 10', 180° arc and pressure compensation, would be specified as: 10-H-PC		

Note: To specify a MPR Plus nozzle with a 570Z sprinkler body, attach the body specification before the above nozzle specification. Do not use PCDs with 570Z PR & 570Z PRX models

PERFORMANCE DATA-MPR PLUS SPRAY NOZZLES

5' SERIES WITH 5° TRAJECTORY—RED

Arc	Desc.	psi	gpm	Ra- dius	Prec. Rate	
					▲	■
90°	5-Q	20	0.05	4	1.40	1.21
		30	0.09	5	1.61	1.40
		40	0.12	6	1.78	1.54
		50	0.15	6	1.86	1.62
	5-Q-PC	30-40	0.09	5	1.61	1.40
120°	5-T	20	0.07	4	1.47	1.27
		30	0.12	5	1.61	1.40
		40	0.16	6	1.78	1.54
		50	0.20	6	1.86	1.62
	5-T-PC	30-40	0.12	5	1.61	1.40
180°	5-H	20	0.10	4	1.40	1.21
		30	0.19	5	1.70	1.47
		40	0.23	6	1.70	1.47
		50	0.27	6	1.68	1.45
	5-H-PC	30-40	0.18	5	1.61	1.40
240°	5-TT	20	0.15	4	1.57	1.36
		30	0.25	5	1.68	1.45
		40	0.30	6	1.66	1.44
		50	0.35	6	1.63	1.41
	5-TT-PC	30-40	0.23	5	1.54	1.34
270°	5-TQ	20	0.20	4	1.86	1.61
		30	0.29	5	1.73	1.50
		40	0.34	6	1.68	1.45
		50	0.40	6	1.66	1.44
	5-TQ-PC	30-40	0.26	5	1.55	1.34
360°	5-F	20	0.25	4	1.75	1.51
		30	0.38	5	1.70	1.47
		40	0.45	6	1.66	1.44
		50	0.53	6	1.65	1.43
	5-F-PC	30-40	0.35	5	1.57	1.36
		40-75	0.39	5	1.75	1.51

8' SERIES WITH 10° TRAJECTORY—GREEN

Arc	Desc.	psi	gpm	Ra- dius	Prec. Rate	
					▲	■
90°	8-Q	20	0.17	7	1.55	1.34
		30	0.24	8	1.68	1.45
		40	0.26	9	1.61	1.39
		50	0.29	9	1.60	1.39
	8-Q-PC	30-40	0.22	8	1.54	1.33
120°	8-T	20	0.23	7	1.58	1.36
		30	0.30	8	1.57	1.36
		40	0.36	9	1.67	1.45
		50	0.40	9	1.66	1.44
	8-T-PC	30-40	0.29	8	1.52	1.32
180°	8-H	20	0.37	8	1.47	1.27
		30	0.50	8	1.75	1.51
		40	0.58	9	1.80	1.56
		50	0.65	9	1.80	1.56
	8-H-PC	30-40	0.44	8	1.54	1.33
240°	8-TT	20	0.56	7	1.92	1.66
		30	0.70	8	1.84	1.59
		40	0.80	9	1.86	1.61
		50	0.88	9	1.82	1.58
	8-TT-PC	30-40	0.59	8	1.55	1.34
270°	8-TQ	20	0.63	7	1.92	1.66
		30	0.76	8	1.77	1.53
		40	0.86	9	1.78	1.54
		50	0.93	9	1.71	1.48
	8-TQ-PC	30-40	0.64	8	1.49	1.29
360°	8-F	20	0.74	7	1.69	1.46
		30	1.00	8	1.75	1.51
		40	1.16	9	1.80	1.56
		50	1.30	9	1.80	1.56
	8-F-PC	30-40	0.85	8	1.49	1.29
		40-75	1.00	8	1.75	1.51

10' SERIES WITH 17° TRAJECTORY—BLUE

Arc	Desc.	psi	gpm	Ra- dius	Prec. Rate	
					▲	■
90°	10-Q	20	0.30	9	1.66	1.44
		30	0.40	10	1.79	1.55
		40	0.50	11	1.85	1.60
		50	0.60	12	1.86	1.62
	10-Q-PC	30-40	0.33	10	1.48	1.28
120°	10-T	20	0.42	9	1.74	1.51
		30	0.52	10	1.75	1.51
		40	0.65	11	1.80	1.56
		50	0.75	12	1.75	1.51
	10-T-PC	30-40	0.44	10	1.48	1.28
180°	10-H	20	0.60	9	1.66	1.44
		30	0.71	10	1.59	1.38
		40	0.85	11	1.57	1.36
		50	0.99	12	1.65	1.43
	10-H-PC	30-40	0.66	10	1.48	1.28
240°	10-TT	20	0.71	9	1.47	1.27
		30	0.97	10	1.63	1.41
		40	1.10	11	1.67	1.45
		50	1.19	11	1.65	1.43
	10-TT-PC	30-40	0.89	10	1.49	1.29
270°	10-TQ	20	0.82	9	1.51	1.31
		30	1.04	10	1.55	1.34
		40	1.20	11	1.62	1.41
		50	1.35	11	1.66	1.44
	10-TQ-PC	30-40	0.99	10	1.48	1.28
360°	10-F	20	1.11	9	1.72	1.49
		30	1.49	10	1.67	1.44
		40	1.61	11	1.63	1.42
		50	1.85	11	1.71	1.48
	10-F-PC	30-40	1.33	10	1.49	1.29
		40-75	1.51	10	1.69	1.46

12' SERIES WITH 24° TRAJECTORY—BROWN

Arc	Desc.	psi	gpm	Ra- dius	Prec. Rate	
					▲	■
90°	12-Q	20	0.40	11	1.48	1.28
		30	0.50	12	1.55	1.35
		40	0.60	13	1.64	1.42
		50	0.63	13	1.67	1.44
	12-Q-PC	30-40	0.48	12	1.49	1.29
120°	12-T	20	0.57	11	1.58	1.37
		30	0.72	12	1.68	1.45
		40	0.87	13	1.87	1.62
		50	0.97	13	1.93	1.67
	12-T-PC	30-40	0.64	12	1.49	1.29
180°	12-H	20	0.95	11	1.76	1.52
		30	1.09	12	1.69	1.47
		40	1.30	13	1.72	1.49
		50	1.55	14	1.77	1.53
	12-H-PC	30-40	0.96	12	1.49	1.29
240°	12-TT	20	1.12	11	1.55	1.35
		30	1.45	12	1.69	1.46
		40	1.63	13	1.75	1.52
		50	1.80	13	1.79	1.55
	12-TT-PC	30-40	1.28	12	1.49	1.29
270°	12-TQ	20	1.05	11	1.42	1.23
		30	1.55	12	1.61	1.39
		40	1.65	13	1.58	1.36
		50	1.80	13	1.59	1.38
	12-TQ-PC	30-40	1.44	12	1.49	1.29
360°	12-F	20	1.67	11	1.54	1.34
		30	2.19	12	1.70	1.47
		40	2.35	13	1.68	1.46
		50	2.70	13	1.79	1.55
	12-F-PC	30-40	1.92	12	1.49	1.29
		40-75	2.10	12	1.63	1.41

15' SERIES WITH 28° TRAJECTORY—BLACK

Arc	Desc.	psi	gpm	Radius	Prec. Rate	
					▲	■
90°	15-Q	20	0.68	14	1.55	1.34
		30	0.85	15	1.69	1.46
		40	1.04	16	1.82	1.57
		50	1.23	16	2.15	1.86
	15-Q-PC	30-40	0.75	15	1.49	1.29
120°	15-T	20	0.95	14	1.75	1.52
		30	1.10	15	1.64	1.42
		40	1.30	16	1.82	1.57
		50	1.45	16	2.03	1.75
	15-T-PC	30-40	1.00	15	1.49	1.29
180°	15-H	20	1.37	13	1.79	1.55
		30	1.65	15	1.66	1.44
		40	2.02	16	1.77	1.53
		50	2.14	16	1.87	1.62
	15-H-PC	30-40	1.50	15	1.49	1.29
240°	15-TT	20	1.78	14	1.59	1.38
		30	2.20	15	1.64	1.42
		40	2.66	16	1.74	1.51
		50	2.84	16	1.86	1.61
	15-TT-PC	30-40	2.00	15	1.49	1.29
270°	15-TQ	20	2.10	13	1.85	1.61
		30	2.60	15	1.72	1.49
		40	3.00	16	1.86	1.61
		50	3.40	16	1.98	1.72
	15-TQ-PC	30-40	2.30	15	1.53	1.32
360°	15-F	20	2.85	13	1.89	1.63
		30	3.60	15	1.79	1.55
		40	4.20	16	1.84	1.59
		50	4.58	16	2.00	1.73
	15-F-PC	30-40	3.00	15	1.49	1.29
		40-75	3.30	15	1.64	1.42

SPECIAL PATTERNS—ORANGE

Pattern	Desc.	psi	gpm	Special Width	Patterns Length	Prec. Rate*
	4-EST	20	0.38	3'	x 12'	2.03
		30	0.45	4'	x 15'	1.44
		40	0.53	5'	x 18'	1.13
		50	0.60	6'	x 20'	0.96
	4-EST-PC	30-40	0.43	4'	x 15'	1.38
	4-CST	40-75	0.50	4'	x 15'	1.61
		20	0.75	3'	x 24'	2.01
		30	0.90	4'	x 30'	1.44
		40	1.04	4'	x 30'	1.67
	4-CST-PC	50	1.16	4'	x 31'	1.80
	9-SST	30-40	0.86	4'	x 30'	1.38
		40-75	1.00	4'	x 30'	1.61
		20	1.00	9'	x 18'	1.19
		30	1.20	9'	x 18'	1.43
	9-SST-PC	40	1.38	9'	x 20'	1.48
	50	50	1.55	10'	x 22'	1.36
		30-40	1.10	9'	x 18'	1.31
		40-75	1.20	9'	x 18'	1.43
		20	0.65	4'	x 24'	1.30
	4-SST	30	0.90	4'	x 30'	1.44
	40	40	1.04	4'	x 32'	1.56
		50	1.16	5'	x 33'	1.35
		30-40	0.88	4'	x 30'	1.41
		40-75	1.00	4'	x 30'	1.61
		2-SST	20	0.08	2'	x 5'
30			0.09	2'	x 6'	1.44
40			0.10	2'	x 7'	1.38
50			0.12	3'	x 7'	1.10
2-SST-PC		30-40	0.09	2'	x 6'	1.44
	4S-SST	40-75	0.10	2'	x 6'	1.61
		20	0.46	4'	x 17'	1.30
		30	0.55	4'	x 18'	1.47
		40	0.63	4'	x 19'	1.60
	4S-SST-PC	50	0.71	5'	x 19'	1.44
	4S-SST-PC	30-40	0.50	4'	x 18'	1.34
		40-75	0.59	4'	x 18'	1.58



Easy Grip Top
The easy grip top makes arc adjustment from 0°–360° a snap

Quick, easy and infinitely adjustable! Toro® Variable Arc Nozzles (TVAN) are designed to deliver excellent irrigation efficiency with maximum versatility.

SPECIFICATIONS

Operational

- Radius: 8' to 17'
- Operating pressure range: 20-50 psi
- Recommended operating pressure: 30 psi

Warranty

- Two years

FEATURES & BENEFITS

Matched Precipitation Rates

Ensures all nozzles with a common radii apply water at approximately the same rate.

Unique Grip and Turn Adjustment

Requires no tools and makes arc setting fast and simple. Adjust from the top of the nozzle – wet or dry.

Infinitely Adjustable from 0° - 360°

The TVAN provides a variety of arc settings to precisely match any terrain and reduces inventory by meeting the needs of any size or shape landscape.

Five Color-coded Nozzles

Allows for quick and easy identification even when retracted.

Additional Features

- ✓ Stainless steel adjustment screw allows up to 25% radius reduction
- ✓ Nozzle arc adjustment opens from a fixed left stop position indicated by an arrow on the top

TVAN VARIABLE ARC NOZZLES MODEL LIST

Model	Description
TVAN8	8' Variable Arc Pattern
TVAN10	10' Variable Arc Pattern
TVAN12	12' Variable Arc Pattern
TVAN15	15' Variable Arc Pattern
TVAN17	17' Variable Arc Pattern

Specifying Information—TVAN

TVANXX	
Model	Radius
TVAN	XX
TVAN—Toro Variable Arc Nozzle	8—8' Variable Arc Pattern 10—10' Variable Arc Pattern 12—12' Variable Arc Pattern 15—15' Variable Arc Pattern 17—17' Variable Arc Pattern
Example: A TVAN8 nozzle, would be specified as: TVAN8	

TVAN VARIABLE ARC NOZZLE PERFORMANCE DATA

Pattern	psi	8' Series-Green				10' Series-Blue				12' Series-Brown				15' Series-Black				17' Series-Gray			
		gpm	Rad	Precip. Rate		gpm	Rad	Precip. Rate		gpm	Rad	Precip. Rate		gpm	Rad	Precip. Rate		gpm	Rad	Precip. Rate	
90°	20	0.58	7	5.26	4.56	0.59	9	3.24	2.81	0.76	10	3.38	2.93	1.06	15	2.09	1.81	1.25	16	2.17	1.88
	30	0.71	8	4.93	4.27	0.72	10	3.20	2.77	0.93	12	2.87	2.49	1.29	15	2.55	2.21	1.46	17	2.25	1.95
	40	0.82	9	4.50	3.90	0.84	10	3.73	3.24	1.07	12	3.30	2.86	1.49	16	2.59	2.24	1.68	18	2.31	2.00
	50	0.92	9	5.05	4.38	0.94	10	4.18	3.62	1.21	13	3.18	2.76	1.66	16	2.88	2.50	1.87	18	2.57	2.22
180°	20	0.81	7	3.67	3.18	0.94	9	2.58	2.24	1.35	10	3.00	2.60	1.71	14	1.94	1.68	1.95	15	1.93	1.67
	30	0.99	8	3.44	2.98	1.15	10	2.56	2.21	1.65	12	2.55	2.21	2.08	15	2.05	1.78	2.38	17	1.83	1.59
	40	1.15	8	3.99	3.46	1.33	10	2.96	2.56	1.91	12	2.95	2.55	2.40	15	2.37	2.05	2.74	17	2.11	1.83
	50	1.28	9	3.51	3.04	1.49	10	3.31	2.87	2.13	13	2.80	2.43	2.68	15	2.65	2.29	3.06	18	2.10	1.82
270°	20	1.08	7	3.27	2.83	1.37	9	2.51	2.17	1.90	11	2.33	2.02	2.41	14	1.82	1.58	2.69	14	2.03	1.76
	30	1.33	8	3.08	2.67	1.67	10	2.47	2.14	2.32	12	2.39	2.07	2.94	15	1.94	1.68	3.28	17	1.68	1.46
	40	1.53	8	3.54	3.07	1.92	10	2.85	2.47	2.68	12	2.76	2.39	3.38	15	2.23	1.93	3.76	17	1.93	1.67
	50	1.70	9	3.11	2.69	2.15	10	3.19	2.76	2.99	12	3.08	2.67	3.77	16	2.18	1.89	4.19	18	1.92	1.66
360°	20	1.25	7	2.84	2.46	1.73	9	2.37	2.06	2.27	10	2.52	2.19	2.69	13	1.77	1.53	3.05	17	1.17	1.02
	30	1.52	8	2.64	2.29	2.11	10	2.35	2.03	2.77	12	2.14	1.85	3.26	15	1.61	1.40	3.73	17	1.43	1.24
	40	1.75	9	2.40	2.08	2.42	10	2.69	2.33	3.12	12	2.41	2.09	3.79	15	1.87	1.62	4.26	18	1.46	1.27
	50	1.96	9	2.69	2.33	2.69	10	2.99	2.59	3.47	12	2.68	2.32	4.33	16	1.88	1.63	4.71	18	1.62	1.40

Shaded data indicates optimal operating pressure. Radius shown in feet. Data based on 360°.

STREAM SPRAY NOZZLES

TORO



SPECIFICATIONS

Operational

- Operating pressure range: 20-75 psi
- Flow Rate: 0.60 – 2.70 gpm
- Radius adjusts up to 50%
- 10° or 35° Angle
- Non-Rotating

Warranty

- Two years



PERFORMANCE DATA 10° STREAM SPRAY

Pattern	Desc.	psi	gpm	Radius	Prec. Rate*
90°	10-SSQ	20	0.60	14	1.36 1.18
		30	0.80	16	1.39 1.20
		40	0.92	17	1.42 1.23
		50	1.03	18	1.41 1.22
180°	10-SSQ-PC	40-50	0.70	13	1.84 1.60
		60-70	0.70	15	1.38 1.20
		20	1.00	14	1.13 .98
		30	1.20	16	1.04 .90
360°	10-SSH-PC	40	1.38	17	1.06 .92
		50	1.55	18	1.06 .92
		40-50	1.40	13	1.84 1.60
		60-70	1.40	15	1.38 1.20

PERFORMANCE DATA 35° STREAM SPRAY

Pattern	Desc.	psi	gpm	Radius	Prec. Rate*
90°	35-SSQ	20	0.60	18	.82 .71
		30	0.80	20	.89 .77
		40	0.92	21	.93 .80
		50	1.03	22	.95 .82
180°	35-SSQ-PC	40-50	0.70	17	1.08 .93
		60-70	0.70	18	.96 .83
		20	1.00	18	.69 .59
		30	1.20	20	.67 .58
360°	35-SSH-PC	40	1.38	21	.70 .60
		50	1.55	22	.71 .62
		40-50	1.40	17	1.08 .93
		60-70	1.40	18	.96 .83

STREAM SPRAY NOZZLES MODEL LIST

Model	Description	Model	Description
NON-PRESSURE COMPENSATING		PRESSURE COMPENSATING	
10-SSQ	90° Arc	10-SSQ-PC	90° Arc
10-SSH	180° Arc	10-SSH-PC	180° Arc
10-SSF	360° Arc	10-SSF-PC	360° Arc
35-SSQ	90° Arc	35-SSQ-PC	90° Arc
35-SSH	180° Arc	35-SSH-PC	180° Arc
35-SSF	360° Arc	35-SSF-PC	360° Arc

Note: Stream sprays are not recommended for turf applications. Radius shown in feet. Data based on 360°.

STREAM BUBBLER NOZZLES

TORO



SPECIFICATIONS

Operational

- Operating pressure range: 10-75 psi
- Flow Rate: 0.49 – 2.02 gpm
- Fits all Toro spray bodies, shrub adapters, risers and riser extenders

Warranty

- Two years



STREAM BUBBLER NOZZLE PERFORMANCE DATA

Pattern	Description	10 psi		20 psi		30 psi		40 psi		50 psi		60 psi	
		gpm	Rad	gpm	Rad	gpm	Rad	gpm	Rad	gpm	Rad	gpm	Rad
2/60°	SB-90	0.49	7	0.70	11	0.86	13	1.00	15	1.12	16	1.23	18
2/60°	SB-90-PC2					0.21	1.5	0.22	1.5	0.23	1.5	0.24	1.5
4/60°	SB-180	0.84	5	1.18	9	1.43	12	1.66	14	1.86	16	2.02	17
4/60°	SB-180-PC2					0.46	2.5	0.49	2.5	0.50	2.5	0.51	2.5
6/60°	SB-360	1.18	3	1.63	6	2.00	8	2.29	9	2.55	10	2.82	11
6/60°	SB-360-PC2					0.74	1.5	0.75	1.5	0.76	1.5	0.77	1.5
2/180°	SB-2-180	0.49	7	0.70	11	0.86	13	1.00	15	1.12	16	1.23	18
2/180°	SB-2-180-PC2					0.21	1.5	0.22	1.5	0.23	1.5	0.24	1.5
2/60x2/60°	SB-4-180	0.84	5	1.18	9	1.43	12	1.66	14	1.86	16	2.02	17
2/60x2/60°	SB-4-180-PC2					0.46	2.5	0.49	2.5	0.50	2.5	0.51	2.5

Radius shown in feet. Data based on 360°.

STREAM BUBBLER NOZZLES MODEL LIST

Model	Description
PRESSURE COMPENSATING	
SB-90-PC2	90° Arc, 2' Radius
SB-180-PC2	180° Arc, 2' Radius
SB-360-PC2	360° Arc, 2' Radius
SB-2-180-PC2	180° Arc, 2 Stream, 2' Radius
SB-4-180-PC2	180° Arc, 4 Stream, 2' Radius



SPECIFICATIONS

Operational

- Operating pressure range: 20-75 psi
Maximum pressure: 75 psi
- Flow Rate: Adjustable: 0–2.0 gpm
Fixed Flow: 0.25, 0.50 and 1.0 gpm
- Adjustment screw allows up to 25% reduction in radius
- Compatible with shrub adapter, 570Z Series sprinklers, risers and riser extenders

Warranty

- Two years



FLOOD BUBBLER PERFORMANCE DATA

Pattern	Model No.	gpm @ 40 psi	gpm @ 50 psi	gpm @ 60 psi
Flood ●	FB25PC	0.25	0.25	0.25
	FB50PC	0.45	0.50	0.50
	FB100PC	0.95	1.00	1.00
	FB200ADJPC	1.90	2.00	2.00

PRESSURE-COMPENSATING FLOOD BUBBLERS MODEL LIST

Model	Description
FB-25-PC	.25 gpm
FB-50-PC	.50 gpm
FB-100-PC	1.00 gpm
FB-200-ADJ-PC2.00	Adjustable gpm



SPECIFICATIONS

Operational

- Operating pressure range:
 - Flood: 15-75 psi
 - Stream: 10-75 psi
 Maximum pressure: 75 psi
- Flow Rate:
 - Flood: 1.7 – 2.7 gpm
 - Stream: 1.08 – 3.70 gpm
- Inlet: ½" female thread
- Attaches directly to risers
- Radius adjusts up to 50%

Warranty

- Two years



ADJUSTABLE FLOOD BUBBLER NOZZLE PERFORMANCE DATA

Pattern	Model No.	psi	gpm
Universal Flood ●	514-20	15	1.70
		20	2.00
		25	2.20
		30	2.40
		35	2.50
		40	2.70

500 SERIES ADJUSTABLE STREAM BUBBLER NOZZLE PERFORMANCE DATA

Pattern	Model No.	10 psi		20 psi		30 psi		40 psi	
		gpm	Rad	gpm	Rad	gpm	Rad	gpm	Rad
2/60°	511-30	1.08	10	1.52	14	1.87	16	2.10	17
4/60°	512-30	1.50	7	2.11	10	2.58	11	2.98	13
6/60°	514-30	1.89	6	2.61	8	3.20	10	3.70	11
2/180°	516-30	1.08	10	1.52	14	1.87	16	2.10	17

Radius shown in feet. Data based on 360°.

500 SERIES BUBBLERS MODEL LIST

Model	Description
511-30	90° Arc, Stream Bubbler
512-30	180° Arc, Stream Bubbler
514-30	360° Arc, Stream Bubbler
516-30	180° Arc, 2-stream Bubbler
514-20	Universal Flood Bubbler



EFFLUENT WATER INDICATORS



89-9752

- Lavender snap-on cover for use on 570Z Series pop-up models



102-1211

- Lavender molded cap for use on 570Z Series pop-up models
- Includes wiper seal



102-0563

(Nozzle not included)

- Lavender molded 570Z Series shrub adapter
- Installs onto a 1/2" NPT riser

ACCESSORIES



995-01

- Flow gauge

SERVICEABLE PARTS



570SEAL

- Serviceable seal for all 570Z models
- Recommended for upgrades



Check Valve 570CV

- Check valve for all the 570Z models
- Install in field to prevent low head drainage

RISERS AND EXTENDERS



570-6X

- 570Z Extender
- Male-inlet threads install onto any 570Z pop-up sprinkler or shrub adapter to provide a 6" extension
- Maximum pressure: 75 psi



570SR-6 and 570SR-18

- 570Z stationary riser
- 1/2" male-threaded inlet for installation on pipe fittings
- Maximum pressure: 75 psi
- Height: 6", 18"

TOOLS



89-6395

- Riser pull-up and screen removal tool for all 570Z Series models



89-7350

- Adjustment tool for all 570Z Series models



PRNTOOL

- Adjustment Tool for Precision™ Series Rotating Nozzles
- Adjusts arc and radius



PNOZZTOOL

- Riser pull up tool
- Fits all 570Z Sprays





SUPER FUNNY PIPE®



Toro® Super Funny Pipe is practical and saves time. Whether you are installing a new system or replacing an old sprinkler, Super Funny Pipe makes the job easier.

FEATURES & BENEFITS

Flexible, Thick-walled Polyethylene Pipe

Super Funny Pipe is a high-strength poly tubing that solves tough sprinkler installation and replacement problems. It acts as an extension cord between the water line and the sprinkler.

Easy Installation For Problem Areas

One of the most useful and time-saving sprinkler installation aids whether you are installing a new system or replacing an old sprinkler. Also comes pre-assembled as the Super Funny Pipe Swing Joints in 8" and 12" lengths or just get the individual fittings as needed.

SUPER FUNNY PIPE FRICTION LOSS DATA

gpm	gpm Flow						
	1	2	3	4	5	6	7
psi Loss	0.01	0.02	0.06	0.09	0.15	0.21	0.27

This chart indicates the amount of pressure loss (psi) per foot of Super Funny Pipe at stated flow rates (gpm).

SUPER FUNNY PIPE MODEL LIST

Model	Description
850-23	20' Length, 3/8" Polyethylene Pipe
850-24	50' Coil, 3/8" Polyethylene Pipe
850-25	100' Coil, 3/8" Polyethylene Pipe



SPECIFICATIONS

Operational

- Maximum pressure: 120 psi
- Cushions sprinklers from external impact
- Connects to sprinklers and Toro fittings

Dimensions

- Wall thickness: .10" ± .01
- Inside diameter: .49" ± 0.005
- Outside diameter: .70"

Warranty

- Two years

SUPER FUNNY PIPE® SWING JOINTS

TORO



SPFA-5125



SPFA-585



SPFA-51275



SPFA-5875

Warranty

- Two years

SUPER FUNNY PIPE SWING JOINTS MODEL LIST

Model	Description
SPFA-585	8" x 1/2"
SPFA-5875	8" x 3/4"
SPFA-5125	12" x 1/2"
SPFA-51275	12" x 3/4"

SUPER FUNNY PIPE® FITTINGS

TORO

SUPER FUNNY PIPE FITTINGS FRICTION LOSS DATA

Model No.	Description	gpm Flow						
		1	2	3	4	5	6	7
850-36	3/4" Male Adapter	0.04	0.10	0.23	0.43	0.80	1.37	1.86
850-35	1/2" Male Adapter	0.03	0.06	0.18	0.31	0.60	1.00	1.41
850-31	1/2" Male Elbow	0.05	0.15	0.36	0.62	1.13	1.62	2.37
850-34	1/2" Female Elbow	0.05	0.15	0.36	0.62	1.13	1.62	2.37
850-32	3/4" Male Elbow	0.06	0.18	0.41	0.80	1.42	2.20	3.05

This chart indicates the amount of pressure loss (psi) per foot of Super Funny Pipe at stated flow rates (gpm).

SUPER FUNNY PIPE FITTINGS MODEL LIST

Model	Description
850-20	Coupling
850-31	Male Elbow, 1/2"
850-32	Male Elbow, 3/4"
850-33	Female Adapter, 1/2" - 3/4"
850-34	Female Elbow, 1/2"
850-35	Male Adapter, 1/2"
850-36	Male Coupling, 3/4"
850-37	Tee, Barbed Inserts
850-60	Saddle Tee, 3/4"
850-61	Saddle Tee, 1"

Warranty

- Two years



850-20



850-34



850-31



850-35



850-32



850-36



850-33



850-37

ROTORS

Dependable, reliable performance is what you will find with Toro rotors for residential, commercial and sports field applications. In addition, you will also find innovative features such as NO TOOLS arc adjustment, higher pop-up heights and some of the most efficient nozzles in the industry.



Simple, Time-Saving & Dependable

Model	Inlet Size	Radius	Flow Range	Operating Pressure Range
Mini 8 Page 32-33	1/2"	20'-35'	0.8-3.40 gpm	30-60 psi
300 Multi-Stream Page 34-35	3/4"	14'-33'	0.57-7.51 gpm	35-50 psi
T5 RapidSet® Page 36-37	3/4"	25'-50'	0.74-9.7 gpm	25-65 psi
T7 Page 38-39	1"	40'-75'	6.7 - 30.6 gpm	40-100 psi
640 Page 42-43	1"	47'-67'	6.0-25.0 gpm	40-90 psi
TS90 Page 44-45	1"	53' - 95'	14.0-61.5 gpm	40-100 psi
TG101 Page 46-47	2"	91'-178'	42-248 gpm	40-95 psi
690 Page 48	1 1/2"	87'-108'	51-82 gpm	80-150 psi



Simple to use, water-efficient, and versatile, the Mini 8 Series does it all. Designed to meet coverage areas between 20 feet and 35 feet, the Mini 8 has a simple to use top-of-rotor arc setting feature that ensures easy and accurate adjustments from 40 degrees to full-circle 360 degrees. Furthermore, the pressure-activated riser seal, robust trip mechanism, ratcheting riser, and pre-installed 1.5 gpm nozzle combine for easy installations and reliable long-term performance. When spray heads won't do the job and a full-size rotor is more than what is needed, the Mini 8 rotor from Toro is the ideal choice.

FEATURES & BENEFITS

Top-of-Rotor Arc Adjustment

Allows easy arc setting with a slotted screwdriver and features a quick reference dial for fast and accurate adjustments.

Pressure-activated Riser Seal

Helps prevent debris intrusion into the rotor's body and, ultimately, the system's water lines.

Ratcheting Riser

Allows the riser and fixed left edge to quickly be turned to the desired position without having to re-orient the entire rotor.

Five Interchangeable Nozzles

To cover varying flow and radius requirements.

Part and Full Circle In One

Offers more flexibility on new system installs and reduces inventory requirements.



Effluent
Options
Available



Nozzle Tree

Five interchangeable nozzles – comes pre-installed with a 1.5 nozzle

WATER MANAGEMENT HIGHLIGHT



Arc Setting

Visual arc setting dial within rubber cover allows for fast and easy arc adjustments.

Not Too Big and Not Too Small – the Mini 8 is Just Right

The Mini 8 nozzles are designed for the efficient watering of smaller spaces, which means water savings when compared to full-size rotors. When compared to fixed sprays, the flexibility of the Mini 8 reduces the number of heads required, which in turn reduces the number of valves and stations needed. In either scenario, the Mini 8 brings together money savings and better water management.

MINI 8 SERIES MODEL LIST

Model	Description
MINI8-4P	Mini 8 Rotor, 4" Lawn Pop-up
MINI8-4PE	Mini 8 Rotor, 4" Lawn Pop-up Effluent

SPECIFICATIONS

Operational

- Radius: 20'–35'
- Operating pressure range: 30–60 psi
- Flow Rate: 0.80 – 3.40 gpm
- Trajectory: 25°

Dimensions

- Body height: 6"
- Pop-up to nozzle height: 3 3/4"
- Exposed diameter: 1 3/4"
- Cap diameter: 2 1/4"
- Inlet: 1/2" female-thread

Options Available

- 102-2024 – Adjustment Tool

Warranty

- Two years

MINI 8 SERIES PERFORMANCE DATA

Nozzle	psi	gpm	Radius (ft.)	Precipitation Rate (in./hour)	
				▲	■
.75	30	0.8	20	0.42	0.36
	40	0.9	21	0.44	0.38
	50	1.0	22	0.46	0.40
1.0	30	1.0	26	0.30	0.26
	40	1.1	27	0.34	0.30
	50	1.3	28	0.36	0.32
1.5*	30	1.3	29	0.24	0.30
	40	1.5	30	0.38	0.32
	50	1.7	31	0.40	0.34
2.0	30	1.7	30	0.42	0.36
	40	2.0	31	0.46	0.40
	50	2.3	31	0.54	0.46
3.0	30	2.6	34	0.50	0.44
	40	3.0	35	0.54	0.48
	50	3.4	35	0.62	0.54

Radius shown in feet. Data based on 180.

▲ Precipitation rates are for triangular spacing, shown in inches per hour, calculated at 50% of diameter.

■ Precipitation rates are for square spacing, shown in inches per hour, calculated at 50% of diameter.

All performance specifications are based on the stated working pressure available at the base of the sprinkler.

*Pre-installed nozzle.

Specifying Information—Mini 8 Series

MINI8-4P-XX-E			
Description	Body	Nozzle	Optional
MINI8	4P	XX	E
MINI8—Mini 8 Rotor	4P—Lawn Pop-up	1.5–1.5 gpm 2.0–2.0 gpm 3.0–3.0 gpm	E—Effluent

Example: A Mini 8 Series sprinkler with a 3.0 nozzle, would be specified as: **MINI8-4P-30**





The 300 Series Multi-Stream Rotor® from Toro® combines a highly distinctive way to irrigate with the reliability you've come to expect. Uniquely designed, Stream Rotors feature multiple rotating streams, a slower precipitation rate and successfully fights wind. The 300 Series utilizes Matched Precipitation Rate (MPR) nozzles ensuring precise, proportional flow for uniform water coverage every time. Interchangeable arc plates and nozzles provide the ultimate in versatility with the ability to cover varying arc requirements from 90 to 360 degrees. Durable plastic and stainless steel construction along with a wide selection of body styles—pop, shrub and high-pop—make the 300 Series ideal for medium to large lawns and ground cover. You can literally see the difference!

FEATURES & BENEFITS

Unique Multiple Rotating Streams

Provides slow, effective watering, and the ability to couple different arcs on the same zone, which saves time and water.

Matched Precipitation Rate Arc Discs

Ensures uniform delivery of water across each square foot of an irrigated area, resulting in high-precision water application.

Choice Of Six Nozzles and Nine Interchangeable Arc Discs

For maximum versatility covering varying landscape needs.



300 Series arc discs come in nine different selections



Effluent
Options
Available



Check
Valve
Options
Available



WATER MANAGEMENT HIGHLIGHT



A Winning Combination of Watering Efficiency and Visual Appeal

The exclusive "fingers of water" application takes a flow of water and divides it into smaller streams at different trajectories for a stronger performance all across the landscape. Shorter radii get the coverage needed with enough water still in the main stream to reach longer distances. This also creates a heavier watering stream at the tail end of the spray allowing for greater wind resistance.

300 SERIES: 300-15 AND 300-25 OMNI™

ADJUSTABLE RADIUS NOZZLE PERFORMANCE CHART

psi	Radius	Precipitation Rate*											
				gpm									
35	15	1.69	1.46	0.85	1.06	1.28	1.49	1.70	1.91	2.13	2.55	3.41	
35	18	1.37	1.19	1.00	1.24	1.50	1.75	2.00	2.25	2.50	3.00	4.00	
35	21	1.15	1.00	1.15	1.42	1.72	2.01	2.29	2.58	2.86	3.44	4.58	
35	24	0.99	0.86	1.29	1.60	1.94	2.26	2.58	2.91	3.23	3.88	5.17	
35	26	0.95	0.82	1.44	1.79	2.16	2.52	2.88	3.24	3.60	4.32	5.76	
50	18	1.60	1.38	1.16	1.44	1.74	2.04	2.33	2.62	2.91	3.49	4.65	
50	21	1.35	1.17	1.34	1.66	2.01	2.35	2.68	3.02	3.35	4.02	5.36	
50	24	1.17	1.02	1.52	1.88	2.28	2.66	3.04	3.42	3.80	4.56	6.08	
50	27	1.04	0.90	1.70	2.10	2.55	2.97	3.40	3.82	4.24	5.09	6.79	
50	30	0.93	0.80	1.88	2.33	2.82	3.29	3.75	4.23	4.69	5.63	7.51	

300 SERIES: FIXED RADIUS NOZZLE PERFORMANCE CHART

Nozzle	psi	Radius	Precipitation										
			Rate*		90°	112°	135°	157.7°	180°	202.5°	225°	270°	360°
					gpm								
01	35	16	0.99	0.86	0.57	0.71	0.86	1.00	1.14	1.28	1.43	1.71	2.28
	50	18	0.99	0.86	0.72	0.90	1.08	1.26	1.44	1.62	1.80	2.16	2.88
02	35	21	0.73	0.63	0.72	0.90	1.08	1.26	1.44	1.62	1.80	2.16	2.88
	50	24	0.66	0.57	0.85	1.06	1.28	1.49	1.71	1.92	2.13	2.56	3.41
03	35	28	0.77	0.67	1.36	1.69	2.04	2.38	2.72	3.05	3.39	4.07	5.43
	50	30	0.80	0.69	1.61	2.01	2.42	2.82	3.23	3.63	4.03	4.84	6.45
63*	35	28	0.39	0.33	0.68	0.85	1.02	1.19	1.36	1.53	1.70	2.04	2.72
	50	30	0.40	0.35	0.81	1.00	1.21	1.41	1.62	1.82	2.02	2.42	3.23
93*	35	28	0.58	0.50	1.02	1.27	1.53	1.78	2.04	2.29	2.54	3.05	4.07
	50	30	0.60	0.52	1.21	1.51	1.82	2.12	2.42	2.72	3.03	3.63	4.84

*▲ Precipitation rates are for triangular spacing, shown in inches per hour, calculated at 50% of diameter.

■ Precipitation rates are for square spacing, shown in inches per hour, calculated at 50% of diameter.

All performance specifications are based on the stated working pressure available at the base of the sprinkler.

*Low gullage. Radius shown in feet. Data based on 360°.

SPECIFICATIONS

Operational

- Radius: 14'-33'
- Flow Rate:
 - Lawn Pop-up and High pop: 0.57-7.51 gpm
 - Shrub (COM): 2.07-6.36 gpm
- Operating Pressure Range: 35-50 psi
- Pop-up Height to Nozzle:
 - Lawn Pop-up: 2 3/4"
 - High Pop: 11 3/4"
- Inlet (Female-threaded):
 - Lawn Pop-up and High pop: 3/4"
 - Shrub: Combined 1/2" to 3/4"
- Large basket filter screen

Dimensions

- Body Diameter: 2 3/8"
- Cap Diameter: 3"
- Height:
 - Lawn Pop-up: 6 1/8"
 - High Pop: 16"
- Shrub Base Diameter: 1 3/4"

Options Available

- Recycled Water Indicators:
 - Omni Nozzle Cover (Use with Part No. 300-15) (89-7853)
 - High-pop Omni Nozzle Cover (Use with Part No. 300-25) (89-7854)
 - Rotor Plug (89-7889)
- Com Check Seal (89-7561; fits shrub models only)

Warranty

- Two years

300 SERIES SHRUB WITH COM (360° ARC DISC) (MODEL NOS. 300-10-00COM)

Nozzle	psi	300 Series gpm	Radius
01	50	2.07	14
01	75	2.95	16
02	50	2.48	23
02	75	3.69	25
03	50	4.55	27
03	75	6.24	29
63	50	2.66	28
63	75	3.82	30
93	50	3.64	29
93	75	5.29	31
Omni (Min)	50	2.67	16
Omni (Min)	75	3.95	18
Omni (Max)	50	5.08	30
Omni (Max)	75	6.36	33

300 SERIES LAWN POP-UP APEX @ 50 PSI

Nozzle	Max. Ht. of Spray
01	27°
02	4' 10"
03	5' 11"
63	7' 0"
93	6' 3"

300 SERIES MULTI-STREAM ROTOR MODEL LIST

Model	Description
300-00-00	Lawn Pop-up without Nozzle
300-10-00	Shrub without Nozzle
300-10-00-COM	Shrub without Nozzle with Check Valve
300-12-00	12" High Pop without Nozzle

Specifying Information—300 Series Multi-Stream Rotor

3XX-XX-XX-COM-E

Arc 3XX	Body XX	Nozzle XX	Optional COM	Optional E
04—90° 05—112° 06—135° 07—157.5° 08—180° 09—202.5° 10—225° 12—270° 16—360°	00—Lawn Pop-up 10—Shrub 12—High Pop	01—Small Radius, 12 Ports 02—Medium Radius, 12 Ports 03—Large Radius, 12 Ports 15—Adjustable Shrub & Lawn Pop-up 63—Large Radius, 6 Ports, Low gpm* 93—Large Radius, 9 Ports, Low gpm*	COM—Check-O-Matic (COM available on shrub model only)	E—Effluent

Example: A 300 Series Shrub Sprinkler with a 90° arc and an adjustable nozzle, would be specified as: **304-10-15**

* Available on Lawn Pop-up and Shrub only.

TORO

T5 RAPIDSET® SERIES ROTORS

**WATER
SMART**

The Toro® T5 RapidSet rotor can be set in seconds. Engineered to use the slip clutch to adjust the arc, the T5 RapidSet rotor requires NO TOOLS for arc adjustments. Along with a five inch pop-up height of the Lawn model, the T5 RapidSet rotors feature exclusive Airfoil™ Technology standard and low angle nozzles that deliver class-leading distribution uniformity. Designed to save water, save time, and save money, the T5 RapidSet rotor is the only $\frac{3}{4}$ " rotor needed to get the job done.

FEATURES & BENEFITS

RapidSet® Arc Adjustment

Arc adjustments from 40° to 360° can be made quickly with a few twists of the turret – no tools required. The RapidSet slip clutch also protects against gear damage caused by intentional vandalism or inexperienced users.

Lawn Model with a 5" Pop-up Height

Fits in the same footprint as many competing 4" rotors for hassle-free retrofits, but delivers an extra inch of pop-up height, allowing the nozzle to clear tall grasses.

Airfoil™ Technology Nozzles

The T5 RapidSet rotor comes with a full set of 8 standard nozzles (25° trajectory) and 4 low angle (10° trajectory) nozzles that utilize proprietary Airfoil technology, which creates a zone of low pressure just below the main stream to gently guide water downward for unmatched uniformity without forcefully washing out newly-laid seeds.

Design Flexibility

T5 RapidSet rotors are available in Effluent, Shrub, and 12" High Pop models.



Effluent
Options
Available



Check
Valve
Options
Available



RapidSet® arc adjustment
requires NO TOOLS!

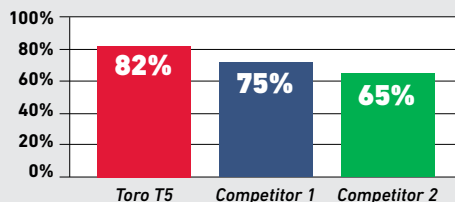


5" Pop-Up In A 4" Body

An extra 1" of pop-up height without the need for any additional digging.



Distribution Uniformity 3.0 Nozzle, 45 PSI, Square Spacing



Based on independently tested performance profiles from the Center for Irrigation Technology

T5 RAPIDSET® ROTOR MODEL LIST

Model	Description
T5P-RS	5" Lawn pop-up
T5PCK-RS	5" Lawn pop-up with check valve
T5PCK1.5-RS	5" Lawn pop-up with check valve, 1.5 gpm nozzle
T5PCK2.0-RS	5" Lawn pop-up with check valve, 2.0 gpm nozzle
T5PCK2.5-RS	5" Lawn pop-up with check valve, 2.5 gpm nozzle
T5S-RS	Shrub
T5SE-RS	Shrub, Effluent
T5HP-RS	12" High Pop
T5HPE-RS	12" High Pop, Effluent

LOW ANGLE NOZZLE PERFORMANCE DATA

Nozzle	psi	Radius	gpm	Precipitation Rate (in/hr) ▲ (in/hr) ■
1.0LA	25	25	0.74	0.26 0.23
	35	28	0.94	0.27 0.23
	*45	28	1.02	0.29 0.25
	55	29	1.14	0.30 0.26
	65	29	1.25	0.33 0.29
1.5LA	25	27	1.10	0.34 0.29
	35	30	1.35	0.33 0.29
	*45	31	1.52	0.35 0.30
	55	31	1.75	0.40 0.35
	65	31	1.90	0.44 0.38
2.0LA	25	29	1.40	0.37 0.32
	35	31	1.72	0.40 0.34
	*45	32	2.05	0.45 0.39
	55	33	2.25	0.46 0.40
	65	33	2.45	0.50 0.43
3.0LA	25	29	2.20	0.58 0.50
	35	33	2.60	0.53 0.46
	*45	34	3.05	0.59 0.51
	55	36	3.40	0.58 0.51
	65	36	3.70	0.63 0.55

*Recommended operating pressure. Data based on 180°.

SPECIFICATIONS

Operational

- Radius: 25 - 50 feet
- Flow rate: 0.74 - 9.70 gpm
- Arc: 40° to 360°, adjustable
- Inlet: 3/4" NPT
- Operating pressure range: 25-65 psi
- Recommended operating pressure: 45 psi
- Trajectory: 25° standard, 10° low angle
- Pop-up height: 5" (measured from top of cap to nozzle high-pop height opening)
- Factory installed 3.0 gpm nozzle (pre-installed 1.5, 2.0, and 2.5 gpm nozzle options available)

Dimensions

- Body Diameter:
- Lawn Pop-up: 2 1/4"
 - Shrub: 2 1/4"
 - High Pop: 2 1/4"
- Cap Diameter:
- Lawn Pop-up: 2 5/8"
 - Shrub: N/A
 - High Pop: 2 5/8"
- Height:
- Lawn Pop-up: 7 1/2"
 - Shrub: 7 3/4"
 - High Pop: 16 7/8"

Warranty

- Five years

T5 RAPIDSET NOZZLE PERFORMANCE DATA

Nozzle	psi	Radius	gpm	Precipitation Rate (in/hr) ▲ (in/hr) ■
1.5	25	33	1.15	0.23 0.20
	35	34	1.38	0.27 0.23
	*45	35	1.59	0.29 0.25
	55	35	1.74	0.32 0.27
	65	36	1.88	0.32 0.28
2.0	25	35	1.45	0.26 0.23
	35	36	1.80	0.31 0.27
	*45	37	2.12	0.34 0.30
	55	37	2.30	0.37 0.32
	65	37	2.58	0.42 0.36
2.5	25	35	1.75	0.32 0.28
	35	36	2.20	0.38 0.33
	*45	37	2.55	0.41 0.36
	55	37	2.80	0.45 0.39
	65	37	3.05	0.50 0.43
3.0 Standard	25	36	2.20	0.38 0.33
	35	38	2.60	0.40 0.35
	*45	40	3.05	0.42 0.37
	55	40	3.52	0.49 0.42
	65	40	3.80	0.53 0.46
4.0	25	37	2.95	0.48 0.41
	35	40	3.55	0.49 0.43
	*45	42	4.10	0.52 0.45
	55	42	4.45	0.56 0.49
	65	43	4.85	0.58 0.50
5.0	25	39	3.75	0.55 0.47
	35	41	4.50	0.60 0.52
	*45	43	5.10	0.61 0.53
	55	45	5.75	0.63 0.55
	65	45	6.10	0.67 0.58
6.0	25	39	4.20	0.61 0.53
	35	43	5.20	0.63 0.54
	*45	46	6.05	0.64 0.55
	55	47	6.65	0.67 0.58
	65	48	7.25	0.70 0.61
8.0	25	36	5.75	0.99 0.85
	35	43	7.10	0.85 0.74
	*45	47	8.05	0.81 0.70
	55	48	8.95	0.86 0.75
	65	50	9.70	0.86 0.75

*Recommended operating pressure. Data based on 180°.

Specifying Information—T5 RapidSet Rotor

T5XX CK X.X E-RS					
Description	Body	Optional	Custom Nozzles	Optional	
T5	XX	CK	X.X	E	-RS
T5—T5 RapidSet Series Rotor	P—Lawn Pop S—Shrub HP—High Pop	CK— Check Valve*	1.5—1.5 gpm 2.0—2.0 gpm 2.5—2.5 gpm	E—Effluent	RS— RapidSet*
Example: A T5 RapidSet Lawn Pop-up sprinkler with a 2.5 nozzle, would be specified as: T5P2.5-RS					

* Check Valve is standard on all shrub models



The 1" inlet Toro® T7 Series rotor is built rugged to withstand the performance and durability requirements of municipal/government, sports fields and large commercial settings. Driven by customer feedback, the T7 Series rotor has been designed and tested to ensure consistent performance and features a full 5" pop-up height, a visual top-of-rotor arc adjustment dial, and Smart Arc™ Memory that resets the rotor's arc should it be changed due to vandalism or inexperienced users. Further enhancing its versatility, the T7 Series is also available in Low Flow models for smaller radius, lower flow applications, such as baseball infields.

FEATURES & BENEFITS

Visual Arc Indication

Arc setting indicator on top of the rotor allows for easy wet or dry adjustments from 45°-360°.

High Efficiency Nozzles

Single port design ensures water is evenly distributed across the pattern without putting too much water near the head, which prevents seed from washing away.

Vandal and Abuse Resistance

Smart Arc™ memory safely returns sprinkler to previously set arc if vandalized. An integrated slip clutch prevents the breaking and stripping of gears.

Design Solutions and Safety

Standard check valve prevents low head drainage, and a minimal 2.2" exposed rubber cover diameter reduces the potential for injuries on play areas.

Durability

Heavy-duty retract spring and wiper seal reduce the occurrence of stick-ups and seal leakage, while a water-lubricated gear drive contributes to long-term consistent performance.



Effluent
Options
Available



SST Riser
Options
Available



Additional Features

- ✓ Standard reversible Check-O-Matic seal
- ✓ Variable reversing stator
- ✓ Included nozzle trees:
 - Low flow nozzles (2, 3, 4.5, 6, 7.5, and 9 gpm)
 - Standard nozzles (7, 9, 12, 16, 20, 24, and 27 gpm)
- ✓ Slip clutch
- ✓ Locking cap screw
- ✓ Adjustment/pull up tool included

NOZZLE PERFORMANCE DATA-HIGH FLOW MODELS

Nozzle	psi	Radius (ft)	gpm	Precip. Rate (in/hr) ▲	Precip. Rate (in/hr) ■
7.0	40	46	6.6	0.72	0.62
	50	47	7.4	0.75	0.65
	60	48	8.1	0.78	0.68
	70	49	8.8	0.82	0.71
	80	51	9.4	0.83	0.72
	90	52	10.3	0.85	0.73
	100	54	10.7	0.83	0.72
9.0	40	47	7.4	0.76	0.66
	50	50	8.3	0.73	0.64
	60	51	8.7	0.76	0.66
	70	52	9.4	0.81	0.70
	80	54	9.9	0.80	0.69
	90	55	10.9	0.82	0.71
	100	56	11.5	0.84	0.73
12.0*	40	50	9.5	0.89	0.77
	50	51	11.6	0.90	0.78
	60	53	12.7	0.91	0.79
	70	54	13.8	0.96	0.83
	80	55	14.7	0.99	0.86
	90	56	15.6	1.02	0.88
	100	57	16.5	1.04	0.90
16.0	40	53	13.0	1.06	0.92
	50	56	15.1	1.06	0.92
	60	58	16.2	1.04	0.90
	70	59	17.5	1.09	0.95
	80	61	18.8	1.10	0.95
	90	62	20.0	1.14	0.98
	100	63	21.1	1.17	1.01
20.0	40	53	16.0	1.28	1.10
	50	58	17.5	1.22	1.05
	60	60	19.5	1.21	1.05
	70	61	20.6	1.26	1.09
	80	65	22.2	1.19	1.03
	90	66	23.6	1.23	1.06
	100	67	24.8	1.25	1.09
24.0	40	52	15.8	1.27	1.10
	50	60	17.5	1.09	0.95
	60	63	19.3	1.11	0.96
	70	65	20.7	1.14	0.99
	80	67	22.3	1.15	1.00
	90	68	23.8	1.20	1.04
	100	71	25.3	1.16	1.01
27.0	40	55	18.7	1.42	1.23
	50	65	23.4	1.16	1.00
	60	71	23.6	1.05	0.91
	70	72	25.8	1.10	0.95
	80	73	27.4	1.14	0.99
	90	74	29.1	1.18	1.02
	100	75	30.6	1.21	1.05

T7 ROTOR MODEL LIST

Model	Description
T7P-02	1" Rotor
T7P-02E	1" Rotor, Effluent rubber cover
T7P-02L	1" Rotor, Low Flow
T7P-02LE	1" Rotor, Low Flow, Effluent rubber cover
T7PSS-02	1" Stainless Steel Rotor
T7PSS-02E	1" Stainless Steel Rotor, Effluent rubber cover
T7PSS-02L	1" Stainless Steel Rotor, Low Flow
T7PSS-02LE	1" Stainless Steel Rotor, Low Flow, Effluent rubber cover

SPECIFICATIONS

Operational

- Radius capability: Low flow models—39'-56'
Standard models—46'-75'
- Flow rates: Low flow models—1.7-12.8 gpm
Standard models—6.6-30.6 gpm
- Operating pressure range: 40-100 psi
- Recommended operating pressure: 60-70 psi
- Inlet size: 1" female NPT
- Nozzle trajectory: 25°
- Arc adjustment: 45°-360° (unidirectional at 360°)

Dimensions

- Pop-up height (measured from top of cap to nozzle): 5"
- Body height: 8.8"
- Body diameter: 2.7"
- Rubber cover diameter: 2.2"

Available Options

- Stainless Steel riser
- Effluent Lavender rubber cover

Warranty

- Five years

NOZZLE PERFORMANCE DATA-LOW FLOW MODELS

Nozzle	psi	Radius (ft)	gpm	Precip. Rate (in/hr) ▲	Precip. Rate (in/hr) ■
2.0	40	39	1.7	0.25	0.22
	50	39	2.0	0.29	0.25
	60	40	2.2	0.30	0.26
	70	40	2.4	0.33	0.28
	80	40	2.6	0.35	0.31
	90	41	2.7	0.36	0.31
	100	41	2.9	0.38	0.33
3.0*	40	39	2.4	0.36	0.31
	50	40	2.8	0.39	0.33
	60	41	3.1	0.41	0.36
	70	41	3.4	0.45	0.39
	80	42	3.6	0.46	0.40
	90	42	3.9	0.47	0.41
	100	43	4.1	0.49	0.42
4.5	40	38	4.1	0.63	0.54
	50	41	4.7	0.62	0.53
	60	41	5.2	0.68	0.59
	70	42	5.7	0.71	0.62
	80	42	6.1	0.77	0.66
	90	43	6.5	0.78	0.68
	100	43	6.9	0.83	0.72
6.0	40	43	5.0	0.59	0.51
	50	46	5.7	0.59	0.51
	60	48	6.3	0.61	0.52
	70	49	7.0	0.65	0.57
	80	49	7.4	0.68	0.59
	90	50	7.9	0.70	0.61
	100	50	8.4	0.74	0.64
7.5	40	44	5.8	0.66	0.58
	50	46	6.7	0.70	0.60
	60	48	7.4	0.71	0.62
	70	49	8.0	0.75	0.65
	80	50	8.8	0.78	0.67
	90	50	9.5	0.84	0.73
	100	52	10.0	0.81	0.70
9.0	40	45	7.4	0.81	0.70
	50	49	8.5	0.78	0.68
	60	51	9.4	0.80	0.70
	70	53	10.4	0.83	0.72
	80	55	11.3	0.83	0.72
	90	55	12.0	0.89	0.77
	100	56	12.8	0.90	0.78

* When the sprinkler is adjusted to 360°, it will be uni-directional in that direction of rotation (clockwise or counterclockwise) at the moment when the sprinkler was changed to 360°.

* Pre-installed nozzle. Data based on 180°.

Specifying Information—T7 Series

T7PXX-02XX			
Description	Optional	Thread	Optional
T7P	XX	02	XX
T7 Series Rotor	SS-Stainless Steel Riser	NPT Thread	E—Effluent L—Low Flow
Example: A low flow T7 Series rotor with a Stainless Steel riser and Effluent rubber cover would be specified as: T7PSS-02LE			



CHALLENGES OF SPORTS TURF MAINTENANCE

Toro offers a complete line of professional products from control systems to sprinklers and in-field monitoring systems that work together to provide optimal water-management solutions for all your sports field needs. We want to help you make your turf the best it can be – that's why Toro is committed to developing advanced and improved products that water more accurately, more efficiently, more dependably, and more affordably.

Our efforts don't stop at irrigation, though... from mowers to grooming equipment to aerators, Toro provides a complete sports field maintenance solution. And, through continued industry efforts like sponsorship of the Sports Turf Managers Association, we look forward to answering your needs as a sports field manager with innovative solutions for years to come.

As a Sports Field Manager, you face unique challenges and goals in landscape maintenance:

Appearance

Making sure your turf looks its best on game day, especially if it will be on national TV.

Playability

Ensuring peak team performance and maximizing player safety, while also minimizing potential liability.

Turf Health

Maintaining your turf in high-usage, short-recovery-window environments.

Water Use

Keeping the field in good condition while keeping your water costs down.

If your fields are surfaced with artificial grass, your irrigation needs are balanced with the goal of no infield disruption of the playing surface:

Wash Down

Ensuring sufficient coverage to clean the entire field.

Cool Down

Minimizing playing surface temperatures, especially in summer.

SPORTS FIELD AND ARTIFICIAL TURF SPRINKLERS

TORO



T7 Series
Radius: 40'-75'



640 Series
Radius: 47'-67'



TS90 Series
Radius: 53'-95'



690 Series
Radius: 87'-108'



TG101 Series
Radius: 91'-178'

SPORTS FIELD MANAGEMENT SOLUTIONS

TORO



Sentinel® Central Control

(Page: 100-106)

- ✓ PC-Based Water Management System
- ✓ Weather-Based Runtime Adjustment
- ✓ Advanced Reporting including Water Use & ET
- ✓ Flow Monitoring with Automatic E-mail Alert
- ✓ Sophisticated Scheduler/Optimizer Program
- ✓ Radio, Ethernet, Internet, & Cellular Communications



Turf Guard® Soil Monitoring System

(Page: 88)

- ✓ Turf Guard® Soil Monitoring System
- ✓ Wireless Soil Monitoring
- ✓ Soil Moisture, Temperature, & Salinity
- ✓ Web-based Reporting & Analysis
- ✓ Monitor up to 500 Sensors per System
- ✓ Ideal for Managing Playability of Sports Fields





Effluent
Options
Available



Check
Valve
Options
Available

Considered the most durable, heavy-duty commercial sprinkler available, the Toro® 640 Series is the proven veteran for athletic fields, parks, campuses and commercial sites.

FEATURES & BENEFITS

Normally Open Valve-In-Head Body

Allows individual head control - the only commercial grade Toro rotor available with this feature.

Standard Check Valve

Prevents low head drainage and keeps laterals charged with water.

Additional Features

- ✓ Standard rubber cover
- ✓ Vandal-resistant cap with locking set screw
- ✓ Small exposed surface diameter
- ✓ Gear drive design
- ✓ Basket filter screen



The 640 installs below grade for increased player safety.

SPECIFICATIONS

Operational

- Radius: 47' – 67'
- Flow Rate: 6.0 – 25.0 gpm
- Operating Pressure Range: 40-90 psi
- Trajectory: 27°
- Pop-up to nozzle: 2 3/8"
- Inlet: 1" female-threaded
- Below-grade installation: up to 1/2"
- Check-O-Matic maintains up to 15' elevation change
- Selection of five nozzles and 12 arcs
- Adjustment screw allows up to 25% radius reduction

Options Available

- Valve-In-Head Snap Ring Pliers (995-100)
- Valve Removal Tool (995-08)
- Valve Insertion Tool (995-35)
- Seal Installation Tool (995-37)
- Canister Removal Tool (995-42)
- Cap Removal Tool (996-51)
- #41 Fast Rotating Stator (35-0579)
- #42/43 Fast Rotating Stator (35-1011)

Dimensions

- Body diameter: 2 1/2"
- Cap diameter: 3 1/4"
- Body height:
 - Check-O-Matic – 9"
 - Valve-In-head – 10 1/2"
- Exposed surface diameter when buried 1/2" below grade: 1 3/4"

Warranty

- Five years

640 SERIES MODEL LIST STANDARD ARCS WITH CHECK-O-MATIC

Model	Description
BODY PACKAGE	
640-02	Check-O-Matic, NPT
640-52	Check-O-Matic, BSP
NOZZLE/STATOR SET	
641-40	#40 Nozzle & Stator
641-41	#41 Nozzle & Stator
641-42	#42 Nozzle & Stator
641-43	#43 Nozzle & Stator
641-44	#44 Nozzle & Stator
642-40E	#40 Nozzle & Stator
642-41E	#41 Nozzle & Stator
642-42E	#42 Nozzle & Stator
642-43E	#43 Nozzle & Stator
642-44E	#44 Nozzle & Stator
DRIVE ASSEMBLIES	
640-090	Drive Assembly, 90 Degrees
640-180	Drive Assembly, 180 Degrees
640-270	Drive Assembly, 270 Degrees

640 SERIES MODEL LIST

Model	Description
640-0XXX	Drive Assembly
640-10	Body Package, Valve-In-Head
640-20	Body Package, Check-O-Matic
640-XX	Nozzle and Stator
640-XXX	Nozzle and Stator, Effluent
STANDARD ARCS WITH CHECK-O-MATIC	
641-02-40	90° Arc, #40 Nozzle
641-02-41	90° Arc, #41 Nozzle
641-02-42	90° Arc, #42 Nozzle
641-02-43	90° Arc, #43 Nozzle
641-02-44	90° Arc, #44 Nozzle
642-02-40	180° Arc, #40 Nozzle
642-02-41	180° Arc, #41 Nozzle
642-02-42	180° Arc, #42 Nozzle
642-02-43	180° Arc, #43 Nozzle
642-02-44	180° Arc, #44 Nozzle
644-02-40	360° Arc, #40 Nozzle
644-02-41	360° Arc, #41 Nozzle
644-02-42	360° Arc, #42 Nozzle
644-02-43	360° Arc, #43 Nozzle
644-02-44	360° Arc, #44 Nozzle

640 SERIES PERFORMANCE DATA

Nozzle	psi	gpm	Radius	360°		270°		238°		192°		180°		173°	
				▲	■	▲	■	▲	■	▲	■	▲	■	▲	■
40	40	6.0	47	0.30	0.26	0.40	0.35	0.46	0.39	0.57	0.49	0.60	0.52	0.63	0.54
	50	6.7	50	0.30	0.26	0.40	0.34	0.45	0.39	0.56	0.49	0.60	0.52	0.62	0.54
	60	7.3	52	0.30	0.26	0.40	0.35	0.45	0.39	0.56	0.49	0.60	0.52	0.62	0.54
	70	8.0	53	0.32	0.27	0.42	0.36	0.48	0.41	0.60	0.52	0.63	0.55	0.66	0.57
	80	8.6	54	0.33	0.28	0.44	0.38	0.50	0.43	0.62	0.53	0.66	0.57	0.68	0.59
41	90	9.2	55	0.34	0.29	0.45	0.39	0.51	0.44	0.64	0.55	0.68	0.59	0.70	0.61
	40	9.5	48	0.46	0.40	0.61	0.53	0.69	0.60	0.86	0.75	0.92	0.79	0.95	0.83
	50	10.2	53	0.40	0.35	0.54	0.47	0.61	0.58	0.76	0.60	0.81	0.70	0.84	0.73
	60	11.0	54	0.42	0.36	0.56	0.48	0.63	0.55	0.79	0.68	0.84	0.73	0.87	0.76
	70	11.9	55	0.44	0.38	0.58	0.50	0.66	0.57	0.82	0.71	0.87	0.76	0.91	0.79
42	80	12.7	56	0.45	0.39	0.60	0.52	0.68	0.59	0.85	0.73	0.90	0.78	0.94	0.81
	90	13.4	57	0.46	0.40	0.61	0.53	0.69	0.60	0.86	0.74	0.92	0.79	0.95	0.83
	40	12.0	52	0.49	0.43	0.66	0.57	0.75	0.65	0.93	0.80	0.99	0.85	1.03	0.89
	50	12.9	55	0.47	0.41	0.63	0.55	0.72	0.62	0.89	0.77	0.95	0.82	0.99	0.85
	60	14.0	56	0.50	0.43	0.66	0.57	0.75	0.65	0.93	0.81	0.99	0.86	1.03	0.89
43	70	14.7	57	0.50	0.44	0.67	0.58	0.76	0.66	0.95	0.82	1.01	0.87	1.05	0.91
	80	15.8	58	0.52	0.45	0.69	0.60	0.79	0.68	0.98	0.85	1.04	0.90	1.09	0.94
	90	16.8	58	0.56	0.48	0.74	0.64	0.84	0.73	1.04	0.90	1.11	0.96	1.16	1.00
	40	13.2	56	0.47	0.41	0.62	0.54	0.71	0.61	0.88	0.76	0.94	0.81	0.97	0.84
	50	14.5	59	0.46	0.40	0.62	0.53	0.70	0.61	0.87	0.75	0.93	0.80	0.96	0.83
44	60	15.7	59	0.50	0.43	0.67	0.58	0.76	0.66	0.94	0.82	1.00	0.87	1.04	0.83
	70	17.0	61	0.51	0.44	0.68	0.59	0.77	0.67	0.96	0.83	1.02	0.88	1.06	0.92
	80	18.3	63	0.51	0.44	0.68	0.59	0.77	0.67	0.96	0.83	1.03	0.89	1.07	0.92
	90	19.4	64	0.53	0.46	0.70	0.61	0.80	0.69	0.99	0.86	1.05	0.91	1.10	0.95
	40	16.7	55	0.61	0.53	0.82	0.71	0.93	0.80	1.15	1.00	1.23	1.06	1.28	1.11
44	50	18.6	60	0.57	0.50	0.76	0.66	0.87	0.75	1.08	0.94	1.15	1.00	1.20	1.03
	60	19.9	61	0.59	0.52	0.79	0.68	0.90	0.78	1.12	0.97	1.19	1.03	1.24	1.07
	70	21.9	63	0.61	0.53	0.82	0.71	0.93	0.80	1.15	1.00	1.23	1.06	1.28	1.11
	80	23.4	65	0.62	0.53	0.82	0.71	0.93	0.81	1.16	1.00	1.23	1.07	1.28	1.11
	90	25.0	67	0.62	0.54	0.82	0.71	0.94	0.81	1.16	1.01	1.24	1.07	1.29	1.12

Nozzle	psi	gpm	Radius	148°		127°		108°		90°		60°		45°	
				▲	■	▲	■	▲	■	▲	■	▲	■	▲	■
40	40	6.0	47	0.73	0.64	0.85	0.74	1.01	0.87	1.21	1.05	1.81	1.57	2.42	2.09
	50	6.7	50	0.72	0.63	0.84	0.73	0.99	0.86	1.19	1.03	1.79	1.55	2.38	2.06
	60	7.3	52	0.73	0.63	0.85	0.74	1.00	0.75	1.20	1.04	1.80	1.56	2.40	2.08
	70	8.0	53	0.77	0.67	0.90	0.78	1.05	0.91	1.27	1.10	1.90	1.65	2.53	2.19
	80	8.6	54	0.80	0.69	0.93	0.80	1.09	0.95	1.31	1.14	1.97	1.70	2.62	2.27
41	90	9.2	55	0.82	0.71	0.96	0.83	1.13	0.98	1.35	1.17	2.03	1.76	2.71	2.34
	40	9.5	48	1.11	0.96	1.30	1.12	1.53	1.32	1.83	1.59	2.75	2.38	3.67	3.18
	50	10.2	53	0.98	0.85	1.14	0.99	1.34	1.16	1.62	1.40	2.42	2.10	3.23	2.80
	60	11.0	54	1.02	0.88	1.19	1.03	1.40	1.21	1.68	1.45	2.52	2.18	3.36	2.91
	70	11.9	55	1.06	0.92	1.24	1.07	1.46	1.26	1.75	1.52	2.62	2.27	3.50	3.03
42	80	12.7	56	1.09	0.95	1.27	1.10	1.50	1.30	1.80	1.56	2.70	2.34	3.60	3.12
	90	13.4	57	1.11	0.97	1.30	1.12	1.53	1.32	1.83	1.59	2.75	2.38	3.67	3.18
	40	12.0	52	1.20	1.04	1.40	1.21	1.64	1.42	1.97	1.71	2.96	2.56	3.95	3.42
	50	12.9	55	1.15	1.00	1.34	1.16	1.58	1.37	1.90	1.64	2.85	2.46	3.79	3.29
	60	14.0	56	1.21	1.05	1.40	1.22	1.65	1.43	1.99	1.72	2.98	2.58	3.97	3.44
43	70	14.7	57	1.22	1.06	1.42	1.23	1.68	1.445	2.01	1.74	3.02	2.61	4.03	3.49
	80	15.8	58	1.27	1.10	1.48	1.28	1.74	1.51	2.09	1.81	3.13	2.71	4.18	3.62
	90	16.8	58	1.35	1.17	1.57	1.36	1.85	1.60	2.22	1.92	3.33	2.89	4.44	3.85
	40	13.2	56	1.14	0.98	1.32	1.15	1.56	1.35	1.87	1.62	2.81	2.43	3.74	3.24
	50	14.5	59	1.13	0.97	1.31	1.14	1.54	1.34	1.85	1.60	2.78	2.41	3.71	3.21
44	60	15.7	59	1.22	1.06	1.42	1.23	1.67	1.45	2.01	1.74	3.01	2.61	4.01	3.47
	70	17.0	61	1.23	1.07	1.44	1.25	1.69	1.47	2.03	1.76	3.05	2.64	4.06	3.52
	80	18.3	63	1.25	1.08	1.45	1.25	1.71	1.48	2.05	1.78	3.08	2.66	4.10	3.55
	90	19.4	64	1.28	1.11	1.49	1.29	1.75	1.52	2.11	1.82	3.16	2.74	4.21	3.65
	40	16.7	55	1.49	1.29	1.74	1.50	2.04	1.77	2.46	2.13	3.68	3.19	4.91	4.25
44	50	18.6	60	1.40	1.21	1.63	1.41	1.91	1.66	2.30	1.99	3.45	2.99	4.60	3.98
	60	19.9	61	1.45	1.25	1.68	1.46	1.98	1.71	2.38	2.06	3.57	3.09	4.76	4.12
	70	21.9	63	1.49	1.29	1.74	1.53	2.04	1.84	2.45	2.13	3.68	3.19	4.91	4.25
	80	23.4	65	1.50	1.30	1.74	1.51	2.05	1.78	2.46	2.13	3.70	3.20	4.93	4.27
	90	25.0	67	1.50	1.30	1.75	1.52	2.06	1.79	2.48	2.15	3.72	3.22	4.95	4.29

*▲ Precipitation rates are for triangular spacing, shown in inches per hour, calculated at 50% of diameter.

*■ Precipitation rates are for square spacing, shown in inches per hour, calculated at 50% of diameter.

All performance specifications are based on the stated working pressure available at the base of the sprinkler. Radius shown in feet. **Note:** For the 640, differing arcs cannot be valved together.

Specifying Information—640 Series Rotor

640 X-X-4X-XXX-E					
Arc	Thread	Valve Type	Nozzle	Special Arc	Optional
X	X	X	X	XXX	E
0—Special Arc 1—90° 2—180° 3—270° 4—360°	0—NPT Thread 5—BSP Thread	1—Normally Open Valve-In-Head 2—Check-O-Matic	0 1 2 3 4	045° 060° 108° 127° 148° 173° 192° 238°	E—Effluent Model
Example: A 640 Series Sprinkler with a 90° arc, 40 nozzle and a check valve, would be specified as: 641-02-40					

Most 640 sprinklers are available in component parts only. Consult Res/Com Finished Goods Price List for a complete list of sprinklers available as finished goods.



For big open spaces, the Toro® TS90 provides unparalleled features and performance into a fully adjustable rotor. Designed for large turf areas, its radius of 53' to 95' is ideal for parks, sports fields, synthetic turf athletic fields and horse arenas. In addition, Toro patented TruJectory™ allows for the fine tuning of nozzle spray height from 7-30° to ensure wind resistance and head-to-head spacing.

FEATURES & BENEFITS

TruJectory™ Adjustment from 7° to 30°

Fine tunes nozzle spray height, helps provide true head-to-head coverage, and compensates for windy conditions.

Part- and Full-Circle in One Sprinkler

No need to inventory multiple models or service parts

Back Nozzle Capable

Perfect for perimeter of sports fields. Provides the flexibility for fine-tuning any watering requirement.

Ratcheting Riser

Allows you to adjust the riser position in the body without disassembling. Simply pull up the riser and ratchet it to the precise position you want to water.

Three Nozzle Configuration

Provides better distribution uniformity, nozzle flexibility and system efficiency.

Constant-Velocity Drive

Provides reliable rotation speed – from sprinkler to sprinkler.

TurfCup™ for Sports Fields

The optional TurfCup version seamlessly integrates into either natural grass or artificial turf sports fields, enhancing player safety, surface playability and field aesthetics.



Effluent
Options
Available





SPECIFICATIONS

Operational

- Radius: 53'-95' at 25° trajectory
- Flow Rate: 14.0-61.5 gpm
- Precipitation Rate: 0.6" per hour
- Arc: Full- and Part-circle in one
 - Full-circle: 360° unidirectional clockwise rotation
 - Part-circle: 40°-330°
- Rotation Speed: 3 minutes ± 30 seconds
- Inlet: 1" female-threaded (NPT or BSP)
- Operating pressure range: 40-100 psi

Dimensions

- Body Height: 10"
- Overall Height: 12 1/2"
- Retracted Height: 8 1/2"
- Pop-Up Height: 4"
- Exposed Cap Diameter: 2 1/4"

Options Available

- Effluent Cap (118-0063)
- Main Nozzle Tool (995-99)
- Intermediate nozzle and TruJectory™ tool (995-105)

Warranty

- Five years

TS90 SERIES MODEL LIST

Model	Description
TS90TP-02-14	#3 nozzle pre-installed (comes with #1, #2 and #4 nozzles)
TS90TP-02-58	#6 nozzle pre-installed (comes with #7, #5 and #8 nozzles)
TS90TP-02TC	#8 nozzle and TurfCup pre-installed (comes with #5, #6 and #7 nozzles)

Additional Features

- ✓ Full set of color-coded nozzles that thread directly into the nozzle port
- ✓ Rubber cover and below grade installation
- ✓ Check Valve standard – maintains up to 10' elevation
- ✓ Nozzle options: nine main, three intermediate, one inner

TS90TP NOZZLE PERFORMANCE DATA

Nozzle Set		Stator	50 psi		60 psi		70 psi		80 psi		90 psi		100 psi	
Number	Main/Intermediate		Radius (ft.)	Flow (gpm)	Radius (ft.)	Flow (gpm)	Radius (ft.)	Flow (gpm)	Radius (ft.)	Flow (gpm)	Radius (ft.)	Flow (gpm)	Radius (ft.)	Flow (gpm)
1	Yellow/Blue	102-1939 Yellow	53	14.0	54	15.2	55	16.4	55	17.4	54	18.5	56	19.4
2	Blue/Red		55	18.8	59	20.5	61	22.1	59	23.6	59	25.0	62	26.3
3	Brown/Orange		-	-	57	22.7	60	24.5	61	26.1	63	27.6	68	29.1
4	Orange/Orange		-	-	-	-	74	32.7	80	35.1	81	37.0	82	38.9
5	Green/Blue	102-1940 White	-	-	-	-	-	-	79	37.7	82	39.9	84	41.8
6	Gray/Blue		-	-	-	-	-	-	82	39.6	86	41.9	87	44.1
7	Black/Orange		-	-	-	-	-	-	80	43.6	87	46.2	84	48.6
8	Red/Blue		-	-	-	-	-	-	86	48.5	88	51.4	88	54.1
9	Beige/Blue	102-1941 White	-	-	-	-	-	-	85	55.1	91	58.3	95	61.6

Specifying Information—TS90TP

TS90TP-02 TC-X-E				
Arc	Threads	TurfCup™	Nozzle	Optional
TS90TP	02	TC	X	E
TS90TP—TS90TP 1" Rotor with TruJectory™	02—NPT	TC—TurfCup option	1, 2, 3, 4, 5, 6, 7, 8, 9	E—Effluent model

Example: A TS90 Series sprinkler with TruJectory, NPT threads, and with an 82' radius would be specified as: **TS90TP-02-58**





The Toro® TG101-NPT large-radius, gun-style sprinkler is ideal for applications that require long distance throw, such as irrigation solely from the perimeter of sports fields, or for cleaning and cooling artificial turf. It's unique, automatic braking system adjusts automatically to varying pressures or nozzle configurations, to ensure a steady rotation speed for uniform coverage.

FEATURES & BENEFITS

Innovative Drive System

Adjusts automatically, ensuring steady rotation and uniform coverage at varying pressures.

Excellent Uniformity

Using a single nozzle design (spreader nozzles not required).

Dispersed Jet Upon Start-Up

Reduces run-off and over-watering.

Self-adjusting Jet Breaker Device

To vary distribution at lower pressures or to increase close-in watering.

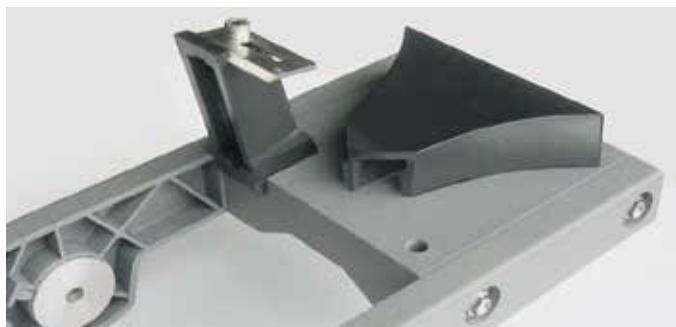
Low Maintenance

The TG101 is a very low maintenance gun-style sprinkler.



Energy Savings

The great versatility of the gun is further increased with the dynamic intermittent jet-breaker. It allows energy savings and reduction of system operating costs by running an irrigation system at lower pressures.





Low maintenance

The TG101's modern design contains no ball bearings, which can seize after prolonged contact with moisture and lead to mechanical failures.

Additional Features

- ✓ Powerful and efficient stream diffusion
- ✓ Standard 2" NPT thread connection
- ✓ High quality, durable construction
- ✓ Full or part-circle operation in one unit
- ✓ Adjustable rotation speed

SPECIFICATIONS

Operational

- Radius: 91-178 feet
- Flow Rate: 42-248 gpm
- Operating Pressure Range: 40-95 psi
- Trajectory: 24°
- Two standard nozzle options: 0.63" and .87" (additional range of nozzles available for specialty applications)

Warranty

- Two years



TG101-NPT PERFORMANCE DATA — 24° TRAJECTORY

Pressure psi	Nozzle 0.47"		Nozzle 0.55"		Nozzle 0.63"		Nozzle 0.71"		Nozzle 0.79"		Nozzle 0.87"		Nozzle 0.94"	
	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)	Flow gpm	Radius (ft.)
30			46.7	85.3	61.2	91.5	77.5	97.4	95.5	103.3	115.8	108.6	137.8	113.8
35			52.4	92.8	68.2	99.7	86.7	106.3	107.0	112.5	129.4	118.4	154.1	124.0
40	42.3	91.5	57.2	99.4	74.8	107.0	95.1	113.8	112.3	120.4	141.8	127.0	168.6	132.9
50	45.8	96.8	62.1	105.3	81.0	113.2	102.6	120.7	126.3	127.6	153.2	134.5	182.3	141.1
60	48.9	102.0	66.5	110.9	86.7	119.1	109.6	127.0	135.1	134.5	163.8	141.4	195.0	148.3
65	51.5	106.6	70.4	115.8	92.0	124.7	116.2	132.9	143.5	140.4	171.4	148.0	206.5	155.2
70	54.6	110.9	74.0	120.7	96.8	129.6	122.4	138.1	151.9	146.3	183.1	186.7	217.9	161.4
80	57.2	115.2	77.9	125.0	101.7	134.5	128.5	143.4	158.5	151.6	191.9	159.8	228.5	167.3
90	59.9	119.1	81.0	129.3	106.1	139.1	134.3	148.0	168.5	156.8	200.3	165.0	238.6	172.9
95	62.1	122.7	84.5	133.2	110.5	143.0	139.5	152.6	172.6	161.7	208.7	170.3	248.3	178.5

*Note: Products may not be available in all regions.
Please consult your Toro regional manager for availability.*

TG101 MODEL LIST

Model	Description
TG101-NPT	Large Radius Gun-Style Sprinkler, NPT
TG101-D912	0.47" Nozzle
TG101-D914	0.55" Nozzle
TG101-D916	0.63" Nozzle
TG101-D918	0.71" Nozzle
TG101-D920	0.79" Nozzle
TG101-D922	0.87" Nozzle
TG101-D924	0.94" Nozzle

Specifying Information—TG101

TG101-NPT-XX		
Description	Nozzle	
TG101-NPT	XX	
TG101-NPT—TG101 Sprinkler	16—16.0	24—24.0
	20—20.0	26—26.0
	22—22.0	28—28.0
Example: A TG101 sprinkler, part circle with a 16.0 nozzle, would be specified as: TG101-NPT-16		



Extremely rugged, the 690 Series is constructed of brass, stainless steel and commercial-grade plastics for unmatched performance in the most demanding environments.



SPECIFICATIONS

Operational

- Radius: 87' – 108'
- Flow Rate: 51.0 – 82.2 gpm
- Operating Pressure Range: 80-150 psi
- Pop-up height to nozzle: 3/4"
- Inlet: 1 1/2" NPT
- Check-O-Matic: Maintains 37' of elevation
- Electric Valve-In-Head Solenoid: 24 VAC, 50/60 Hz
 - Inrush: 60 Hz, 0.30 amps
 - Holding: 60 Hz, 0.20 amps
- All internal components serviceable from the top

Dimensions

- Body diameter: 10"
- Body height: 16"
- Weight: 5.6 lbs.

Warranty

- Three years

FEATURES & BENEFITS

Artificial Playing Surfaces

Radius and flow capabilities are perfect for cooling and rinsing artificial playing surfaces, such as football fields.

Electric Valve-In-Head Models

Provide individual head control that ensures run times can be set to match differing soil, turf and terrain watering requirements, pressure regulation to ensure all nozzles perform at the same pressure and manual ON-OFF-auto control at the head.

Fixed Arc Drives

Nine fixed arc drive assemblies ensure positive retention of the coverage area with no arc drift.

Balanced Application Rate

Used in single or double row applications, 690 Series sprinklers operate at a slower speed over the non-overlap area and a faster speed over the overlapped areas to provide a balanced application rate.

690 SERIES MODEL LIST

Model	Description
691	90° Part-circle sprinkler
692	180° Part-circle sprinkler
694	Full-circle sprinkler
696	Two-speed (60°-120°) sprinkler
698	Two-speed (180°-180°) sprinkler

690 SERIES PERFORMANCE CHART

Base Pressure	Nozzle Set 90		Nozzle Set 91		Nozzle Set 92	
	psi	Radius	gpm	Radius	gpm	Radius
80	87	51.0	96	61.2	100	74.0
100	90	57.1	100	73.5	108	82.2

*Radius shown in feet.
Sprinkler radius of throw per ASAE standard S398.1.*

Specifying Information—690 Series

69X-0X-XXX			
Arc	Valve-In-Head Type	Nozzle	Pressure Regulation*
69X	0X	XX	X
1—90° 2—180° 4—Full-circle 6—Full-circle, 2-speed (60°-120°) 8—Full-circle, 2-speed (180°-180°)	1—Normally Open Hydraulic 2—Check-O-Matic 6—Electric	90 91 92	8—80 psi 1—100 psi
Example: When specifying a 690 Series sprinkler with a 180° arc, electric Valve-In-Head, #91 nozzle, and pressure regulation at 80 psi, you would specify: 692-06-918			

**Electric models only.*

EFFLUENT WATER INDICATORS FOR 300 SERIES



89-7853

- Lavender cover for 300 Series Omni nozzle
- Use with part no. 300-15 (Omni Nozzle)



89-7854

- Lavender cover for 300 Series Omni nozzle High-Pop models
- Use with part no. 300-25 (Omni Nozzle)



89-7889

- Lavender plug for 300 Series with fixed-radius nozzles

NOZZLES



T7 Nozzle Tree 102-2633



T5 Nozzle Tree Kit 102-7712

- 20 nozzle trees per bag

INSTALLATION/ADJUSTMENT TOOLS



Mini 8 Adjustment Tool 102-2024



T5 Rotor Check Valve Kit 102-7714

- 20 valve seals per bag



T5 and T7 Rotor Adjustment Tool 102-6527



995-51

- Pressure gauge kit



995-50

- Pilot tube



995-49

- 0-200 psi pressure gauge hermetically sealed shake resistant-free



995-01

- Flow gauge

INSTALLATION/ADJUSTMENT TOOLS FOR 640 SERIES



995-07

- VIH pliers



995-08

- Valve removal tool
- Designed for quick removal of valve assembly from body



995-42

- Canister removal tool



996-51

- Cap removal tool



995-37

- Seal installation tool



995-35

- Valve insertion tool
- Designed for accurate one-step insertion of valve assembly and snap ring



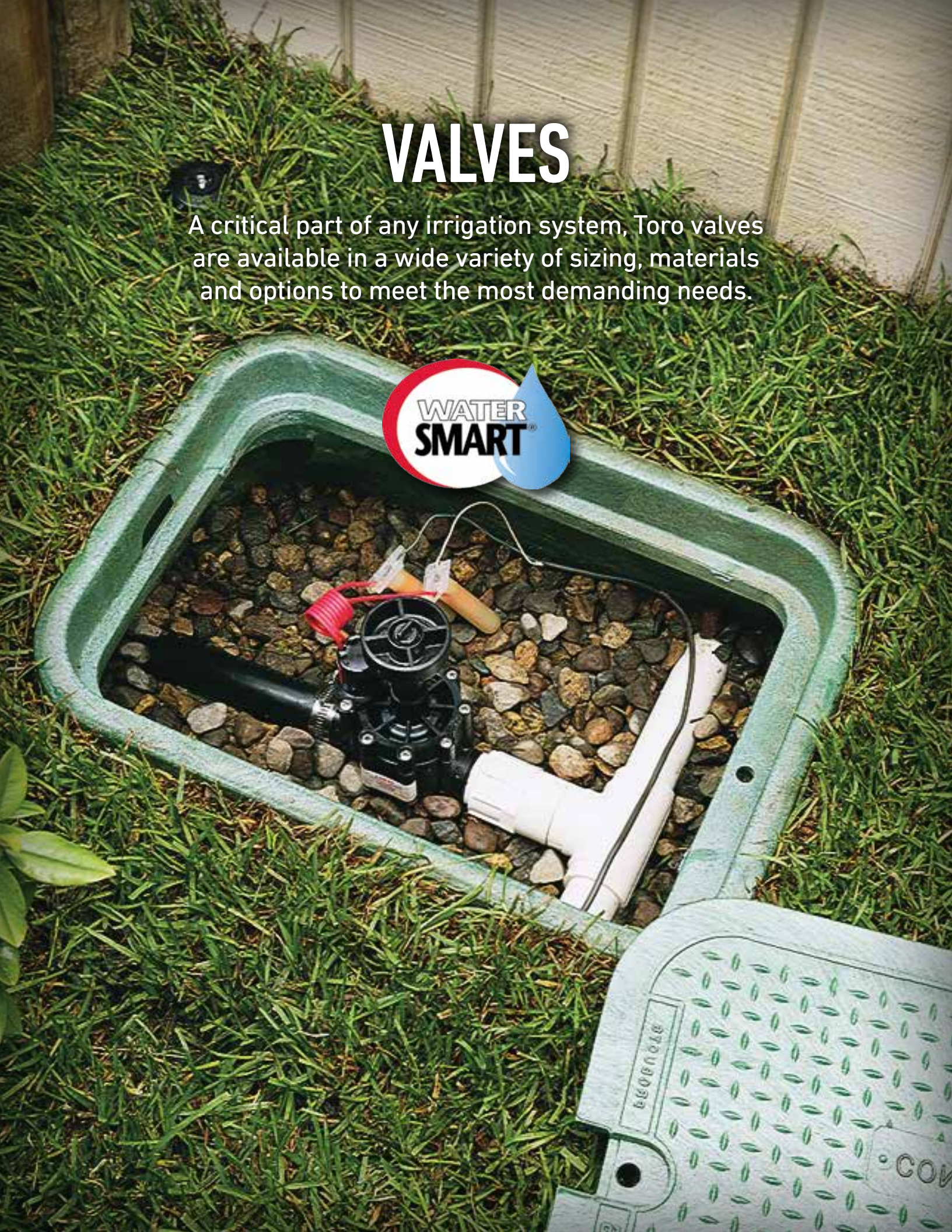
995-33

- 1/16 Allen screwdriver



VALVES

A critical part of any irrigation system, Toro valves are available in a wide variety of sizing, materials and options to meet the most demanding needs.





Heavy Duty, Hardworking & Built to Last



Model	Flow Range	Pressure Range	Sizes	Configurations	Material
EZ-Flo® Plus Page 52-53	.025-30 gpm	10-150 psi Max	3/4" 1"	Angle Anti-Siphon Inline/Globe	PVC Glass-filled Polypropylene
TPV Series Page 54-55	0.1- 40 gpm	10-175 psi Max	1"	Inline/Globe	PVC
250/260 Series 254/264 Series Page 56-57	0.25-30 gpm	10-150 psi Max	3/4" (254/264 only) 1"	Inline/Globe	ABS Glass-filled Nylon
252 Series Page 58-59	5.0-150 gpm	20-150 psi Max	1" 1 1/2" 2"	Angle Inline/Globe	Glass-filled Nylon
P-220 Series Page 60-61	5.0-300 gpm	10-220 psi Max	1" 1 1/2" 2" 3"	Angle Inline/Globe	Glass-filled Nylon
P-220 Scrubber Page 62-63	5.0-300 gpm	10-220 psi Max	1" 1 1/2" 2" 3"	Angle Inline/Globe	Glass-filled Nylon
220 Brass Series Page 64-65	5.0-350 gpm	10-220 psi Max	1" 1 1/4" 1 1/2" 2" 2 1/2" 3"	Angle Inline/Globe	Brass
Quick Coupler Series Page 66	1.5-8.0 gpm	150 psi Max	3/4" 1"	—	Stainless Steel Brass
Valve Accessories Electric-Hydraulic Converters Page 67	—	—	—	—	—



The name says it all. Easy to install, and even easier to service, Toro® EZ-Flo® Plus Series valves are available in a comprehensive range of in-line or anti-siphon configurations that provide design and retrofit flexibility for any residential application. The EZ-Flo valves' heavy duty jar top designs make servicing fast and simple without the need for removing screws or fasteners. Constructed of corrosion- and UV-resistant commercial grade PVC and glass-filled nylon, all EZ-Flo Series valves feature double-beaded chloramine- and ozone-resistant Santoprene® leak-proof diaphragms, manual external bleed screws, and fully encapsulated solenoids. Robust construction, reliable operation, and jar-top designs that make for tool-free access for servicing – it couldn't be easier.

FEATURES & BENEFITS

Jar-Top Design

No screws or fasteners means fast and easy servicing without the need for tools.

PVC, Glass-Filled Nylon and Stainless Steel Construction

Helps provide longer service life and leak protection in nearly any environment.

Double-beaded, Chloramine- and Ozone-Resistant Santoprene® Diaphragm

Ensures a consistent, leak-proof seal up to 150 psi.

In-Line or Anti-Siphon Models

Comprehensive range of options for new or retrofit installations.

*Santoprene is a registered trademark of the Monsanto Company

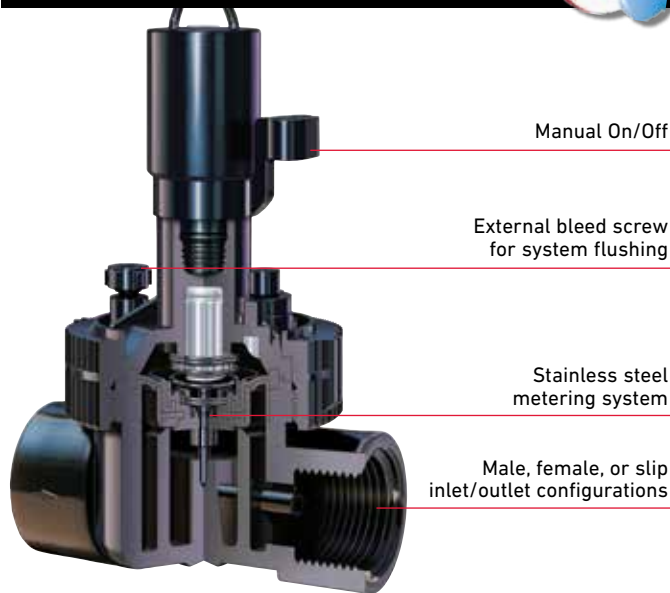


Effluent
Options
Available



DC Latching
Solenoid
Option

WATER MANAGEMENT HIGHLIGHT



Flow Control

The precise flow control with ergonomic handle allows fine tuning of the downstream pressure to prevent pressure spikes that damage sprinklers and moderate high pressures that cause misting and poor nozzle performance.

FRICTION LOSS DATA (measured in pressure loss, psi)

Size	Model	gpm Flow					
		0.25	5	10	15	20	30
1"	In-line	2.0	3.5	4.0	3.0	3.3	6.2
1"	Anti-siphon	2.0	2.1	3.1	2.3	3.8	8.1
¾"	Anti-siphon	2.0	4.2	4.2	4.8	7.6	—

SPECIFICATIONS

Operational

- Flow Range:
 - ¾" – 0.25 – 20 gpm
 - 1" – 0.25 – 30 gpm
- Operating Pressure: 10-150 psi
- Encapsulated solenoid with captured hex plunger, 24 VAC (102-7053):
 - Inrush current, 0.4 amps
 - Holding current, 0.2 amps

Dimensions

- Female Globe: 5 ½" H x 3" W x 4" L
- Male Globe: 5 ½" H x 3" W x 5 ½" L
- Anti-Siphon: 6" H x 3" W x 6 7/8" L

Available Parts & Accessories

- Potted DC Latching Solenoid (DCLS-P)
- Effluent Solenoid Assembly and Tag (EFF-KIT-60HZ)

Warranty

- Five years

EZ-FLO® PLUS JAR-TOP SERIES MODEL LIST

Model	Description
AC SOLENOIDS	
EZF-29-03	¾" Electric, NPT, Anti-siphon with Flow Control
EZF-29-04	1" Electric, NPT, Anti-siphon with Flow Control
EZF-20-04	1" Electric, Slip with Flow Control
EZF-26-04	1" Electric, Female NPT with Flow Control
EZF-21-04	1" Electric, Male x Male NPT with Flow Control
EZF-25-04	1" Electric, Male x Barb NPT with Flow Control
EZF-00-04	1" Electric, Slip without Flow Control
EZF-06-04	1" Electric, Female NPT without Flow Control
EZF-01-04	1" Electric, Male x Male NPT without Flow Control
EZF-05-04	1" Electric, Male x Barb NPT without Flow Control
DC SOLENOIDS	
EZF-20-94	1" Electric, Slip, with DC Latching Solenoid and Flow Control
EZF-26-94	1" Electric, Female, NPT, with DC Latching Solenoid and Flow Control
EZF-21-94	1" Electric, Male x Male NPT with DC Latching Solenoid and Flow Control
EZF-25-94	1" Electric, Male x Barb NPT with DC Latching Solenoid and Flow Control

Specifying Information—EZ-Flo® Plus Valve

EZF XX-XX			
Model	Flow Control	Body Style	Size
EZF	X	X	XX
EZF—EZ-Flo® Plus Valve	0—Without 2—With	0—1" Slip x Slip 1—1" Male x Male NPT 5—Male NPT x Barb 6—1" Female NPT 9—Anti-siphon	03—¾" 04—1" 94—1" with DCLS-P (flow control models only)

Example: A 1" EZ-Flo Plus Valve with slip configuration and flow control would be specified as: **EZF-20-04**





The search for a full-featured yet economically priced, residential and commercial valve is over thanks to Toro's 1" valve offering—the TPV Series. These full-featured, rugged, debris-resistant valves range in flow from 0.1 to 40 GPM, making them ideal for everything from drip to high-flow residential and light-commercial applications.

FEATURES & BENEFITS

Double-Beaded, Chloramine and Ozone-Resistant Santoprene® Diaphragm

Ensures a consistent, leak-proof seal all the way up to 175 psi.

Multiple Body Styles

Choose from various styles to meet any installation requirement.

Wide Range of Flows and Pressure

Comprehensive product line to meet the needs of any site.

Robust Solenoid Design

Ensures reliable opening and closing.



Glue Stop™

TPV Slip x Slip models include this patented feature that ensures the installer cannot block the downstream port of the valve during installation with primer and cement.



Effluent
Options
Available



DC Latching
Solenoid
Option

WATER MANAGEMENT HIGHLIGHT



Flow Control

The precise flow control with ergonomic handle allows fine tuning of the downstream pressure to prevent pressure spikes that damage sprinklers and moderate high pressures that cause misting and poor nozzle performance.

TPV SERIES MODEL LIST

Model	Description
AC SOLENOIDS	
TPV100	1" Female NPT, In-Line, without Flow Control
TPVF100	1" Female NPT, In-Line, with Flow Control
TPV100MM	1" Male Thread x Male Thread, In-Line, without Flow Control
TPVF100MM	1" Male Thread x Male Thread, In-Line, with Flow Control
TPV100S	1" Slip x Slip, In-Line, without Flow Control
TPVF100S	1" Slip x Slip, In-Line, with Flow Control
TPV100MB	1" Male Thread x Barb, In-Line, without Flow Control
TPVF100MB	1" Male Thread x Barb, In-Line, with Flow Control
DC SOLENOIDS	
TPVF100DC	1" Female NPT, In-Line, with Flow Control, DCLS-P
TPVF100MMDC	1" Male Thread x Male Thread, In-Line, with Flow Control, DCLS-P
TPVF100SDC	1" Slip x Slip, In-Line, with Flow Control, DCLS-P
TPVF100MBDC	1" Male Thread x Barb, In-Line, with Flow Control, DCLS-P

SPECIFICATIONS

Operational

- Flow Range: 0.1 to 40 gpm
- Operating Pressure: Electric – 10 to 175 psi
- Burst pressure safety rating: 525 psi
- Solenoid: 24 VAC (50/60 Hz) Standard
 - Inrush: 0.4 amps
 - Holding: 0.2 amps

Dimensions

- 5 1/8" H x 2 3/4" W x 5" L

Options Available

- Effluent Water Solenoid Assembly and Watering Tag (EFF-Kit-60Hz)
- Potted DC Latching Solenoid Assembly (DCLS-P)

Warranty

- Five years

Additional Features

- ✓ Patented Debris Bypass System (DBS™) technology
- ✓ Operates in low-flow and landscape drip applications when a filter is installed upstream (see page 127)
- ✓ Built with either AC or DC Latching Solenoids
- ✓ Manual operation without the use of a controller—internal and external bleed
- ✓ Captured hex/Phillips screws
- ✓ Optional flow control allows precise zone adjustment and manual shutoff
- ✓ Encapsulated injection-molded solenoid with a captured plunger
- ✓ Removable flow control handle to ensure vandal-resistance
- ✓ Self-aligning bonnet permits fast and easy servicing

TPV FRICTION LOSS DATA

gpm Flow	.10	.25	5	10	15	20	30	40
psi Loss	2.0	2.0	3.5	3.9	3.0	3.3	7.0	13

Specifying Information—TPV Series Valves

TPVF100XXXX				
Model	Flow Control	Size	Body Style	Optional
TPV	E	100	XX	XX
TPV—TPV Valve	F—With Flow Control	100—1"	MM—Male X Male S—Slip MB—Male X Barb	DC—DCLS-P Latching Solenoid

Example: A 1" TPV Valve with slip configuration and flow control would be specified as: **TPVF100S**





Heavy duty. Hard-working. The Toro® 250/260 and 254/264 Series globe-style valves are made to withstand all that a large residential or light commercial application can dish out. The durable and dependable, glass-filled Zytel®* bonnet and body construction allows these valves to be rated up to 150 psi, and are available in various inlet/outlet configurations meant to meet contractors' unique preferences. The 1" inlet/outlet 250/260 Series valves feature female inlets with female or barbed outlets available in electric, hydraulic or pin-type styles, while the 254/264 Series valves are electric valves with male inlets and male or barbed outlets available in ¾" or 1" sizes.

FEATURES & BENEFITS

Heavy-Duty Toro Solenoid

Provides dependable operation and long life.

Optional Flow Control

Allows the ability to adjust the flow of each zone.

Comprehensive Inlet and Outlet Choices

Flexibility for new installations and retrofit projects.

Single-Piece Rubber Diaphragm

For reliable, leak-tight closing.

Tough, Glass-Filled Zytel® Bonnet And Body

Durable construction that provides years of reliable operation.

*Zytel is a registered trademark of E. I. du Pont de Nemours and Company

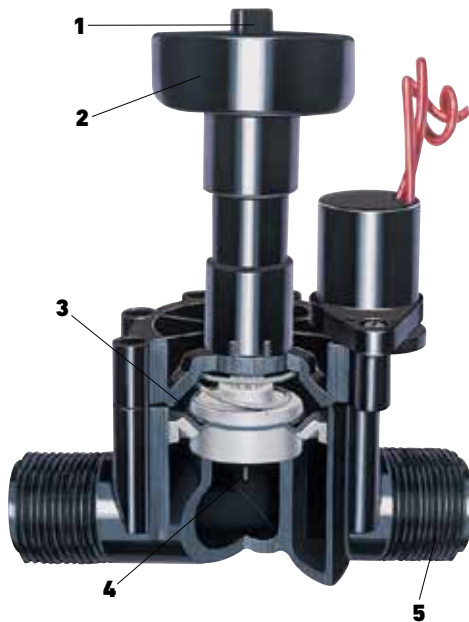
Additional Features

- ✓ Manual flow control adjustable to zero flow
- ✓ Self-cleaning, stainless steel metering pin
- ✓ External manual bleed
- ✓ 18" lead wires (electric)
- ✓ Low in-rush solenoid



Effluent
Options
Available

254 MALE X MALE VALVE



1. Manual bleed screw
2. Optional flow control
3. Single-piece rubber diaphragm
4. Stainless-steel metering pin
5. Tough, glass-filled cap and body

254/264 SERIES FRICTION LOSS DATA

Size	Model	gpm Flow											
		.5	1	2	5	10	15	20	25	30	35	40	45
3/4"	Electric	<1.0	<1.0	<1.0	1.5	3.0	6.5						
1"	Electric				2.0	2.0	2.3	3.1	4.0	5.4	7.0	8.7	10.5

Note: For optimum sprinkler performance when designing a system, calculate total friction loss to ensure sufficient downstream pressure. Flow rates are recommended not to exceed 5 psi loss. Values are listed in psi.

250/260 SERIES FRICTION LOSS DATA

Size	Model	gpm Flow							
		0.5	10	15	20	25	30	40	
1"	Hydraulic	<1.0	1.0	2.0	3.0	4.0	6.0	9.5	
1"	Electric		4.4	4.5	5.0	5.0	7.0	9.5	

SPECIFICATIONS

Operational

- Recommended flow range:
 - 3/4": 0.25 to 15.0 gpm
 - 1": 5.0 to 30.0 gpm
- Operating Pressure
 - 3/4": 10 to 150 psi
 - 1": 20 to 150 psi
- Solenoid: 24 VAC
 - 3/4": Inrush: 0.25 amps, 6.00 VA; Holding: 0.19 amps, 4.56 VA
 - 1": Inrush: 0.30 amps, 7.20 VA; Holding: 0.20 amps, 4.80 VA
- Burst pressure safety rating: 380 psi

Options Available

- Effluent Water Valve Flow Control Knob (89-7855)

Dimensions

- 3/4": 3" H x 4" W
- 1" 250 & 254 (with flow control): 6" H x 4 1/2" W
- 1" 260 & 264 (without flow control): 4 1/2" H x 4 1/2" W

Warranty

- Two years

250/260 SERIES MODEL LIST

Model	Description
FEMALE THREADS	
250-06-04	1" Female NPT, In-line, with Flow Control
260-06-04	1" Female NPT, In-line, without Flow Control
250-00-04	1" Female NPT, In-line, Pin-type Hydraulic, with Flow Control
250-01-04	1" Female NPT, In-line, Normally Open Hydraulic, with Flow Control
MALE THREADS	
264-06-03	3/4" Male Thread x Male Thread, In-Line, without Flow Control
254-06-04	1" Male Thread x Male Thread, In-Line, with Flow Control
264-06-04	1" Male Thread x Male Thread, In-Line, without Flow Control
254-16-04	1" Male Thread x Barbed Insert, In-Line, with Flow Control
264-16-04	1" Male Thread x Barbed Insert, In-Line, without Flow Control

Specifying Information—250/260 Series Valves

2X0-0X-04		
Flow Control	Activation Type	Size
2X0	0X	04
5—with Flow Control 6—without Flow Control	0—Pin-type Hydraulic 1—Normally Open Hydraulic 6—Electric	04—1"

Example: A 1" 250 Series Valve with flow control and electric activation would be specified as: **250-06-04**

Note: DC Latching Solenoid not available.

Specifying Information—254/264 Series Valve

2X4-X6-0X		
Flow Control	Body Style	Size
2X4	X6	0X
5—with Flow Control 6—without Flow Control	0—Male Thread x Male Thread 1—Male Thread x Barbed Insert	3—3/4" 4—1"

Example: A 1" electric 264 Series Valve without flow control with a barb would be specified as: **264-16-04**

Note: DC Latching Solenoid not available.

Toro® 252 Series valves are built tough and ready to withstand the harshest conditions in any commercial application. With several configurations to choose from, 252 Series valves are available in electric or hydraulic, 1", 1.5" and 2" globe/angle models with flow control. Offering the same glass-filled cap and body construction as the 250/260 Series, these valves are also rated up to 150 psi. Each valve diaphragm is a single piece and made with fabric-reinforced rubber for long-term tear and stretch tolerance. All models are female inlet/outlet NPT and their durable plastic construction makes them an economical option for commercial applications.

FEATURES & BENEFITS

Heavy-Duty Toro Solenoid

Provides dependable operation and long life.

Fabric-Reinforced Rubber Diaphragm

Provide long-term resistance to tears and stretches.

Flow Control Handle

Adjusts the flow of each zone on a system.



Robust ABS Material

Ensures the valve can withstand high pressures and flow without compromise.

Additional Features

- ✓ 24" lead wires 1½" and 2" electric or 18" lead wires 1" electric
- ✓ Self-cleaning, stainless steel metering pin (electric)
- ✓ Tough, glass-filled bonnet
- ✓ Single-piece diaphragm



Effluent
Options
Available

WATER MANAGEMENT HIGHLIGHT



External Bleed

The external bleed allows manual operation of the valve without electrically charging the solenoid. System flushing can also be accomplished using the external bleed with debris and other material being flushed out of the port.

252 SERIES MODEL LIST

Model	Description
FEMALE NPT GLOBE/ANGLE WITH FLOW CONTROL	
252-06-04	1"
252-26-06	1 1/2"
252-26-08	2"
252-21-06	1 1/2" Normally Open
252-21-08	2" Normally Open

252 SERIES FRICTION LOSS DATA

Size	Type	Config.	gpm Flow												
			5	10	20	25	30	40	50	60	70	80	100	120	150
1 1/2"	Hydraulic	Globe				1.0	1.0	2.0	3.0	4.0	5.5	6.5			
		Angle				1.0	1.0	1.5	1.5	3.0	4.0	5.0			
2"	Hydraulic	Globe								1.5	2.0	2.0	3.5	5.0	8.0
		Angle								1.0	1.0	1.5	2.0	3.0	5.0
1"	Electric	Globe	3.0	4.0	5.0	6.0	7.0	9.5							
		Angle	2.0	3.5	4.5	4.5	5.0	7.5							
1 1/2"	Electric	Globe				1.5	1.0	2.0	3.0	4.0	5.0	7.0			
		Angle				1.5	1.0	1.5	2.0	3.0	3.0	5.0			
2"	Electric	Globe								2.0	2.0	2.5	3.5	5.5	8.0
		Angle								1.0	1.0	2.0	3.0	4.0	5.0

Note: For optimum performance when designing a system, be sure to calculate total friction loss to ensure sufficient downstream pressure. For optimum regulation performance, size regulating valves toward the higher flow ranges. Flow rates are recommended not to exceed 5 psi loss.

■ = Debris-resistant models

Specifying Information—252 Series Valves

252-XX-0X		
Model	Activation Type	Size
252	XX	0X
252—252 Series Valve	06—1" Electric 21—Normally Open Hydraulic 26—1 1/2" or 2" Electric	4—1" 6—1 1/2" 8—2"

Example: A 1 1/2" electric 252 Series Valve, would be specified as: **252-26-06**

Note: DC Latching Solenoid not available.

SPECIFICATIONS

Operational

- Recommended Flow Range:
 - 1": 5.0 to 25 gpm
 - 1 1/2": 25 to 70 gpm
 - 2": 60 to 150 gpm
- Operating Pressure: 20 to 150 psi
- Solenoid: 24 VAC, 50/60 Hz
 - Inrush: 0.30 amps, 7.20 VA
 - Holding: 0.20 amps, 4.80 VA
- Burst pressure safety rating: 750 psi

Options Available

- Effluent Water Indicator Flow Control Knob (89-7855)

Dimensions

- 1": 6 3/4" H x 4 1/2" W
- 1 1/2": 7 3/4" H x 6" W
- 2": 9 1/2" H x 7" W

Warranty

- Two years



Globe and Angle In One Valve
The all-in-one globe and angle configuration allows flexibility in design and installation.

Angle installations allow for less friction loss across the piping system while globe configurations are standard in many irrigation systems.





For proven reliability in the field, the Toro® P-220 Series valves deliver. Constructed of heavy-duty, glass-filled nylon material, these valves are ready to consistently withstand pressures up to 220 psi.

FEATURES & BENEFITS

Durable Glass-Filled Nylon

Ensures the P-220 can operate at pressures up to 220 psi.

Precise Pressure Control Option

Compact EZReg® dial-design technology can be factory or field installed and does not require the removal of the solenoid.

External Manual Bleed

Keeps valve box dry and easy to use.

Standard Schrader Valve at Outlet

Simple verification of downstream pressure.

Optional Spike Guard™ Solenoid

Reduces wire size requirements, allows twice as many valves to run simultaneously on a transformer, and lowers power costs with a lightning rating exceeding 20,000 volts.

Filter Screen On 2" and 3" Models

Allows for upstream filtration of water to ensure no clogging occurs inside the valve.

Flow Control Handle

Adjusts the flow of each zone on a system.



Effluent
Options
Available



Pressure
Regulation



DC Latching
Solenoid
Option

WATER MANAGEMENT HIGHLIGHT



Pressure Regulator
The EZReg® module can regulate flows as low as 5 gpm with a 1" valve and only requires 10 psi differential to operate. The pressure regulator can be easily and quickly installed—even under pressure—with no danger of water geysers.

SPECIFICATIONS

Operational

- Flow Range:
 - 1": 5 to 40 gpm
 - 1 1/2": 30 to 100 gpm
 - 2": 80 to 180 gpm
 - 3": 150 to 300 gpm
- Operating Pressure
 - 1" & 1 1/2" Models: 10 to 220 psi
 - 2" & 3" Models: 20 to 220 psi
- Pressure regulating:
 - Outlet (EZR-30): 5 to 30 psi ± 3
 - Outlet (EZR-100): 5 to 100 psi ± 3
- Minimum pressure differential (between inlet and outlet) for pressure regulation: 10 psi
- Body styles:
 - Globe/Angle – 1", 1 1/2", 2" & 3" female threads
- 118-5982 Solenoid: 24 VAC (50/60 Hz) Standard
 - Inrush: 60 Hz: 0.4 amps
 - Holding: 60 Hz: 0.2 amps

Options Available

- EZReg®, 5–30 psi Regulator Module (EZR-30)
- EZReg®, 5–100 psi Regulator Module (EZR-100)
- Effluent Water (Lavender) Solenoid Assembly (24 VAC, 60 Hz) and Warning Tag (EFF-KIT-60Hz)
- Solenoid: 24 VAC (50/60 Hz) Standard (118-5982)
- Potted DC Latching Solenoid Assembly (DCLS-P)
- Spike Guard™ Solenoid: 24 VAC (50/60 Hz) (SGS-12)

Dimensions

- 1": 6 3/4" H x 3 5/8" W
- 1 1/2": 7 1/4" H x 3 5/8" W
- 2": 9 1/2" H x 6 1/8" W
- 3": 10 3/4" H x 6 1/8" W

Warranty

- Five years

P-220 SERIES MODEL LIST

Model	Description	
WITH PRE-INSTALLED LATCHING SOLENOIDS		
P220-26-04	1" In-line, Angle	P220-26-94
P220-26-06	1 1/2" In-line, Angle	P220-26-96
P220-26-08	2" In-line, Angle	P220-26-98
250-01-04	3" In-line, Angle	P220-26-90
PRESSURE-REGULATED WITH EZ REG® WITH PRE-INSTALLED LATCHING SOLENOIDS		
P220-27-04	1" In-line, Angle	P220-27-94
P220-27-06	1 1/2" In-line, Angle	P220-27-96
P220-27-08	2" In-line, Angle	P220-27-98
P220-27-00	3" In-line, Angle	P220-27-90

Additional Features

- ✓ Tough glass-filled nylon and stainless steel construction
- ✓ No external tubing for either pressure-regulating model
- ✓ Self-aligning bonnet to ensure correct installation
- ✓ Self-cleaning, stainless steel metering rod
- ✓ Low-flow capability down to 5 gpm with EZReg®
- ✓ Low-power requirement for longer wire runs

P-220 SERIES FRICTION LOSS DATA

Size	Config.	gpm Flow																							
		5	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	180	200	225	250	275	300		
1"	Globe Angle	4.00 4.00	4.20 4.20	3.20 3.10	4.10 2.70	7.20 4.80																			
1 1/2"	Globe Angle				1.60 2.30 1.30	2.30 1.60	3.60 2.80	5.20 4.00	7.00 5.50	9.20 7.10	11.20 8.90	13.60 10.90	16.40 13.50												
2"	Globe Angle									2.10 1.20	2.70 1.60	3.30 2.00	4.00 2.40	4.80 2.80	5.60 3.30	6.50 3.90	7.50 4.40	8.70 5.20							
3"	Globe Angle																2.50 1.90	3.00 2.40	4.10 3.30	5.30 4.30	6.70 5.50	8.30 6.90	10.10 8.50		

Note: For optimum performance when designing a system, be sure to calculate total friction loss to ensure sufficient downstream pressure. For optimum regulation performance, size regulating valves toward the higher flow ranges. Flow rates are recommended not to exceed 5 psi loss.

Specifying Information—P-220 Series Valves

P220-2X-X-X			
Model	Activation Type	Solenoid	Size
P220	2X	X	X
P220—P-220 Series Plastic Valve	26—NPT, Electric 27—NPT, Pressure-regulated EZR-100 (Standard)	0—Standard Solenoid 9—DC Latching Solenoid	4—1" 6—1 1/2" 8—2" 0—3"

Example: A 1" P-220 Series plastic electric, pressure-regulating valve would be specified as: **P220-27-04**



True dirty water irrigation valves, the Toro® P-220S Scrubber Series valves are built to handle chlorine, chloramine, and other chemicals found in reclaimed and non-potable water systems. Constructed of heavy duty, glass-filled nylon and EPDM rubber components the P-220S valves feature Toro's patented Active Cleansing Technology (ACT™), which helps prevent the build-up of sand, algae, and other organic materials that may inhibit water from metering properly through the valve.

FEATURES & BENEFITS

Multiple Design Configurations

Available in 1", 1 1/2", 2", and 3" inlet/outlet designs, all of which allow the flexibility of globe or angle orientation.

Durable Glass-Filled Nylon Construction

Robustly built to operate at pressures of up to 220 psi.

Active Cleansing Technology (ACT™)

The industry's first active scrubber valve cleans continuously, whereas competing valves only clean upon their opening and closing.

Fabric-reinforced EPDM Diaphragm and EPDM Seat

Designed to work in virtually all water applications.

Rugged Internal Plastic and Stainless Steel Components

The ACT scrubber turbine, nut and metering system are constructed of marine and aerospace-grade plastics and metals that make them resistant to chlorine- and ozone-treated water.

Available with Precise Pressure Regulation

Compact EZReg® dial-design technology ensures precise downstream pressure for optimized sprinkler head performance.

Completely Serviceable and Retrofittable

The ACT scrubber diaphragm assembly can be replaced, and can also be retrofit into previously installed P-220 models.



Effluent
Options
Available



Pressure
Regulation



DC Latching
Solenoid
Option

The new P-220 Scrubber Series valves feature Toro's patented Active Cleansing Technology (ACT™) system. The ACT system's durable turbine is in constant rotation, which in turn keeps the metering and filtration area free of dirt and algae build-up. The turbine is constructed of materials resistant to chlorine, chloramines, and ozone, thereby keeping the valve operating at peak performance.



P-220 SCRUBBER SERIES MODEL LIST

Model	Description
P220S-26-94	1" with ACT™ System & DC Latching Solenoid
P220S-26-96	1 1/2" with ACT™ System & DC Latching Solenoid
P220S-26-98	2" with ACT™ System & DC Latching Solenoid
P220S-26-90	3" with ACT™ System & DC Latching Solenoid
P220S-26-04	1" with ACT™ System
P220S-26-06	1 1/2" with ACT™ System
P220S-26-08	2" with ACT™ System
P220S-26-00	3" with ACT™ System
P220S-27-04	1" with EZReg® and ACT™ System
P220S-27-06	1 1/2" with EZReg® and ACT™ System
P220S-27-08	2" with EZReg® and ACT™ System
P220S-27-00	3" with EZReg® and ACT™ System
P220S-KIT-04	1" Scrubber diaphragm assembly kit
P220S-KIT-06	1 1/2" Scrubber diaphragm assembly kit
P220S-KIT-08	2" Scrubber diaphragm assembly kit
P220S-KIT-00	3" Scrubber diaphragm assembly kit

SPECIFICATIONS

Operational

- Flow Range:
 - 1": 5 to 40 gpm
 - 1 1/2": 30 to 100 gpm
 - 2": 80 to 180 gpm
 - 3": 150 to 300 gpm
- Operating Pressure
 - 1" & 1 1/2" Models: 10 to 220 psi
 - 2" & 3" Models: 20 to 220 psi
- Regulated Outlet Pressure Range:
 - EZR-30: 5 to 30 psi +/- 3 psi
 - EZR-100: 5 to 100 psi +/- 3 psi
- Minimum Pressure Differential (between inlet and outlet) for Pressure Regulation: 10 psi
- Body Styles: Globe/Angle with female threads
- 102-5073 Solenoid:
 - Inrush: 60 Hz, 0.4 amps
 - Holding: 60 Hz, 0.2 amps

Options Available

- EZReg, 5-30 psi regulator module (EZR-30)
- EZReg, 5-100 psi regulator module (EZR-100)
- Effluent Water solenoid assembly and warning tag (lavender color; 24 VAC, 60 Hz) (EFF-KIT-60HZ)
- 24 VAC solenoid assembly (60 Hz, 18-inch leads, and captive plunger) (102-5073)
- Potted DC latching solenoid assembly (DCLS-P)

Dimensions

- 1": 6 3/4" H x 3 5/8" W
- 1 1/2": 7 1/4" H x 3 5/8" W
- 2": 9 1/2" H x 6 1/8" W
- 3": 10 3/4" H x 6 1/8" W

Warranty

- Five years

Additional Features

- ✓ Internal and external bleed
- ✓ Available in electric or pressure-regulating models
- ✓ No external tubing for either pressure-regulating model
- ✓ Standard, built-in Schrader-type valve for downstream pressure verification
- ✓ Flow control independent of solenoid
- ✓ Self-aligning bonnet to ensure correct installation
- ✓ Self-cleaning stainless steel metering rod

TORO P-220 SCRUBBER VALVES

Size	Config.	Flow																			
		5	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	180	200	250	300
1"	Globe	4.63	4.74	3.10	6.05	10.75															
	Angle	4.14	4.64	2.54	5.53	9.46															
1 1/2"	Globe			1.14	1.56	2.85	4.36	6.28	8.57	11.20	14.03	17.20	20.46								
	Angle			0.95	1.51	2.28	3.69	5.29	6.97	9.26	11.80	14.60	17.40								
2"	Globe									3.57	4.62	5.33	6.80	8.20	9.02	10.46	11.61				
	Angle									2.79	3.50	4.41	5.62	6.39	7.35	8.81	9.37				
3"	Globe														2.06	2.34	2.70	3.88	4.86	7.26	10.23
	Angle														1.86	2.16	2.44	3.35	4.11	6.42	9.31

Note: For optimum performance when designing a system, be sure to calculate total friction loss to ensure sufficient downstream pressure. For optimum regulation performance, size regulating valves toward the higher flow ranges. Flow rates are recommended not to exceed 5 psi loss.

Specifying Information—P-220S Scrubber Series Valves

P220S-2X-X-X			
Model	Activation Type	Solenoid	Size
P220S	2X	X	X
P220S—P-220S Scrubber Series Plastic Valve	6—NPT, Electric 7—NPT, Pressure-regulated EZR-100 (Standard)	0—Standard 24 VAC Solenoid 9—DC Latching Solenoid	4—1" 6—1 1/2" 8—2" 0—3"

Example: A 2" P-220S Series plastic electric, pressure-regulating valve would be specified as: **P220S-27-08**



Built for superior performance under pressure, these Toro® heavy-duty brass and stainless steel valves are rugged and reliable. The debris-resistant design is tested and proven under the harshest conditions.

FEATURES & BENEFITS

Class Leading Lightning and Protection

A lightning rating that exceeds 20,000 volts—nearly 3x that of competing products.

Precise Pressure Control Option

Compact EZReg® dial-design technology can be factory or field installed and does not require the removal of the solenoid.

Dirty Water Resistance

A 120-mesh stainless steel filter screen is constantly flushed by the flow, enabling the use of very dirty water without clogging and valve closure failure.

External Downstream Manual Bleed

Keeps valve box dry and allows for manually setting pressure regulation.

Spike Guard™ Solenoid

Reduces wire size requirements and allows twice as many valves to run simultaneously on a transformer, which lowers power costs.

Flow Control Handle

Adjusts the flow of each zone on a system.



*Notes: All come with Effluent Sticker and Label.
Compatible with DC Latching Solenoid.*



Effluent
Options
Available



Spike Guard
Standard



Pressure
Regulation



DC Latching
Solenoid
Option



Dirty Water Resistance

The 120 mesh stainless steel filter screen is positioned on the supply side of the water stream. It is constantly flushed by the flow, enabling the use of very dirty water without clogging. Stainless steel construction of both the filter screen and the valve solenoid seat ensures long component life in all types of water and pressures.

Additional Features

- ✓ Diaphragm stem guide
- ✓ 316 nuclear-grade stainless-steel stem for maximum corrosion resistance
- ✓ Pressure regulator can be installed as a service kit without draining the main line
- ✓ Pressure regulates in electric and manual modes, serviceable under pressure
- ✓ Forward-flow design for more precise regulation
- ✓ Standard, built-in Schrader-type valve for downstream pressure verification
- ✓ Anti-vandal dust cap on pressure-regulating models
- ✓ No external tubing for either electric or pressure regulating models
- ✓ Manual flow control: adjustable to zero flow
- ✓ Tough, double-beaded, fabric-reinforced rubber diaphragm

SPECIFICATIONS

Operational

- Flow Range:
 - 1": 5 to 40 gpm
 - 1 1/4": 20 to 100 gpm
 - 1 1/2": 20 to 130 gpm
 - 2": 30 to 180 gpm
 - 2 1/2": 60 to 250 gpm
 - 3": 80 to 350 gpm
- Operating Pressure:
 - Electric – 10 to 220 psi
- Pressure regulating:
 - Outlet (EZR-30): 5 to 30 psi $\pm$ 3
 - Outlet (EZR-100): 5 to 100 psi $\pm$ 3
- Inlet: 10 to 220 psi
- Minimum pressure differential (between inlet and outlet) for pressure regulation: 10 psi 2" & 3" – 20 psi
- Burst pressure safety rating: 750 psi
- Body styles:
 - Globe valve – 1", 1 1/4", 1 1/2", 2" female threads
 - Angle valve – 2 1/2", 3" female threads
- Spike Guard™ Solenoid: 24 VAC (50/60 Hz) Standard
 - Inrush: 60 Hz: 0.12 amps
 - Holding: 60 Hz: 0.1 amps

Options Available

- EZReg, 5–30 psi regulator module (EZR-30)
- EZReg, 5–100 psi regulator module (EZR-100)
- Effluent Water solenoid assembly and warning tag (lavender color; 24 VAC, 60 Hz) (EFF-KIT-60HZ)
- 24 VAC solenoid assembly (60 Hz, 18-inch leads, and captive plunger) (118-5982)
- Potted DC latching solenoid assembly (DCLS-P)

Dimensions

- 1": 5 1/4" H x 5" W
- 1 1/4": 6 1/2" H x 6" W
- 1 1/2": 6 1/2" H x 6" W
- 2": 7 1/2" H x 7" W
- 2 1/2": 8 3/4" H x 8 1/2" W
- 3": 8 3/4" H x 8 1/2" W

Warranty

- Five years

220 BRASS SERIES MODEL LIST

Model	Description
220-26-04	1" In-line
220-26-05	1 1/4" In-line
220-26-06	1 1/2" In-line
220-26-08	2" In-line
220-26-09	2 1/2" Angle
220-26-00	3" Angle
PRESSURE REGULATED WITH EZREG®	
220-27-04	1" In-line
220-27-05	1 1/4" In-line
220-27-06	1 1/2" In-line
220-27-08	2" In-line
220-27-09	2 1/2" Angle
220-27-00	3" Angle

Model	Description
WITH LATCHING SOLENOID	
220-26-94	1" In-line
220-26-95	1 1/4" In-line
220-26-96	1 1/2" In-line
220-26-98	2" In-line
220-26-99	2 1/2" Angle
220-26-90	3" Angle
ELECTRIC VALVES LESS SOLENOID	
220-26-64	1" In-line
220-26-66	1 1/2" In-line
220-26-68	2" In-line
220-26-60	3" Angle

220 BRASS SERIES FRICTION LOSS DATA

Model	Type	gpm Flow																		
		5	10	15	20	30	40	50	60	70	80	100	120	150	170	180	200	250	300	350
1"	Electric	1.75	2.0	2.2	3.10	5.05	7.80													
1 1/4"	Electric				1.85	2.50	2.70	3.50	4.10	5.6										
1 1/2"	Electric				2.15	2.45	2.80	3.05	3.80	5.0	6.55									
2"	Electric					3.05	3.20	2.90	2.95	3.25	3.40	4.50	6.55	10.10	13.45	14.85				
2 1/2"	Electric								2.0	2.2	2.3	2.4	2.5	3.0	4.0	4.5	5.5			
3"	Electric										2.2	2.4	2.5	3.0	4.0	4.5	5.5	6.5	7.0	7.5

Notes: For optimum performance when designing a system, calculate total friction loss to ensure sufficient downstream pressure. For optimum regulation performance, size regulating valves toward the higher flow ranges. Flow rates are recommended not to exceed 5 psi loss.

Specifying Information—220 Brass Series

220-2X-XX				
Model	Activation Type	Solenoid	Size	
220	2X	X	X	
220—220 Series Brass Valve	6—NPT, Electric 7—NPT, Pressure regulated (5–100)	0—Spike Guard Solenoid 6—Less Solenoid 9—DC Latching Solenoid	4—1" 5—1 1/4" 6—1 1/2"	8—2" 9—2 1/2" 0—3"

Example: A 1" NPT pressure-regulated, 220 Series Brass Valve with Spike Guard solenoid, would be specified as: **220-27-04**

Note: 1", 1 1/2" and 2"—globe configuration. 2 1/2" and 3"—angle configuration.


QUICK COUPLER KEYS AND ACCESSORIES MODEL LIST

Model	Description
075-SLK	¾" Single Lug Key with ¾" Male and ½" Female Pipe Threads outlet
100-AK	1" ACME Thread Key with 1" Pipe Thread outlet
100-SLK	1" Single Lug Key with 1" Male Pipe Thread and ¾" Female NPT Outlet
075-75-MHS	¾" NPT x ¾" MHT Hose Swivel
075-MHS	1" NPT x ¾" MHT Hose Swivel
100-MHS	1" NPT Inlet x 1" MHT, Hose Swivel
LK	Key for Locking Cap

QUICK COUPLER VALVES MODEL LIST

Model	Description	Key(s)
075-SLSC	¾" inlet QCV, one-piece body, Single Lug with Stainless Steel cover	075-SLK
100-SLSC	1" inlet QCV, one-piece body, Single Lug with Stainless Steel cover	100-SLK
100-SLVC	1" inlet QCV, one-piece body, Single Lug with Yellow Vinyl cover	100-SLK
100-SLVLC	1" inlet QCV, one-piece body, Single Lug with Yellow Vinyl locking cover	100-SLK
100-2SLVC	1" inlet QCV, two-piece body, Single Lug with Yellow Vinyl cover	100-SLK
100-ATLVC	1" inlet QCV, one-piece body, ACME thread with Effluent Vinyl locking cover	100-AK
100-2SLLVC	1" inlet QCV, two-piece body, Single Lug with Effluent Vinyl locking cover	100-SLK

Whether for hand watering the hot spots, fertilizer wash in, or washing down equipment, Toro® Quick Coupler Valves and Keys are designed for everyday use in environments that require quick remote access to the mainline water supply.

FEATURES & BENEFITS

Stainless Steel And Brass Construction

Quick Couplers are also available with metal or vinyl covers in locking or non-locking options.

Multiple Models To Choose From

There are a variety of one-piece and two-piece models in ¾" and 1" sizes, including ACME thread key connections.

Eliminate Tangled Hoses

The 360-degree hose swivel provides movement without hose tangling.

QUICK COUPLER SERIES FRICTION LOSS DATA

Model	gpm Flow											
	10	15	20	25	30	35	40	50	60	70	85	100
¾" inlet	1.5	3.1	5.3	8.5								
1" inlet			1.1	2.2	3.6	5.7	8.0					

Note: For optimum sprinkler performance when designing a system, be sure to calculate total friction loss to ensure sufficient downstream pressure. Values listed in psi. Flow rates are recommended not to exceed 5 psi loss.

Specifying Information—Quick Couplers

XXX-XXX-XXX		
Size XXX	Nozzle XXX	Optional XXX
075—¾" 100—1"	SL—One-piece, Single Lug 2SL—Two-piece, Single Lug AT—ACME Thread	SC—Standard Cover VC—Vinyl Cover LVC—Effluent Vinyl Cover VLC—Vinyl Locking Cover
Example: A 1" one-piece, single lug Quick Coupler Valve with a vinyl locking cover, would be specified as: 100-SLVLC		

VALVE ACCESSORIES

TORO

SOLENOIDS



DCLS-P

- Potted DC latching solenoid for Toro valves used with EZ-Flo® Plus, TPV, P-220 or 220 Series brass valves



118-5982

- Solenoid assembly for EZ-Flo Plus, TPV, P-220 or 220 Series brass valves
- Captive hex plunger features
- 24 VAC
- 60 Hz, 18" leads



SGS-12

- Spike Guard™ Solenoid compatible with EZ-Flo Plus, TPV, P-220 or 220 Series brass valves
- Inrush 0.2A
- Holding: 0.1A
- 20,000 volts lightning rating



LWS

- Low Wattage Solenoid compatible with EZ-Flo Plus, TPV, P-220 or 220 Series brass valves
- Inrush 0.2A
- Holding: 0.1A

EFFLUENT WATER INDICATORS



89-7855

- Effluent flow control knob for 254/264, 250/260 and 252 Series valves



EFF-KIT-60HZ

- Effluent solenoid with warning tag for EZ-Flo Plus, TPV, P-220 or 220 Series brass valves
- Captive hex plunger features 24 VAC, 0.40 amp inrush, and 0.20 amp holding



RWSG-Kit

- Effluent sticker and tag for P-220 valves with Spike Guard solenoids



1088501

- Effluent tag for use with Toro or competitive valves

EZREG® PRESSURE/INSTALLATION REGULATOR & EHC ACCESSORIES



EZR-30 and EZR-100

- Pressure regulator module for use with P-220, P-220S and 220 Series valves
- EZR-30: 5–30 psi
- EZR-100: 5–100 psi



995-51

- Pressure gauge kit



995-49

- 0–200 psi pressure gauge
- Hermetically sealed shock resistant face



850-00

- Valve cover



995-14

- Supply screen fitting



995-02

- Flushing adaptor

ELECTRIC-HYDRAULIC CONVERTERS

TORO

ELECTRIC-HYDRAULIC CONVERTERS MODEL LIST



Model	Description
EHC-01-01	1-Station, Normally Open
EHC-01-04	4-Station, Normally Open
EHC-08-04	4-Station, Normally Closed
EHC-01-12	12-Station, Normally Open
EHC-08-12	12-Station, Normally Closed
EHC-01-16	16-Station, Normally Open
EHC-08-16	16-Station, Normally Closed

SPECIFICATIONS

- Pressure: 40–150 psi
- Wiring: 18 AWG x 4' wire leads
 - Maximum distance from converter to valve: $\frac{3}{16}$ " – 500'
 - $\frac{1}{4}$ " – 1000'
- Normally open: Valve elevation should not exceed 25' above or 70' below controller elevation
- Normally closed: Valve elevation should not exceed 0' above or 70' below controller elevation
- Direct manual control activates any sprinkler from the converter
- Optional plastic pedestal (89-8342)

Electrical

- Input power:
 - 24 VAC (60 Hz)
 - Holding - .225A @ 24 VAC
 - Inrush - .400A @ 24 VAC

Dimensions

- 4-Station:
 - $8\frac{3}{4}$ " W x $4\frac{1}{2}$ " H x $2\frac{1}{2}$ " D
- 12-Station:
 - $8\frac{3}{4}$ " W x $12\frac{1}{2}$ " H x $2\frac{1}{2}$ " D
- 16-Station:
 - $8\frac{3}{4}$ " W x $16\frac{1}{2}$ " H x $2\frac{1}{2}$ " D

Warranty

- Two years

Toro® Electric-Hydraulic Converters (EHC) provide the ability to bring together electrical outputs from sophisticated electric controllers and the pressure-based signals in hydraulic irrigation systems.

CONTROLLERS

From standard to advanced irrigation control, Toro irrigation controllers meet the needs of the most demanding users. Innovative sensing and wireless communication capabilities give users even more control over water savings and maintaining healthy landscapes.





CONTROLLER OVERVIEW



Smart, Capable & Customizable



Model	Stations	Enclosure	Maximum Station Runtime	Output	Optional Upgrades
EVOLUTION® Page 70-75	4 to 16 Modular	Indoor/ Outdoor	12 Hours	24 VAC Solenoid	Rain Sensor Weather Sensor Precision™ Soil Sensor Handheld Remote Wireless Relay
DDC™ WP Page 76-77	2, 4, 6, 8 Fixed	Waterproof Indoor/ Outdoor	4 Hours	DC Solenoid	Rain Sensor
TMC-424E Page 78-79	4 to 24 Modular	Indoor/ Outdoor	8 Hours	24 VAC Solenoid	Rain Sensor Precision™ Soil Sensor Maintenance Remote Flow Sensors
Custom Command™ Page 80-81	9, 12, 15, 18, 24, 36, 48 Fixed	Outdoor Enclosure, Pedestal Options	10 Hours	24 VAC Solenoid	Rain Sensor Precision™ Soil Sensor Maintenance Remote
TDC Series Page 82-83	Up to 200 Decoder Stations	Outdoor Enclosure, Pedestal Options	24 Hours	DC Solenoid	Rain Sensor Precision™ Soil Sensor Maintenance Remote



TORO

EVOLUTION® SERIES CONTROLLER



Introducing the next generation in controllers! With an intuitive interface and exclusive features for “smart” control, the new Toro® EVOLUTION® is an easy choice for residential and light-commercial applications.

FEATURES & BENEFITS

Revolutionary Interface

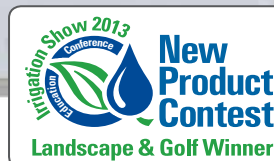
The EVOLUTION controller’s user interface was designed with the customer in mind. Shortcut buttons provide quick access to basic functions while the advanced menu leverages the experience and knowledge of the irrigation professional, all shown on a graphics display that navigates similar to many modern consumer electronic devices.

Easy Upgrade to Integrated Smart Control

An optional Smart Connect® device plugs into the timing mechanism, enabling it to wirelessly communicate directly with a number of add-on devices—including a weather sensor, handheld remote, multiple soil sensors, and up to two wireless relays.

Computer-programmable with USB Drive

Simple-to-use software allows you to program everything at a computer. Use a standard USB drive to transfer programming to one or more controllers in a matter of seconds. Create custom schedules or utilize the easy-to-use wizard to generate schedules based on historical watering requirements of your location.



12-station configuration
with (2) 4-station modules



16-station configuration
with (1) 12-station module



When equipped with
Smart Connect®
wireless ET sensor

WATER MANAGEMENT HIGHLIGHT



Smart Connect® Add-On Devices

Simply plugging the Smart Connect® into the EVOLUTION® controller allows it to communicate wirelessly with a number of add-on devices, providing a great opportunity to upgrade with a number of different water-saving and time-saving options.



Toro® Smart Connect® Plug-In Receiver

Installs easily on the backside of the EVOLUTION® controller's Front panel. No wires, No externally mounted receiver. One Smart Connect® Receiver is all that is required to communicate to all Add-On Devices.



Wireless Weather Sensor

Uses live temperature and solar measurements as well as historical weather data for your location to calculate the amount of water needed from the irrigation system.



Handheld Remote

Backlit display makes maintenance checks a snap, day or night, allowing you to run sprinklers or schedules from up to 1000 feet away.



Precision™ Soil Sensor

Up to three soil sensors can be used (one per schedule) to monitor the moisture level in the soil and prevent over- and underwatering. With up to a 500 feet wireless range, there's no digging required to install.



Wireless Auxiliary Relay

Up to two wireless relays can be used to turn on lighting, pumps, or fountains, just to name a few possibilities.





EVOLUTION® SERIES CONTROLLER

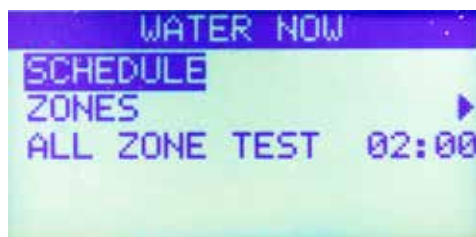
Controller Interface

The EVOLUTION controller's interface is a system of informative yet easy-to-understand screens that are quickly accessible using the controller's shortcut buttons.



Standard Functions

The Standard menu gives the homeowner access to the most fundamental functions of the controller, such as manual watering, setting watering days and start times and adjusting the amount of irrigation, all directly accessible through dedicated shortcut buttons.



Water Now Screen

Allows the user to begin watering with as few as just two button presses, with the option of starting a specific schedule, specific zone(s), or watering all zones in series.



Review Screen

At-a-glance summary showing which days the controller is going to water in the next seven days for the schedule you select. Lets the user know how the irrigation will run.



Advanced Functions

The Contractor has full access to the power of the EVOLUTION controller, including the ability to set up multiple irrigation and auxiliary schedules, create custom grow-in schedules, and configure any "smart" add-on devices – all operations that may otherwise overwhelm a homeowner.



Apply Sensors

The screen allows the user to easily view and configure all the sensors available to the controller, including rain, ET, and soil.



Grow In Screen

Allows the user to set up a grow in schedule for a user-defined period of time (up to 90 days), after which the controller will default back to its normal irrigation schedule(s).

Other Examples



Home Screen

Displays the current time and date, what zones are scheduled to water next, or if currently watering, what zone(s) are currently watering and how much time is remaining, as well as any alerts – in the absence of any alerts, the screen will display "SYSTEM OK."



Contractor Message Screen

Allows the contractor to input a custom message with their name and contact information into the controller from the software via a USB drive so it is visible to the homeowner when they press the "Help" button.

EVOLUTION SERIES MODEL LIST

Model	Description
EVO-4ID	4-station Indoor Controller
EVO-4OD	4-station Outdoor Controller
ADD-ONS AND ACCESSORIES	
EMOD-4	4-station Expansion Module
EMOD-12	12-station Expansion Module
EVO-SC	Smart Connect® Plug-In Receiver
PSS-SEN	Wireless Precision™ Soil Sensor Probe Only
EVO-WS	Wireless Weather Sensor
EVO-HH	Wireless Handheld Maintenance Remote
EVO-AR	Wireless Auxiliary Relay

Programming Features

- ✓ One schedule in the default "STANDARD" mode
- ✓ Up to six schedules in "ADVANCED" mode:
 - Three irrigation schedules, four start times per schedule
 - One wired auxiliary schedule, plus two optional wireless auxiliary schedules
- ✓ Three scheduling choices:
 - Seven-day calendar
 - 1- to 30-day interval with up to seven day exclusions
 - Odd/even days with up to seven day exclusions
- ✓ Monthly season adjust by schedule
- ✓ Schedule stacking, with automatic split cycle when watering adjustments are greater than 100%
- ✓ Grow-in schedule settable up to 90 days, automatically reverts to regular irrigation schedule
- ✓ Station runtimes from one minute to twelve hours
- ✓ Allows 30, 60, or 90 second manual runtimes for things such as winterization/blowouts
- ✓ Programmable well-recovery/station-delay from 10 seconds to 30 minutes
- ✓ Pump start delay from 10 seconds to 30 minutes
- ✓ Master valve ON/OFF by zone
- ✓ Timed water off from one to fourteen days
- ✓ Compatible with normally-closed rain sensors
- ✓ Automatic short detection for circuit protection and faster troubleshooting
- ✓ Non-volatile memory doesn't require batteries and holds programming for up to five years
- ✓ Diagnostic zone test measures and displays current draw of solenoid and identifies short, over current and open conditions

SPECIFICATIONS

Electrical

- Electrical input power:
 - 120 VAC
 - 30 VA maximum
 - UL, CUL Listed
- Station output power:
 - 24 VAC
 - 0.75 amps per station maximum
 - 0.75 amps pump/master valve
 - 1.0 amps total load
- Surge Protection:
 - 6.0 KV common mode; 1.0 KV normal mode
- Operation of two solenoids per station

Dimensions

- 11 1/4" W x 7 3/4" H x 4 1/4" D
- Weight: 4.5 lbs.

Warranty

- Five years

Hardware Features

- ✓ 4-station base; expandable to 16-stations with 4- and 12-station hot-swappable modules
- ✓ Cabinet easily mounts to the wall through two easily-accessible screw holes on the upper left-hand and right-hand sides of the controller
- ✓ Red LED next to display lights in the event of an alert
- ✓ 128 x 64 pixel graphical display
- ✓ Battery on the timing mechanism for "ARMCHAIR" programming
- ✓ Outdoor key-lock cabinet manufactured out of durable UV-resistant plastic and includes standardized key used on many of the most popular controllers
- ✓ Indoor cabinet includes internal transformer and factory installed power cord

Specifying Information- EVOLUTION® Series

EVO-XX-XX-SC			
Description	Cabinet Type	Module	Connector Options
EVO-4	XX	XX	SC
EVO-4 – EVOLUTION Controller	ID – Indoor OD – Outdoor	4 – No Additional Modules 8 – One, 4-Station Modules 12 – Two, 4-Station Modules 16 – One, 12-Station Module	SC – Smart Connect®

Example: A 16-station EVOLUTION controller in an indoor cabinet with the Smart Connector would be specified as: **EVO-ID-16-SC**





Simple programming made even easier! The Scheduling Advisor™ software makes the already easy-to-program EVOLUTION® series controller even easier to program by allowing you to set up irrigation and auxiliary schedules at your computer and transfer everything to the controller in seconds using a standard USB drive. Managing multiple controllers for different installation locations is a much more manageable task with this powerful tool.

FEATURES & BENEFITS

An Even Easier Way to Program

Whether you're at your desk or in your truck on a laptop, the optional Scheduling Advisor™ software allows you to program the EVOLUTION controller using the power of a PC and the internet on Windows-based operating systems (Windows® 7 or 8). A simple to use wizard will create schedules for you based on local area ET history, and set cycle and soak values for each zone.

Quick Uploading with USB

Once you're done programming on the computer, transferring the information to the controller is easy with a USB drive—making it simple to create, save, and load different schedules for multiple controllers – *there's no limit!*

Standard and Advanced Modes

The software can tailor itself to your needs and be only as advanced as you want it to be. Standard mode covers the basics for a single schedule while advanced mode provides additional scheduling options, such as ET-based programming and creating more than one schedule.

Backup

The EVOLUTION software gives you the ability to store programming for multiple controllers on your computer, maintain schedules for all of your customers in one place that you can access at any time. Changes to programming can be made ahead of time and transferred by USB, or even emailed to your customer making field changes easy.



Software*
Programming can be transferred from your computer to the controller in seconds using a standard USB drive.



Download FREE software from
www.toro.com/evolution

*Smart Connect device not required for software programming capability.

Simple Setup

A simple wizard walks you through the schedule setup process step-by-step, allowing you to select the different features specific to each zone on the system. This data is then used to create a fully customized and optimized irrigation schedule for the controller.



Turf Grass (Cool)

Single Stream Rotor

Full Shade



Loam

Greater than 12% slope

Expanded Customization

The software also allows you to enter custom names for schedules and zones (such as "Shrubs" or "Front Yard" instead of "Zone 1"), as well as contact information that the homeowner can access in the "local contact" screen any time they press the "Help" button on the controller. The information can be transferred to the controller using the USB making it easier to operate.



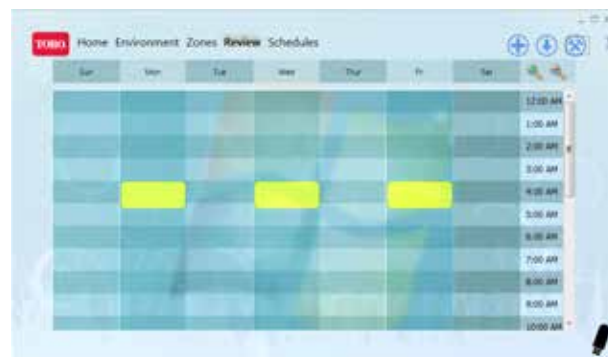
Zones Screen

In advanced mode, this screen is where you enter the characteristics of each of the zones on the system, including the type of plant, soil, sprinkler, slope, and amount of sun exposure, to create the most efficient irrigation schedule possible. You also have the option of loading custom photos to represent each zone, create custom plant types and custom watering methods.



Review Screen

Similar to the review screen in the controller itself, this "at-a-glance" view of upcoming irrigation events graphically displays on a calendar when watering is scheduled to occur and for how long. You can zoom in and out on any section of the calendar and click on a segment of any schedule to see details of which zone is scheduled to water at that time.



TORO

DDC™ WP SERIES CONTROLLER

**WATER
SMART**

Looking for a rugged waterproof controller ideal for remote or isolated installations? Toro's DDCWP Series controller provides all that and more. The DDCWP is battery-operated using two 9V batteries, and controls up to 8 ported DC latching solenoids.

FEATURES & BENEFITS

Fully Waterproof and Submersible

Submersible up to 6.5' per IP-68 standards, allowing contractors to mount up to an 8-station controller in a valve box.

Operates DC Latching Solenoids

Controller is compatible with most manufacturers' DC latching solenoids.

Exclusive "Digital Dial" Technology

Simple programming functions.

Unique Power Feature

Verifies sufficient voltage level for turning stations off before turning any stations on.

Monthly Watering Schedule

Monthly preset option – ideal for automatic runtime adjustments.

Easy to Use Lock-out Feature

Press the "ON/OFF" button for three seconds to lock out the controller and protect it against vandalism. Press again to return to normal operation.

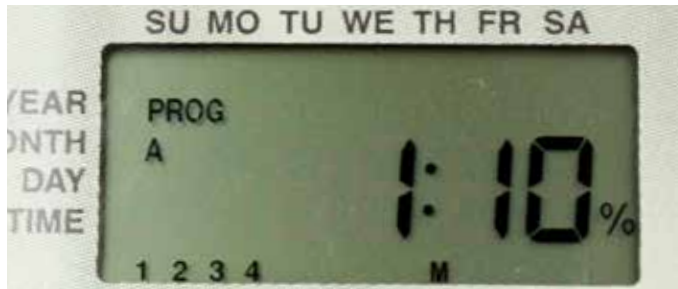


Wired Rain
Sensor
Compatible

WATER MANAGEMENT HIGHLIGHTS



1 = The first month, January



10 = 100%. 140% would be designated as 14.

Monthly % Adjust

DDCWP adjusts annual irrigation run time during initial controller set up. Options include from 0-200% and January to December scheduling. With easy adjusting for seasonal watering, water savings is enhanced for all-around intelligent programming.



Battery Cap

Easy installation of two 9V batteries with the simple screw ON/OFF lid. The battery cap provides a dependable leak-proof seal allowing submersion up to 6.5' per IP-68.



EZ-Flo® Plus and P-220 valves shown with the DCLS-P Latching solenoid which provide cost and labor savings.

SPECIFICATIONS

Operational

- Operating temperature: 0° - 60° C
- Operates using two x 9V alkaline batteries (not supplied)
- Operates one latching solenoid per station and one latching solenoid-equipped master valve
- Controller is compatible with all Toro valves accepting latching solenoids (model DCLS-P or equivalent) and competitive valve models/latching solenoids
- Accepts Toro TRS Wired RainSensor™, Wired Rain/Freeze and other normally-closed sensors
- Low-battery indicator visible on LCD screen
- Three independent programs and three start times per program
- Three scheduling choices by program:
 - Seven-day calendar
 - 1 to 7-day interval
 - Odd/even with 365-day calendar and 31st day exclusion
- Station run times from one minute to four hours in one-minute increments
- Seasonal adjust by month from 0-200% in 10% increments
- Manual operation by station or program
- Self-diagnostic circuit breaker skips shorted stations
- Up to five-year program retention with on-board coin battery saves time of day and all programming features
- Vandal proof lock out feature

Dimensions

- 5³/₄" W x 5" H x 1¹⁵/₁₆" D
- Weight: 23.3 oz. without 9V battery

Warranty

- Three years

DDCWP SERIES MODEL LIST

Model	Description
DDCWP-2-9V	2-station
DDCWP-4-9V	4-station
DDCWP-6-9V	6-station
DDCWP-8-9V	8-station

WIRE RUN LENGTHS FOR DDCWP

With battery voltage at 9 VDC, maximum recommended wire runs for an 8-station DDCWP are:

Multi-strand Wire	Distance (Ft.)
18 AWG	197
16 AWG	305
14 AWG	493
12 AWG	820

Specifying Information—DDCWP

DDCWP-X-9V		
Description	Stations	Voltage
DDCWP	XX	9V
DDCWP—Digital Dial Waterproof Controller	2—2 Stations 6—6 Stations 4—4 Stations 8—8 Stations	9V—9 Volt
Example: An 8 station DDCWP controller would be specified as: DDCWP-8-9V		



The TMC-424E Series takes modularity to a whole new level. Toro's advanced modular technology combines sophisticated features with simple operation to provide a customizable controller.

FEATURES & BENEFITS

Station Count Modularity

Station count modularity from 4 to 24 stations using 4- or 8-station modules for flexibility.

Two Levels of Surge Protection

Standard or High Surge modules provide options to meet regional lightning protection needs.

Flow-Sensing

Monitor and react to system leaks or breaks.



Up to 4 Master Valve or Pump Start Connections

Options for connection of up to four Master Valve or Pump Start Relays utilizing TSM-4F or TSM-8F modules.

Run Times In Minutes or Seconds

Ability to set run times for less than a minute provides efficient watering for planter box, misting cycle, nursery, or syringe cycle needs.

Armchair Programming

Removable Timing Mechanism can be powered by 9V battery allowing for easy and comfortable programming.



Rain
Sensor
Compatible



PSS-KIT
Compatible



Flow
Sensor
Compatible



TMR-1
Compatible

WATER MANAGEMENT HIGHLIGHT



Flow-Sensing for Greater Water Savings

With flow-sensing capability that monitors up to three independent flow sensors, the controller consistently monitors for problems and takes action as needed to isolate breaks or system issues.



Up to 4 Master Valve/PS Connections

One on controller terminal block and 3 flow-sensing modules. Any station can be assigned to any MV. Options for a single station to activate both a controller and flow module MV/PS connection (e.g., MV and Booster Pump activation).

TMC-424E SERIES MODEL LIST

Model	Description
TMC-424E-ID*	Modular, Indoor
TMC-424E-OD*	Modular, Outdoor
* Base models include TSM-4 (4-station Module)	
STATION MODULES - BASE MODEL INCLUDES 4 STATIONS	
TSM-4	4-station Expansion Module
TSM-4H	4-station Expansion Module, High-Surge
TSM-4F	4-station Expansion Module, Flow-Sensing
TSM-8	8-station Expansion Module
TSM-8H	8-station Expansion Module, High-Surge
TSM-8F	8-station Expansion Module, Flow-Sensing

SPECIFICATIONS

Electrical

- Input power:
 - 120 VAC
 - 30 VA (internal and external plug-in type transformer)
 - UL, CUL-listed
- Station output power:
 - 24 VAC
 - 0.50 amps per station maximum
 - 0.50 amps pump/master valve
 - 1.20 amps total load
- Surge Protection:
 - Standard – 6.0 KV common mode; 600 V normal mode
 - High Surge – 6.0 KV common mode; 6.0 KV normal mode

Dimensions

- 10³/₄" W x 10¹/₄" H x 4⁵/₈" D
- Weight: Indoor–7.5 lbs.; Outdoor–7.1 lbs.

Optional Accessories

- PSS-KIT – Precision™ Soil Sensor Kit
- TRS – Wired RainSensor
- 53853 – Wired Rain/Freeze Sensor
- TWRS/TWRS – Wireless RainSensor or Wireless Rain/Freeze Sensor
- TMR-1 – Maintenance Remote
- TFS-Flow Sensor

Warranty

- Five years

Additional Features

- ✓ Four programs with 16 total start times
- ✓ Three Scheduling choices
 - Seven-day calendar
 - 1- to 31-day interval with day exclusion
 - Odd/even days with day exclusion
- ✓ Station run times in minutes or seconds
- ✓ Programmable well recovery/station delay from 1 to 60 seconds or 1 to 60 minutes
- ✓ Pump start/master valve settable by program and station
- ✓ Operate up to three programs simultaneously
- ✓ Rain delay from one to 14 days and water budgeting from 0-200% in 10% increments
- ✓ Hot-swappable station modules
- ✓ Review feature quickly recaps all program information
- ✓ Short detection for faster troubleshooting
- ✓ Valve Test mode for quick system checks
- ✓ Multi-language capability (English, Spanish, French, Italian, German and Portuguese)
- ✓ Program erase
- ✓ 12/24-hour real-time clock
- ✓ Non-volatile memory

Specifying Information—TMC-424

TMC-424E-XX-XX-XX-XX			
Model	Type	Description	
TMC-424E	XX	XX-XX-XX	
TMC-424E—Toro Controller	ID—Indoor OD—Outdoor	4—4-station, Standard-Surge 4H—4-station, High-Surge 4F—4-station, High-Surge and Flow-Sensing	8—8-station, Standard-Surge 8H—8-station, High-Surge 8F—8-station, High-Surge and Flow-Sensing

Example: A 16-station TMC-424E controller in an indoor cabinet with one flow monitor would be specified as: **TMC-424E-ID-8F-8**

* Note: Base model comes with one TSM-4 (4-station) included.





With the highest surge protection in its price range, the Toro® Custom Command offers durability and performance in one rugged commercial-grade controller.

FEATURES & BENEFITS

Versatile Runtimes

Runtimes from one minute to ten hours in one-minute increments meet the needs of standard or drip applications.

Independent Programs

Four fully independent programs and 16 start times that can run concurrently with start time overlap protection within each program.

High Surge Protection

Highest surge protection in its price range for lightning-prone areas.

Metal or Plastic Enclosures

Available in wall-mount metal cabinet with optional metal pedestal, or wall-mount plastic cabinet.

Hand-Held Remote Compatible

Compatible with the Toro TMR-1 Maintenance Remote for ease of use, troubleshooting, and field maintenance operation.



Multiple Enclosure Options
Metal or plastic cabinets and optional metal pedestals meet a variety of installation needs.



EPA WaterSense®
approved when
used with Irritrol®
Climate Logic®



TMR-1
Compatible



Rain
Sensor
Compatible



PSS-KIT
Compatible

WATER MANAGEMENT HIGHLIGHT



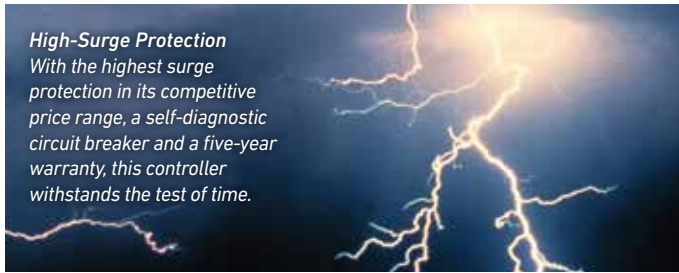
Wired RainSensor or Wireless Rain/Freeze Sensors

Stops irrigation when it rains or when temperature drops below a user-defined point.



High-Surge Protection

With the highest surge protection in its competitive price range, a self-diagnostic circuit breaker and a five-year warranty, this controller withstands the test of time.



Additional Features

- ✓ Three selectable watering schedules:
 - Seven-day calendar
 - Odd/even days with day exclusion
 - 31-day interval
- ✓ 365-day calendar with automatic compensation for leap year
- ✓ Rain delay from one to seven days
- ✓ Program stacking for simultaneous operation of one to four programs (four program stacking only in 36- and 48-station models)
- ✓ Season % adjust by month
- ✓ Individual station manual start and manual start by program
- ✓ Independent program erase for each program
- ✓ Master valve/pump start operation selectable by program
- ✓ Available in 9-, 12-, 15-, 18-, 24-, 36- and 48-station models
- ✓ Non-volatile memory retains programmed information in event of power failure
- ✓ Time and date retention for up to 90 days using 9-volt battery
- ✓ Self-diagnostic circuit breaker that identifies and overrides faulty stations

SPECIFICATIONS

Electrical

- Input Power
 - 120 VAC $\pm$ 10%, (60 Hz)
 - 0.50 amps (24 W) maximum
- Station output power
 - 24 VAC (60 Hz)
 - 0.50 amps (12 VA) per station maximum
 - 0.50 amps (12 VA) pump/master valve
 - 1.25 amps (30 VA) total load
- UL, CUL Listed

Dimensions

- Plastic: 11 1/2" W x 5 7/8" H x 8 5/8" D
- Metal (12-, 15-, 18- and 24-stations):
 - 10 3/4" W x 9 3/4" H x 5 3/4" D
- Metal (36- and 48-stations):
 - 10 3/4" W x 15 3/4" H x 5 3/4" D
- Pedestal (CC-PED):
 - 10 3/4" W x 27 7/8" H x 3 3/8" D
- Weight
 - Plastic: 8 lbs
 - Metal (12-, 15-, 18-, and 24-station): 14 lbs
 - Metal (36- and 48-station): 18 lbs

Optional Accessories

- PSS-KIT – Precision™ Soil Sensor Kit
- TRS – Wired RainSensor
- 53853 – Wired Rain/Freeze Sensor
- TWRS/TWRFS – Wireless RainSensor or Rain/Freeze Sensor
- TMR-1 – Maintenance Remote

Warranty

- Five years

CUSTOM COMMAND SERIES MODEL LIST

Model	Description	Model	Description
WALL-MOUNT METAL CABINET		WALL-MOUNT PLASTIC CABINET	
CC-M12	12-station	CC-P9	9-station
CC-M15	15-station	CC-P12	12-station
CC-M18	18-station	CC-P15	15-station
CC-M24	24-station	CC-P18	18-station
CC-M36	36-station	CC-P24	24-station
CC-M48	48-station		
METAL PEDESTAL MOUNT (OPTIONAL)			
CC-PED	Compatible with CC-M12 to CC-M24 models only		
TIS-PED	Compatible with CC-M36 and CC-M48 models only		

Specifying Information—Custom Command

CC-X-XX-PED			
Model	Cabinet	Description	Optional
CC	X	XX	PED
CC—Custom Command	M—Metal P—Plastic	9—9-stations 12—12-stations 15—15-stations 18—18-stations 24—24-stations 36—36-stations 48—48-stations	PED—Optional Pedestal Mount

Example: A 12-station Custom Command Controller with an internal transformer and metal cabinet would be specified as: **CC-M12**





For an energy efficient, highly cost-effective way to irrigate large commercial installations, you'll want the TDC Series from Toro®. Using a two-wire path to communicate to buried decoders, the TDC system eliminates high costs associated with traditional valve wiring, trenching and trouble-shooting.

FEATURES & BENEFITS

New ISP Decoders

Industry leading surge protections up to 20 KV means less grounding in the field than competitive products.

Advanced Diagnostics

The TDC provides true two-way communication with each decoder in the field, thus providing communication verification to decoders in the field, as well as shorted or open solenoid conditions, making troubleshooting a breeze.

Low-Power Operating Costs

The TDC Decoders operate DC Latching Solenoids which utilize no power when valves are in operation.

Water Budget

Water budget by controller, by program and by station (Season Adjust) 0 to 250% in 1% increments.

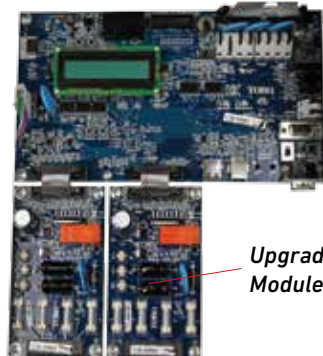
Simple, Intuitive Programming

Installation and future servicing are quick and simple thanks to the large LCD display and the industry's most intuitive interface.



Modular Design

The base model of the TDC offers 100 stations with capability to add another module allowing up to 200-station control. This is ideal for phased projects. Independently fused wire paths (4 per 100 stations = 8 for 200 stations) provide protection to the controller in the event of a short in field wiring.



Upgrade Module



TMR-1
Compatible



Rain
Sensor
Compatible



PSS-KIT
Compatible



Key-locking, Front-Entry, Metal Cabinet

TDC offers a key-locking cabinet in both the outdoor and indoor model controllers. Constructed from heavy-duty powder-coated metal, this is a wall-mount cabinet that provides superior weather and vandalism resistance.



Stainless Steel Pedestal Option
With Toro's EICON Special Build division, TDC units may be ordered with a stainless steel pedestal. To order please specify CDEC-PED-100 or CDEC-PED-200.

SPECIFICATIONS

Electrical

- Input Power: 120 VAC or 220/240 VAC (50/60 Hz)
- Station Output Power: Up to 38 VAC maximum; 3 amps max. output
- Wiring—two wire path: Jacketed, twisted pair 14 AWG to 15,000 ft.
- Wiring—two wire path: Jacketed, twisted pair 16 AWG to 8,450 ft.
- Wiring—decoder to solenoid: Standard pair 14 AWG to 400 ft.

Dimensions

- Cabinet: 14" W x 13" H x 6" D
- Stainless steel pedestal-mount: 17 1/8" W x 34 1/2" H x 8 5/8" D

Optional Accessories

- PSS-KIT – Precision™ Soil Sensor Kit
- DEG-SG-LINE – Decoder, Line Surge Protector
- TRS – Wired RainSensor
- 53853 – Wired Rain/Freeze Sensor
- TWRS/TWRFS – Wireless RainSensor or Wireless Rain/Freeze Sensor
- TMR-1-KIT – Toro Maintenance Remote

Warranty

- Five years

TDC SERIES MODEL LIST

Model	Description
METAL PEDESTAL MOUNT	
CDEC-SA-100	100-station, with remote connection
CDEC-SA-200	200-station, with remote connection
CDEC-PED-100	100-station, Two-wire controller on stainless steel pedestal*
CDEC-PED-200	200-station, Two-wire controller on stainless steel pedestal*
* Order through EICON Special Build	
TWO-WIRE STATION DECODERS	
CDEC-ISP-1	1-station with integrated surge protection (Operates up to two solenoids)
CDEC-ISP-2	2-station with integrated surge protection (Operates up to four solenoids)
CDEC-ISP-4	4-station with integrated surge protection (Operates up to eight solenoids)

Additional Features

- ✓ 20 KV surge protection with proper grounding of 10 Ohms or less at the controller
- ✓ 10 independent irrigation programs
- ✓ Six start times per program
- ✓ Day of the week programming, odd/even, interval (1-31 days)
- ✓ 0-255% adjust by controller, by program, by station
- ✓ Day Exclusion (remove a day from standard program)
- ✓ Programmable master valve and pump start, by station
- ✓ Manual start of each station or entire program
- ✓ Non-volatile memory retains programming
- ✓ Self-diagnostics circuit breaker skips shorted/open stations
- ✓ Two-way confirmation of decoder activation
- ✓ Activate up to 20 solenoids at up to 2.8 miles away
- ✓ Programmable rain delay up to 31 days
- ✓ Water window calculator
- ✓ 10-digit alpha-numeric zone identification
- ✓ Remote-Ready and RainSensor-compatible
- ✓ Upgradeable to Sentinel® Central Control
- ✓ Utilizes DC latching solenoids for valve control

Specifying Information—Decoders

Model	Description
CDEC-ISP-1	Single Station Decoder with integrated surge protection
CDEC-ISP-2	Two Station Decoder with integrated surge protection
CDEC-ISP-4	Four Station Decoder with integrated surge protection

Specifying Information—DEC

Model	Description
DEC-SG-LINE	Decoder, line surge protector*

*One per 1500 Feet

Specifying Information—TDC

CDEC-XXX-XXX		
Model	Cabinet	Description
CDEC	XXX	XXX
CDEC—2-wire Controller with remote hook up	SA—Wall Mount Metal Cabinet PED—Stainless Steel Pedestal	100—100 Stations 200—200 stations

Example: A TDC Controller with 200 stations would be specified as: **CDEC-SA-200**



SENSORS & REMOTES

With today's focus on sustainable landscapes, Toro sensors have proven significant water savings and control for both residential and commercial applications



Smart, Accurate & Easy to Install



Model	Sensor Type	Transmission Range (Line-Of-Sight)	Compatible Controller
Precision™ Soil Sensor Page 86-87	Soil Moisture	Up To 500'	PSS-KIT: 24 VAC Controllers; PSS-SEN: EVOLUTION® Controller Only
Turf Guard® Soil Monitoring System Page 88	Soil Moisture Temperature Soil Salinity	Up To 500'	Standalone Computer Based System
Pro Series™ Soil Sensor Page 89	Soil Moisture	Up To 500'	Sentinel® Controllers
Smart Connect® Wireless Weather Sensor Page 90-91	Weather	Up To 1000'	EVOLUTION® Series Controller
Wireless RainSensor™ Page 92	Rain	Up To 500'	24 VAC Controllers
Wired RainSensor™ Page 93	Rain	Wired	24 VAC Controllers
TFS Flow Sensors Page 94	Flow	Wired	TMC-424 & Sentinel Central Controllers
TMR Maintenance Remote Page 95	—	Up to 1.5 Miles	TMC-424 & Custom Command™ Controllers
EVOLUTION® Remote Page 96	—	Up To 1000'	EVOLUTION® Series Controller
EICON Remote Page 97	—	Up to 5 Miles	24 VAC Controllers





Leveraging Toro® sensing technology used on high-end commercial sites and world-class golf courses around the globe, the Toro Precision™ Soil Sensor reduces water waste by continuously measuring moisture levels in the soil and determining when to allow your controller to water, maximizing the efficiency of your irrigation system. Communication between the sensor probe and receiver is completely wireless, so installation is quick and easy with no digging required.

FEATURES & BENEFITS

Works with Nearly All Irrigation Controllers

Can be installed on any irrigation controller, including competitive models.

Prevents Overwatering

Continuously measures soil moisture levels and determines when to allow your irrigation controller to water, making sure just the right amount of water is applied.

No Digging Required

Communication between the sensor probe and the receiver is completely wireless, with up to a 500' range (line of sight). Installation doesn't disturb the soil, giving you accurate moisture readings starting as soon as the sensor is put in the ground.

Automatic Calibration

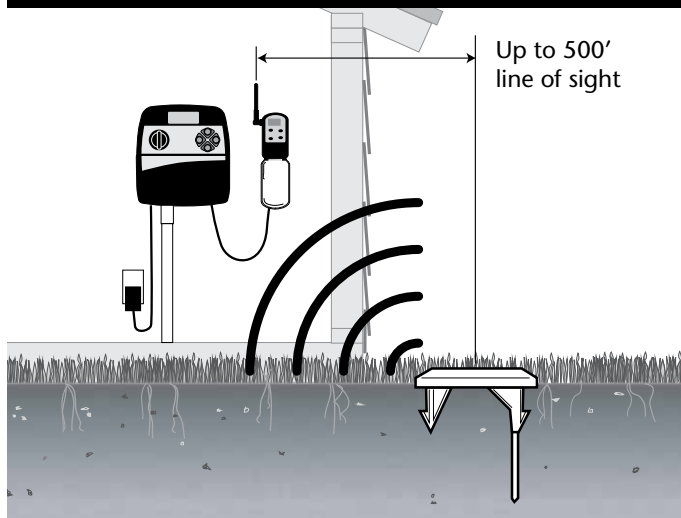
The sensor will automatically detect the soil type and adjust all calculations accordingly.

Freeze Detection

The only soil sensor to offer freeze detection that prevents irrigation when temperatures approach freezing.



HOW IT WORKS



- There are two components to the system - a battery-powered wireless sensor probe and a receiver that wires into any irrigation controller's sensor port.
- Once installed, the sensor calculates field capacity for your soil (or the maximum amount of water the soil can hold after excess water has drained away) and sets that as "100%".
- Any time the moisture level in the soil exceeds field capacity, the irrigation controller is prevented from watering until the moisture level falls below the level set in the receiver (default is 50% of field capacity, adjustable by the user).

UNIVERSAL PSS-KIT INSTALLATION

1

Hook up the receiver to your irrigation controller



2

Install the batteries to power up the sensor probe



3

Place the probe in the ground



Visit www.toroevolution.com to download free software to help optimize your irrigation controller's schedule for the Precision™ Soil Sensor.

SPECIFICATIONS

Electrical

- Receiver input power: 24 VAC
- Probe: Three AA batteries

Temperature

- Operating (Probe): 14°F to 170°F
- Operating (Receiver): 14°F to 140°F
- Storage: -22°F to +149°F

Dimensions

- Probe body: 5" x 3 3/4" x 3/4"
- Probe spikes: 4 3/4"
- Receiver body: 3" x 3 3/4" x 1 1/2"

Warranty

- Two years

Additional Features

- ✓ Sensor receiver hooks up to irrigation controller's sensor port (if available) or is wired into common wire
- ✓ Up to 500' range, line of sight
- ✓ One sensor per receiver
- ✓ Adjustable moisture threshold in 1% increments allows the user to set the desired moisture level
- ✓ Sensor automatically determines soil type and adjusts calculations accordingly
- ✓ Freeze detection prevents irrigation when temperatures approach freezing
- ✓ Smart bypass overrides the sensor for a user-defined length of time (especially useful during system winterization)
- ✓ If the sensor is tripped while the irrigation controller is in the middle of a watering program, the optional "Cycle Delay" feature ensures all subsequent zones in the irrigation program have a chance to get watered before the sensor halts watering
- ✓ Multi-color LED on the sensor probe indicates radio signal strength
- ✓ Sensor probe's ultra-slim 3/4" profile allows it to avoid being damaged by mowing equipment
- ✓ Extra long stainless-steel electrodes measure over 4" down into the soil profile
- ✓ Sensor probe's support stakes hold sensor firmly in place when installed
- ✓ Easily replaceable batteries last up to two years with alkaline batteries (longer with lithium)



PSS-SEN Model
Can be used with the EVOLUTION® Controller with intergraded Smart Connect®

Specifying Information—Precision™ Soil Sensor

Model	Description
PSS-KIT	Universal Precision™ Soil Sensor Kit (Probe + Receiver)
PSS-SEN	Sensor Only (for use with EVOLUTION Smart Connect®)



SPECIFICATIONS

Electrical

- Input Power:
 - Repeater: <.02A @ 6 VDC
 - Base Station: <.1A @ 120 VAC, 50/60 Hz

Temperature

- Operating: 32°F to 140°F
- Storage: -22°F to 180°F

Dimensions

- Body: 2" x 3 5/8" x 6 1/8"
- Spikes: 1 3/4" x 3/16"
- Installation Hole Diameter: 4 1/4"

Communication

- Repeater Range: Up to 2,000' line-of-sight
- Buried Sensor Range: Up to 500' line-of-sight
- 900 MHz ISM Band FHSS Communication
- Additional licensing not required

Warranty

- Comes with one year of NSN support (extended support plans available)

The Toro® Turf Guard Wireless Soil Monitoring system is a revolutionary technology that lets you know what's going on beneath the surface of your turf, so you can make timely, more-informed adjustments.

FEATURES & BENEFITS

Wireless Communication

Turf Guard's advance wireless MESH network technology makes for an easy installation with no trenching required.

Monitor Moisture Levels in the Soil

Reduce water usage and improve playability without risking turf quality. Promote root growth by avoiding over watering and detect dry areas before it impacts the turf's health.

Track Salt Build-up And Schedule Flushing

Take the guesswork out of monitoring and managing salinity levels. Know when and how much water to flush with.

Review Daily Soil Temperatures

Predict peak soil temperatures early in the day to start remediation activities before an emergency. Schedule fungicide applications and pesticides for optimal effectiveness.

Additional Features

- ✓ Comes with free SiteVision™ software for viewing data
- ✓ Advanced MESH routing technology overcomes obstacles
- ✓ Durable sensor housing is resistant to aeration damage
- ✓ Supports up to 500 sensors per system
- ✓ Expected sensor battery life of three years, field replaceable
- ✓ Sensor reading sent every five minutes
- ✓ Measures two distinct depths in the soil profile
- ✓ Automatic network configuration and failure recovery
- ✓ Graphical system overview displays sensor data at-a-glance
- ✓ Plots trends and compares historical and current readings
- ✓ Move quickly from system-wide averages to individual sensor readings

Specifying Information—Turf Guard

Model	Description
TG-S2-R	Turf Guard Sensor with Replaceable Battery Repeater-Internal Mount Repeater-External Mount Base Station Battery Kit
TG-R-INT	
TG-R-EXT	
TG-B	
TG-S2-BAT	



Automate or manually adjust irrigation based on moisture level trends in the soil, using the Toro® Pro Series™ Soil Sensor – a wireless soil moisture sensor that works in conjunction with the Toro Sentinel® central irrigation control system, measuring at depths up to three and a half feet below the surface of the soil.

FEATURES & BENEFITS

Wireless Communication

The wireless radio communication from the sensor to the controller “base station” means no trenching or wiring required.

Ultimate Flexibility

The unique design of the probe incorporates a tether that allows measurements to be taken anywhere from just below grade to upwards of three and a half feet below the surface, making it suitable for anything from turf to large trees or anything in between.

Maximum Control

Up to 16 sensors can be used with any Sentinel controller, transmitting real-time moisture data every 5 minutes.

Easy Installation

All “V3” Sentinel controllers come standard with the port that accepts the Pro Series receiver, allowing for “plug and play” upgrades. The sensor can either be completely buried in soil for greater vandal resistance or installed in a valve box for easier servicing.

Proven Technology

The Toro Pro Series Soil Sensor leverages both hardware and proprietary programming used for over a decade on golf courses and high-profile sports fields.

SPECIFICATIONS

Operational

- Works with Sentinel® central control system to adjust watering
- Up to 16 sensors per controller
- Leverages Turf Guard® wireless communication technology
- Compatible with Turf Guard® repeaters to extend range
- Replaceable battery (lasts up to 3 years after installed)

Electrical & Wireless

- Up to 500' range line-of-site from buried sensor to controller
- 900 MHz ISM Band FHSS communication
- Input power for receiver: - <.02A @ 6 VDC from controller

Dimensions

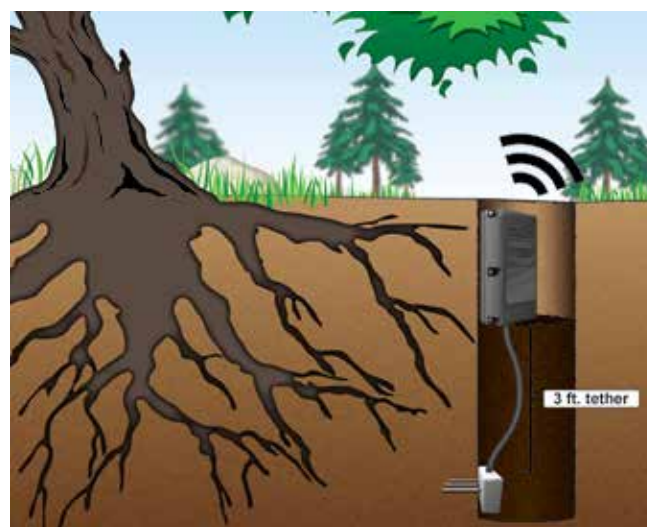
- Body: 2" x 3 5/8" x 6 1/8"
- Spikes: 1 3/4" x 3/16"
- Tether: 3'

Additional Options

- Toro Pro Series Soil Sensor wireless receiver (TPS-RX)

Warranty

- Two years



Specifying Information—Pro Series™ Soil Sensor

Model	Description
TPS-SS	Toro Pro Series Soil Sensor
TPS-RX	Toro Pro Series Internal Receiver



TORO

SMART CONNECT® WIRELESS WEATHER SENSOR



For simple water saving controller adjustments, Toro introduces the Smart Connect® Wireless weather sensor. The sensor works with the EVOLUTION® Series controllers to manage water usage by using live temperature and solar measurements as well as historical weather data for a particular location to calculate the right amount of water needed from the irrigation system. The integrated Smart Connect® Receiver then automatically updates the controller for hassle free water savings.

FEATURES & BENEFITS

Prevents Overwatering

Continuously monitors air temperature and solar radiation to generate watering adjustments based on actual local weather conditions.

Built in RainSensor™

Adjustable for the amount of precipitation required to shut off the system.

Wireless Installation

Install this sensor in minutes with no wires to route back to the controller. You have the flexibility of placing the sensor across walkways, driveways or across the property without the need to run wires to it.

Historical Weather Information

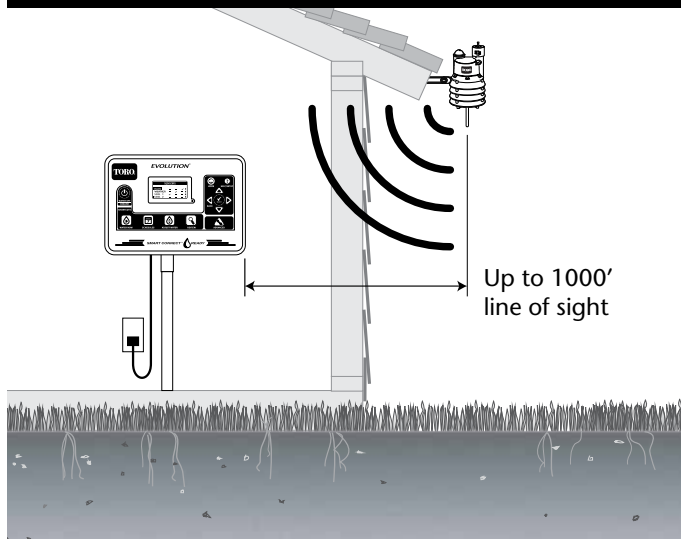
The sensor is supplied with an SD card which contains 10 years of historical weather information for North American based on ZIP Code or latitude/longitude locations. The data is used to generate the weather adjustments and can also be used as backup values if sensor communications are ever lost.

No Service Fees

The wireless weather sensor does not require any external data connection to operate. There are no monthly or yearly service fees required to have ET based weather adjustments based on local conditions.



HOW IT WORKS



SPECIFICATIONS

Operational

- Sensor is wirelessly connected to the Smart Connect Receiver (EVO-SC) sold separately.
- Up to 1000' range, line of sight.
- One sensor per receiver, but multiple receivers can connect to the same sensor

Electrical

- Hydraulic or electric models available
- 9VDC Battery

Temperature

- Operating: -14° F to 140° F
- Storage: -22° F to 149° F

Dimensions

- 6" x 6 1/2" x 2 3/4" (mounting arm extended)

Warranty

- Five years



Additional Features

- ✓ Setup and review menu's integrated in the EVOLUTION controller
- ✓ Built-in Solar Sensor monitors the amount of sun exposure the landscape is receiving
- ✓ Built-in temperature sensor monitors air temperature
- ✓ Automatic freeze shutoff feature prevents watering when temperatures approach freezing
- ✓ Low battery indicator and alert in the EVOLUTION controller
- ✓ 0-14 day watering hold after a rain event
- ✓ Assignable weather sensor irrigation control by schedule
- ✓ One sensor can support multiple controllers within the radio range of the sensor.



Certified by
ICC-ES

EPA WaterSense approved when
equipped on an EVOLUTION controller

Specifying Information—Smart Connect® Sensor

Model	Description
EVO-WS	Smart Connect Wireless Weather Sensor



No wires. No hassle. Just reliable rain sensing that provides optimum water savings. Toro® innovative wireless technology provides easy to use, advanced features for prompt reaction when it starts to rain.



SPECIFICATIONS

Operational

- Operating temperature: -20° F to 120° F
- Housing material: Weather and UV resistant engineered polymer
- Transmitting range: up to 500' (line-of-sight) with adjustable antenna
- Sensor: maintenance free hygroscopic disks; adjustable rain sensitivity: 1/8" to 3/4"

Dimensions

- Transmitter: 1 3/4" W x 3 1/2" H x 1 3/4" D
- Receiver: 2" W x 4" H x 1 3/4" D
- Weight: 0.78 lbs. product and carton

Warranty

- Five years

Electrical

- Transmitter Power: Two replaceable lithium cells (CR2032-3V)
- Receiver Power Source: 22-28 VAC/VDC, 100mA (from existing timer or optional transformer)
- Relay contacts output: Normally-opened or normally-closed; 3A @ 24 VAC
- FCC, IC, AVA, UL, CUL, CE and C-tick approved

FEATURES & BENEFITS

Smart Bypass™

Allows for system override at any time and resets automatically.

Rain/Freeze Combination

Features digital programmable accuracy – a first in the industry. The Freeze shutoff can be set from 35°–45°F in 2° increments.

WATER MANAGEMENT HIGHLIGHT



Water Conservation Modes

Selectable water conservation modes delay resumption of irrigation by intelligently extending beyond mechanical reset time and can save you up to 30%* more water.

* Savings vary based on sensor setting, watering schedule and other conditions.

Additional Features

- ✓ Low battery indicator
- ✓ Signal strength indicator/scale
- ✓ Rain delay feature that works intelligently with the rain sensor (unlike most controller-based rain delays)
- ✓ Fail-safe modes in the event of loss of communications or failed sensor
- ✓ Real-time outside temperature displayed on the LCD (TWRFS only)
- ✓ Five year easy to replace, standard coin batteries
- ✓ Versatile mounting options: one-piece Quick-Clip™ gutter bracket or 1/2" conduit adapter
- ✓ Can control multiple receivers/controllers with one sensor transmitter

Specifying Information–Wireless

Model	Description
TWRS	Toro Wireless RainSensor
TWRFS	Toro Wireless Rain/Freeze Sensor



Wired Rain/Freeze Sensor
New Wired Rain/Freeze Sensor automatically suspends irrigation when the temperature drops below 37° F (2,8°C) saving piping networks and irrigation components.

When it rains sometimes all you need is a simple sensor that ensures the job gets done. With multiple set-points for adjustable rain sensitivity and maintenance-free sensing disks, Toro's TRS provides the reliability required.

FEATURES & BENEFITS

Compatible With All Toro And Other Manufacturers' Controllers

Universal Normally Open and Normally Closed operation for compatibility with all controllers that are designed to accept a sensor device.

Maintenance Free Hygroscopic Discs

Industry standard sensing discs with adjustable rain shut-off indexes at 1/8", 1/4", 1/2" and 3/4" of rain.

25 Feet Of UV-Resistant Cable

Includes 25 feet of white outdoor-rated, UV-resistant cable.

Specifying Information—Wired Sensor

Model	Description
TRS	Toro Wired RainSensor
53853	Toro Wired Rain/Freeze Sensor

WIRED RAINSENSOR™



First LCD In A Wireless Rainsensor
Provides informative system feedback including outside temperature, and transmitter signal strength and battery life.

SPECIFICATIONS

Operational

- Relay contacts output, normally open or normally closed: 3A, 24 VAC
- Operating temperature: -20° F to 120° F (-28°C– 49°C)
- Low profile design and UV-resistant housing for sensor
- No special tools required for installation

Dimensions

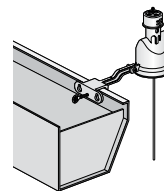
- Transmitter: 1¾" W x 3½" H x 1¾" D
- Weight: 0.80 lbs. product and carton

Warranty

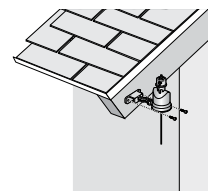
- Two years

THREE MOUNTING OPTIONS:

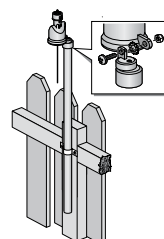
Quick Clip Gutter Bracket



Wall Mount



Conduit Adapter





The Toro TFS series flow sensors provide reliable flow information to aid in the detection of and response to system issues like piping breaks, while being accurate enough for tracking water usage.

FEATURES & BENEFITS

Effective Flow Monitoring Even In Flows Less Than 5 gpm

Effective in ranges from 1.2 gpm to 500 gpm. Teamed with the Toro TMC-424, 1/2", 3/4" and 1" sensors provide a cost-effective flow monitoring and alarm system.

Compatible With Competitive Controllers

In addition to the Toro compatible controllers – TDC+, TMC-424E, TIS-PRO and Sentinel® – these flow sensors work with any controller or control system compatible with frequency output flow sensors (pulses per second proportional to flow velocity).

Additional Features

- ✓ Simple impeller-based design
- ✓ Potted electronics designed for valve box or underground applications
- ✓ Sensor pre-installed in tee
- ✓ Removable sensor design for easy replacement without removal of tee
- ✓ Socket end tee



SPECIFICATIONS

Operational

- Output: 2-wire, unscaled pulse – pulse width 5msec +/- 25%
- Frequency: 3.2 to 200 Hz
- Pressure Rating:
 - 1/2", 3/4" and 1": up to 150 psi
 - 1 1/2", 2", 3" and 4": up to 100 psi
- Temperature Rating: Up to 140° F (60° C)
- Flow Range (Velocity):
 - 1/2", 3/4" and 1": 2'-20' per second
 - 1 1/2", 2", 3" and 4": 0.5'-30' per second
- Tee:
 - 1/2", 3/4" and 1": Schedule 40 PVC
 - 1 1/2", 2", 3" and 4": Schedule 80 PVC

- Sensor Housing: Potted, PPS
- Impeller:
 - 1/2", 3/4" and 1": 300SST
 - 1 1/2", 2", 3" and 4": Glass-filled nylon
- Shaft: Tungsten Carbide
- Bearing: UHMWPE
- Wires: 18AWG direct burial shielded cable

Warranty

- Two years

TFS SERIES FLOW SENSOR PERFORMANCE DATA

Sensor Model	TFS-050	TFS-075	TFS-100	TFS-150	TFS-200	TFS-300	TFS-400
Size	1/2"	3/4"	1.0"	1.5"	2.0"	3.0"	4.0"
K Value	00.78	0.1563	0.26112	1.699	2.8249	8.309	13.74283
Offset	0.9	0.9	1.2	-3.016	0.1435	0.227	0.23707

TFS SERIES MODEL LIST

Model	Description	Suggested Operating Range:
TFS-050	1/2" Flow Sensor	1.2-12 gpm
TFS-075	3/4" Flow Sensor	2.7-28 gpm
TFS-100	1" Flow Sensor	5-50 gpm
TFS-150	1 1/2" Flow Sensor	5-100 gpm
TFS-200	2" Flow Sensor	10-200 gpm
TFS-300	3" Flow Sensor	20-300 gpm
TFS-400	4" Flow Sensor	40-500 gpm

Specifying Information—TFS Sensor

TFS-XXX		
Model	Configuration	
TFS	XXX	
TFS—Flow Sensor	050—1/2" Plastic Tee 075—3/4" Plastic Tee 100—1" Plastic Tee 150—1 1/2" Plastic Tee	200—2" Plastic Tee 300—3" Plastic Tee 400—4" Plastic Tee



This is irrigation maintenance at its easiest! The Toro® TMR is a maintenance remote system that allows a single operator to perform irrigation checks and fully operate the system from up to 1.5 miles away.

FEATURES & BENEFITS

Operates on Unlicensed MURS Frequencies

Up to 1.5 mile line-of-sight range without the hassles of FCC licensing.

Toro Exclusive All Stations Cycle (ASC) Function

Provides one-start system operation for walk-throughs, maximizing productivity – 2-minute runtimes per station.

Quick-Connect System (For Toro Controllers)

Allows receiver to easily be moved from one controller to another; circular connector can be bracket-mounted or mounted using 1/2" conduit.

Multi-Controller/Multi-Site Capability

Programmable address allowing selection of up to 999 different remote receivers at controllers.

SPECIFICATIONS

Operational

- Frequency: MURS designated channels – U.S. USE ONLY (151.82, 151.88, 151.94, 154.57, 154.6 MHz)
- Automatic detection and avoidance of busy channels
- Operating temperature range: -14° to 140° F
- Up to 1.5 miles line-of-sight range and typically 1/2 mile in obstructed areas
- Intuitive, easy-to-use keypad
- Large, easy-to-read LCD display
- Remotely controls up to 500 stations
- Battery life indicator
- Circular connector comes standard with 5' cable
- Simple, intuitive command set
- Default run time is 10 minutes
- Display shows countdown of time left to run
- Ergonomic design and removable belt clip

Electrical

- Receiver input voltage: 22-26 VAC input
- Transmitter DC Operating voltage: 4-6V DC
- Transmitter operates on 4 AA batteries
- Receiver operates off of the 24 VAC power from the controller
- FCC, UL-listed

Controller Compatibility

- Toro: TMC-212, TMC-424E, Custom Command, TIS-PRO, TDC

Dimensions

- Receiver size: 12" x 3" with antenna
- Transmitter size: 12" x 3" with antenna

Warranty

- Two years

Specifying Information—TMR Maintenance Remote

TMR-1-XXX	
Model	Description
TMR-1	XXX
TMR-1—Toro Maintenance Remote	KIT—Complete Kit: Transmitter, Receiver, Circular Connector/Cable Assembly, Carrying Case CC—Circular Connector for Receiver

Example: A complete TMR Maintenance Remote Kit would be specified as: **TMR-1-KIT**



EVOLUTION® SMART CONNECT® REMOTE



SPECIFICATIONS

Operational

- Up to 1,000' range line of sight
- Address PIN range 0000-9999
- Watering and auxiliary modes

Electrical

- 9 VDC Battery

Temperature

- Operating -14°F to 140°F
- Storage -22°F to 149°F

Dimensions

- 7" x 2 3/4" x 1 1/4"

Warranty

- Five years

For simple time saving operation of zones and schedules, Toro® introduces the Smart Connect® Handheld Remote. The remote works with the EVOLUTION® Series Controller to activate zones and schedules from up to 1000' line of sight distances.

FEATURES & BENEFITS

Compatible with EVOLUTION

Works with EVOLUTION Series Controllers outfitted with Smart Connect® receivers.

Backlit Display Handheld Remote

Makes maintenance checks easy after sunset with a backlit display.

Additional Features

- ✓ Provide individual zones or schedule ON/OFF schedules
- ✓ Mini USB port for upgrades to features or access to data
- ✓ Water resistant case
- ✓ Battery indicator
- ✓ Set the maximum zone count to match the controller

Specifying Information—Smart Connect® Remote

Model	Description
EVO-HH	Smart Connect Handheld Remote



For powerful, long-range, multi-site control, EICON maintenance remotes have been the irrigation industry for over 40 years.

FEATURES & BENEFITS

Up to 5-Mile Line-of-Sight Range

Plus powerful UHF FM signal is the best available tool for communicating with receivers behind walls or in other hard-to-reach locations.

Universal Wiring

Receivers connect to any controller with 24 VAC outputs.

Two-way Voice Communication

Handheld transmitter is capable of two-way voice communication as well as data transmission.

SPECIFICATIONS

Operational

- Handheld radios feature rechargeable batteries
- Low battery indicators
- Handheld transceivers are locally serviceable at radio service centers
- All components comply with FCC rules and regulations
- Receivers available in 12, 24, 36 or 48 station configurations
- MRC units are compatible with any controller that controls solenoids, relays etc., utilizing 24 VAC
- Any of the outputs in the host controller maybe turned on or off in any order
- A run time can be entered from the handheld transceiver (from 1 to 20 minutes) for multiple valve syringe or sequential operations
- Ability to individually address and control up to 1000 controllers with a single handheld transceiver
- Receiver address codes may be changed by the operator
- An indicator light illuminates and begins blinking when the receiver unit is properly installed
- External antenna connectors are standard. For special applications where reception may become a problem such as deep underground or extreme ranges, special application antennas are available

Optional Accessories

- UHF Handheld Transceiver with DTMF Keypad – includes charger (TRX-5U)
- 30", 12-station wiring harness for wiring to individual station outputs (P-30)
- 48", 12-station wiring harness for wiring to individual station outputs (P-48)
- 36" pigtail extension (E-36)

Dimensions

- MRC Receiver: 6 1/4" D x 8" W x 2 1/2" H

Warranty

- Two years

Specifying Information—EICON Special Build

ESB-XX-XX-XX			
Description SB	Model XX	Type XX	Options XX
SB—EICON Special Build	MRC—Maintenance Remote Complete Kit MRX—Maintenance Remote Receiver RLM—Permanent Mount Receiver Card	12—12-Stations Universal 24—24-Stations Universal 36—36-Stations Universal 48—48-Stations Universal	RB—Rain Bird® (ESP-MC) Remote Connector*

*Only available in RLM Version

CENTRAL CONTROL

Leveraging cutting-edge wireless communication and sensing technologies, Toro's line of Sentinel® central control products offers maximum flexibility and control in an easy-to-use package for sites both large and small.





Powerful, Reliable & Versatile



Model	Conventional Output Boards	Wireless Output Boards	DC Two-Wire	AC Two-Wire	No Keypad Option	Maximum Stations	Dimensions	Warranty
WS1 Small Powder-Coated Wall-Mount Enclosure Page 103	X	X		X	X	48 Conventional or Wireless; 204 two-wire	10 ¼" W x 15 ¼" H x 5 ¼" D	Five years
WS5 Large Stainless Steel Wall-Mount Enclosure Page 103	X	X	X	X		48 Conventional or Wireless; 204 two-wire	17 1/8" W x 30 ¾" H x 8 5/8" D	Five years
PS1 Stainless Steel Pedestal Page 103	X	X	X	X		48 Conventional or Wireless; 204 two-wire	17 1/8" W x 34 ½" H x 8 5/8" D	Five years
PP1 Plastic Pedestal Page 103	X	X	X	X		48 Conventional; 96 wireless; 204 two-wire	17" W x 40" H x 16" D	Five years
WS3 Small Stainless Steel Wall-Mount Enclosure Page 104	X				X	18 Conventional	10 ¾" W x 9 ¾" H x 3 ½" D	Five years
WS2 Medium Powder-Coated Wall-Mount Enclosure Page 105			X			204 two-wire	14" W x 13" H x 6" D	Five years



SENTINEL® CENTRAL CONTROL



Sentinel Central Control from Toro® is a powerful system that literally “stands guard” over irrigation sites. With the ability to control up to 999 field satellites from one location, users have a water management tool that provides ultimate customizability and reliability.

FEATURES & BENEFITS

Simple To Use

Microsoft® Windows-based software – daily operations and scheduling are made quick and easy.

Features For Water Management

ET-based watering, flow sensing and optimization, water usage report with historical comparison maximize system efficiency.

Smartphone and Tablet Connectivity

The new Sentinel WMS software package also includes iPhone® and iPad® connectivity for remote programming and alerts on ALL new systems.

Multiple Communication Options

Communication options like radio, Wi-Fi, cellular, and Ethernet can be mixed and matched to meet system requirements.

Distributed Programming

Stores irrigation programs in the computer while allowing irrigation control at the satellite level, ensuring the loss of a component does not result in the loss of irrigation across the system.

Toro NSN® Support

All centrals come with a minimum of two years of NSN support – unlimited 24-hour toll-free support with 24/7/365 emergency paging.



iPhone® and iPad® Connectivity



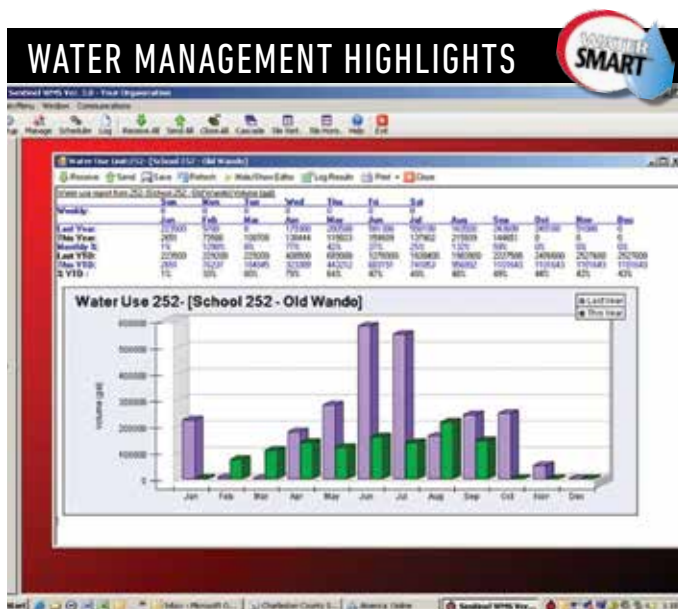
Remote
Ready



Soil
Sensing
Option



ET Adjust



Water Savings – ET-based (multiple weather station options)
Effective ET-based system management can lead to water savings of 25% to 30% per year. As an additional source of savings, pipeline breaks, malfunctioning valves, and missing heads are automatically detected and shut down, preventing excessive water loss.



Distributed Intelligence
Each Sentinel® controller is a fully intelligent unit with program data stored at both the field satellite and within the central computer. In the event a computer or master controller goes off line, there will be no loss of irrigation. True two-way communication allows programming changes to occur at the on-site field controller and uploaded to the central computer. Protection from unauthorized changes is ensured as the controller program can be easily compared to the program saved in the central computer.

SPECIFICATIONS

Electrical

- Control up to 999 field satellites
- Group controllers into "systems" for system-wide adjustments:
 - Rain Days
 - Percent Adjust
 - ET-Adjustment from shared weather source
- Field changes to controller programs can be uploaded to computer
- Support for the System Administration
 - Set system, program and satellite descriptions
 - Map valve positions on site maps
 - Mark special dates on on-screen calendar
- Alarm reporting of any system component failure, including communications, over/under-flow conditions, electrical problems or power failure
- Extensive reporting features:
 - Run time reports
 - Water usage
 - Alarms
 - Logging of system changes

Warranty

- Two year extendable by continuous NSN subscription

Additional Features

- ✓ Flow optimizing to maintain optimum flow and shorten water window
- ✓ Ability to redefine valve sequence without physically changing wire terminations in field satellite
- ✓ Information overview by group and satellite
- ✓ System status indications for individual field satellite
- ✓ On-line help screens
- ✓ Map-based feedback on system status
- ✓ Standard internet connection allows for remote access to central software via NSN® Connect

SENTINEL CENTRAL MODEL LIST

Model	Description
CENTRAL SOFTWARE/COMPUTER MODELS	
SGIS-1-T	Software Only with 2 years of NSN Support
SGIS-0-1	Software, Peripheral Hardware with 2 years of NSN Support
SGIS-1-0	Software, Computer Equip, Peripheral Hardware with 2 years of NSN Support
NSN SUPPORT EXTENSION MODELS	
SSE-T-1	1 year Extension for SGIS-0-1 of SGIS-1-T
SSE-T-3	3 year Extension for SGIS-0-1 of SGIS-1-T
SSE-C-1	1 year Extension for SGIS-1-0 (with computer warranty)
SSE-C-3	3 year Extension for SGIS-1-0 (with computer warranty)

Specifying Information—Sentinel Central Control

Description	Optional
SGIS	-X-X
SGIS—Sentinel Central Control Irrigation System	1-T—Software Only with 2 Years of NSN Telephone Support for Software 0-1—Software, Peripheral Hardware with 2 Years of NSN Telephone Support 1-0—Software, Computer Equipment, Peripheral Hardware with 2 Years of NSN Telephone Support (with computer warranty)



Toro® Sentinel field satellites are commercial grade, modular units that do the irrigation control work in the field designed to operate in both stand-alone and central mode.

FEATURES & BENEFITS

Flow Sensing

Reads, displays and reacts to under and over flow situations and tracks water usage. No additional circuit boards are required.

Expanded Wireless Connectivity

Sentinel offers true two-way communication via several different connectivity options that can be mixed and matched to meet system requirements.

Firmware Updating

Firmware is now easier than ever to update or upgrade by simply inserting a USB thumb drive.

Weather-Based Irrigation

Sentinel waters according to ET values by using one or a number of onsite weather stations.

Advanced Troubleshooting

The new satellite controller has significantly more internal memory, allowing for extensive event logging and data storage, making it easier to diagnose issues in the field.



The newly-redesigned satellite controller offers a number of new features and enhancements, including a completely-redesigned interface for easier standalone programming that incorporates a large backlit graphical display, new shortcut buttons for frequently-used functions, as well as a number of other additions.

WATER MANAGEMENT HIGHLIGHT



Pro Series™ Soil Sensor

The new satellite controller can easily be upgraded to operate with the new Toro Pro Series™ Soil Sensor, communicating directly with up to 16 sensors per controller (1 per program), continually measuring moisture levels in the soil, and adjusting irrigation as needed. See page 89 for more details.



Remote
Ready



Flow
Sensor
Compatible



Soil
Sensing
Option

CABINET CHOICES



WS1

Powder-coated, wall-mount enclosure



WS5 Stainless Steel Wall Mount

16-gauge stainless steel, front-entry, wall-mount enclosure with backplate and junction box



PP1 Plastic Pedestal

Double-sided, plastic, top-entry pedestal-mount enclosure with dual backplates and junction box



PS1 Stainless Steel Pedestal

16-gauge stainless steel, top-entry, pedestal-mount enclosure with backplate and junction box

SPECIFICATIONS

Operational

- 16 programs
- Eight start times per program
- 6-week scheduling calendar
- Station runtimes from one minute to 4 hours and 15 minutes
- Global adjustment from 0-255%
- Handheld remote ready
- ET and Soil Sensing options
- Two sensor inputs included for rain sensors or other switch sensors
- Operating temperature: 14° to 140°F
- Two flow sensor inputs
- Lower cost "faceless" controller option without faceplate (handheld and central programming only)

Dimensions

- Small wall-mount: 10 1/4" W x 15 1/4" H x 5 1/4" D
- Stainless steel wall-mount: 17 1/8" W x 30 3/4" H x 8 5/8" D
- Stainless steel pedestal-mount: 17 1/8" W x 34 1/2" H x 8 5/8" D
- Plastic Pedestal-mount: 17" W x 40" H x 16" D
- Weight:
 - Small Metal Wall-mount: 21 lbs
 - Stainless steel wall-mount: 47 lbs
 - Stainless steel pedestal-mount: 64 lbs
 - Plastic Pedestal: 60 lbs

Electrical

- Input power:
 - 120 VAC, 60 Hz
- Station output power:
 - 24 VAC
 - 1.0 amps per station maximum
 - 2.0 amps total load
- Surge protection: 24 V output boards, 20 KV @ 10 KVA

Optional Accessories

- TRS – Wired RainSensor
- TWRS/TWRFS – Wireless RainSensor or Wireless Rain/Freeze Sensor
- TFS Flow Sensors
- SHHR – Handheld Remote
- TPS-RX – Toro Pro Series™ Soil Sensor Receiver
- TPS-SS – Toro Pro Series Soil Sensor

Warranty

- Five years

Additional Features

- ✓ Upgrade to a central computer system without additional field satellite hardware or costs
- ✓ Program single or multiple stations to operate sequentially or start a program or multiple programs with just a few keystrokes
- ✓ Ability to read open- or closed-contact switches in any station count configuration
- ✓ Current monitor will disable a station if excessive amp draw is detected
- ✓ Non-volatile memory will retain all programming and real-time data for ten years
- ✓ Multi-language display: English, Spanish, French, and Italian

Specifying Information—Sentinel

SB-X-XX-XXX-U			
Configuration	Station Count	Enclosure	Communication
SB-X	XX	XXX	U
SB-Conventional Wired SBW-Short-range Wireless SBN-No Keypad (WS1 Conventional)	12—12-station 24—24-station 36—36-station 48—48-station	WS1—Powder-coated Wall Mount (Small) WS5—Stainless Steel Wall Mount (Large) PP1— Plastic Pedestal Mount (Large) PS1— Stainless Steel Pedestal Mount (Large)	U-UHF radio

Example: A 24-station Sentinel conventional controller in a small powder-coated wall-mount enclosure with UHF communication would be specified as: **SB24WS1U**



SPECIFICATIONS

Operational

- Wireless Output Controllers (SBW models) are expandable from 12 to 96-stations
- Ability to mount outputs remote from Sentinel® Control Module
 - No cabling between output boards and control module improves protection of control module from power surges
- Improved sensing includes real-time current draw per station
- Manual station activation switches
- High surge protection

Options

- Multiple Enclosure Options

Warranty

- Five years

Sentinel Wireless Output Boards utilize spread spectrum radio communication between the control module and the output boards, allowing nearly unlimited installation flexibility while virtually eliminating surge damage to the control module. Retrofits and remote flow sensing are a snap as hardscape crossing issues are eliminated.



Remote
Ready



Flow
Sensor
Compatible

SPECIFICATIONS

Operational

- All the capabilities of a Sentinel Controller, including 16 programs and eight start times per program
- 9, 12, and 18 station models
- 6-week scheduling calendar
- Station runtimes from one minute to four hours and 15 minutes
- Global adjustment from 0-255%
- Percent adjust by program from 0-255%
- Two sensor inputs included for rain sensors or other switch sensors
- Flow Monitoring Only units available (no stations) for water supply flow monitoring
- Lower cost "faceless" controller option without keypad (handheld and central programming only)

Warranty

- Five years

Sentinel Custom Control satellites are built to fit your needs and to avoid overkill on small sites. These satellites ship without manual interface keypad or display, minimizing expense without sacrificing capabilities. All the features expected of a Sentinel controller, but cost-effective for your small site needs.

Specifying Information–Sentinel® Custom Control Series

SCX-XX-WS3-U			
Configuration	Station Count	Enclosure	Enclosure
SBD	XX	WS3	U
SC – Conventional	9—9-station	WS3 Small Station	U – UHF Radio
SCN – No Keypad	12—12-station	Stainless Wall-mount	
	18— 18-station		



Easy to install and expand – a highly cost-effective field controller for large central control installations. Using a two-wire path to communicate to decoders, the Sentinel Two-Wire controller eliminates high costs associated with traditional valve wiring.



Remote Ready



Flow Sensor Compatible



Soil Sensing Option

AC SENTINEL TWO-WIRE STATION DECODERS*

Model	Description
SB-DAC-1	1-station AC decoder
SB-DAC-2	2-station AC decoder
SB-DAC-4	4-station AC decoder
SB-BLA	AC in-line surge protection

**Decoders only compatible with new "SBA" Sentinel controller models.*

DC SENTINEL TWO-WIRE STATION DECODERS

Model	Description
SB-DDC-1	1-station with integrated surge protection (Operates up to two DC)
SB-DDC-2	2-station with integrated surge protection (Operates up to four DC)
SB-DDC-4	4-station with integrated surge protection (Operates up to eight DC)
SB-TWD-ISP	Sentinel two wire DC inline surge protection

SPECIFICATIONS

Operational

- Up to 204 stations
- Operates Valves with DC-Latching Solenoids
- 16 programs, eight start times per program
- 6-week or 365-day scheduling calendar
- Station runtimes from one minute to 4 hours and 15 minutes
- Global adjustment from 0-255%
- Handheld remote ready
- Two sensor inputs included for rain sensors or other switch sensors
- Multi-language display: English, Spanish, French and Italian
- Operating Temperature: 14° to 140° F

Electrical (AC Models)

- Input power:
 - 120 VAC (60 Hz)
- Output power:
 - Up to 2 standard solenoids per station
 - Up to 4 standard solenoids per decoder
 - Up to 8 simultaneous standard solenoids per system
- Two-wire path wiring (jacketed, twisted pair):
 - 14 AWG: 5,000 ft max, 10,000 looped
 - 12 AWG: to 8,000 ft max, 16,000 looped
- Decoder-to-solenoid wiring:
 - 14 AWG: 150 ft max

Electrical (DC Models)

- Input power:
 - 120 VAC or 220/240 VAC (50/60 Hz)
- Output power:
 - Up to 2 DC solenoids per station
 - Up to 16 simultaneous DC solenoids
- Two-wire path wiring (jacketed, twisted pair):
 - 14 AWG: 15,000 ft max
 - 16 AWG to 8,450 ft max
- Decoder-to-solenoid wiring:
 - 14 AWG: 400 ft max

Dimensions

- Small wall-mount: 14" W x 13" H x 6" D
- Stainless steel wall-mount: 17 1/8" W x 30 3/4" H x 8 5/8" D
- Stainless steel pedestal-mount: 17 1/8" W x 34 1/2" H x 8 5/8" D
- Plastic pedestal-mount: 17" W x 40" H x 16" D
- Weight:
 - Small metal wall-mount: 21 lbs
 - Stainless steel wall-mount: 47 lbs
 - Stainless steel pedestal-mount: 64 lbs
 - Plastic Pedestal: 60 lbs

Optional Accessories

- TRS – Wired RainSensor
- TWRS/TWRFS – Wireless RainSensor or Wireless Rain/Freeze Sensor
- TFS – Flow Sensors
- SHHR – Handheld Remote
- TPS-RX – Toro Pro Series™ Soil Sensor Receiver Base Station Module for Sentinel Satellite Connectivity
- TPS-SS – Toro Pro Series Soil Sensor

Warranty

- Five years

Specifying Information-Sentinel 2-Wire Controller

SBX-XXX-U		
Configuration	Station Count	Enclosure
SBX	XXX	U
SBA – Sentinel AC Decoder Controller	WS1—Powder-coated Wall-mount (Medium) AC Only WS2—Powder-coated Wall-mount (Medium) DC Only WS5—Stainless Steel Wall-mount (Large) PP1—Plastic Pedestal-mount (Large) PS1—Stainless Steel Pedestal-mount (Large)	U – UHF Radio
SBD – Sentinel DC Decoder (two-wire) Controller		

Example: A Sentinel DC two-wire controller in a medium powder-coated wall-mount enclosure with UHF communication would be specified as: **SBDWS2PU**

Refer to page 99 for enclosure compatibility.



SENTINEL® SMART IRRIGATION



Maximize efficiency on your Sentinel system by using ET-Based watering. ET-Based watering automatically schedules irrigation based on individual landscape needs and local weather conditions. The result is higher property values, lower water bills and a healthier environment. Unlike competitive systems, Sentinel works in conjunction with multiple weather sources including on-site weather stations and Toro's wireless, web-based Precision™ ET.

FEATURES & BENEFITS

Precision™ ET

Precision™ ET is a web-based ET source that users subscribe to through the Toro National Support Network. Virtual Weather Stations are assigned based on latitude and longitude coordinates. Each "location" will require a yearly fee, however, unlimited controllers may be assigned to any latitude and longitude.

On-Site Weather Stations*

Choose from a number of manufacturer's weather stations to meet your customer's needs. Choose wired or wireless versions to best suit the installation method needed.

*CIMIS (CA Only)
Freely access a network of over 120 automated weather stations in the State of California managed by the California Department of Water Resources (DWR).

SPECIFICATIONS

Recommendation On-Site Weather Station

- Davis Vantage Pro 2 Plus™
 - Cabled (6162C)
- Less Expensive
- 100' feet of cable provided
- 1000' possible
 - Wireless (6162)
- No cable necessary
- Repeaters can be used
 - Wireless Repeaters (7654)
- AC powered
- Solar
- Used with 6162 Davis Station
- WeatherLink® Software (6510 SER)

Supported Weather Sources:

- Precision™ ET (Virtual)
- CIMIS (Free CA only)
- Davis Instruments®
 - Vantage Pro 2 Plus™
 - Grow Weather™
- Campbell Scientific®
 - ET 106
 - Turf Weather
- Irrisoft™
 - Weather Reach™

SENTINEL SMART IRRIGATION MODEL LIST

Model	Description
T-PREC-ET	Precision™ ET Renewal

On-site weather stations ordered separately.



SENTINEL® SOIL SENSING

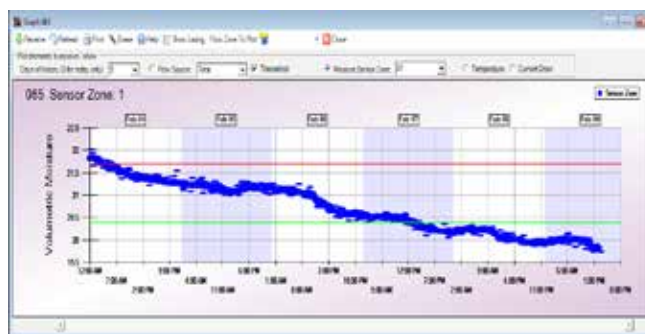
TORO



Using either the new wireless Toro® Pro Series™ Soil Sensor or the full-featured Turf Guard® soil sensor, Sentinel users can set upper and lower moisture level “trip points” in the software to regulate when irrigation is allowed, as well as view the trends over time on an at-a-glance dashboard.

SPECIFICATIONS

- 1 sensor assignable per program
- 16 sensors per controller
- Sensor data read every 5 minutes
- Ability to work in conjunction with ET-based control
- Refer to page 89 for additional information on the Toro® Pro Series™ Soil Sensor.



SOIL SENSING MODEL LIST

Model	Description
TPS-RX	Toro Pro Series Receiver for Sentinel controllers
TPS-SS	Toro Pro Series soil sensor
TG-S2-R	Turf Guard soil sensor



SENTINEL® FLOW SENSING

TORO



SPECIFICATIONS

- Two flow inputs standard on all Sentinel controllers
- High, low, and zero flow detection by station or group of stations
- Unexpected flow detection outside of scheduled watering
- Volumetric flow shutdown option
- Projected and actual flow graphing
- Data exportable to customized Excel spreadsheets
- Each controller stores two years of flow data

FLOW SENSING MODEL LIST

Model	Description
TFS-100	1" sensor (5–50 gpm)
TFS-150	1.5" sensor (5–100 gpm)
TFS-200	2" sensor (10–200 gpm)
TFS-300	3" sensor (20–300 gpm)
TFS-400	4" sensor (40–500 gpm)

Toro Sentinel satellites have extensive flow reading, reaction, and reporting capabilities. All controllers come standard with two flow inputs and two alarm inputs, and are compatible with both standard flow sensors as well as most hydrometers, including reed-switch and 3-wire pulse-diode models.





SPECIFICATIONS

Operational

- Simple command set
- Accesses controller and satellite features from the field
- Direct access to controllers (central control software not required)
- Two-way voice communication capability
- System On and Off command activation
- Five-watt radio
- 120 selectable and programmable channels
- Range: up to 2 to 3 miles

Dimensions

- Transmitter size (with antenna):
2 3/8" W x 1 3/4" D x 11" H

Warranty

- Two years

The Sentinel® remote allows users to conduct irrigation checks, and fully operate the system without opening a field satellite enclosure or needing a second person. This remote also serves as a two-way voice radio, allowing easy communication with other crew members.

SENTINEL HANDHELD REMOTE MODEL LIST

Model	Description
SHHR	Sentinel Handheld Remote



SPECIFICATIONS

Operational

- Flow sensor, ET gauge and rain sensor capabilities
- Non-volatile memory in case of a power outage
- 100% compatibility with the Sentinel central control software
- Optional hand-held control with a Sentinel hand-held unit
- Provides the convenience of remote manual control
- Multiple hand-helds can be used on one site

Dimensions

- 5 1/2" W x 5 1/2" L x 1 1/2" H

Accessories

- SHHR – Sentinel Handheld Remote

Warranty

- Two years

The Sentinel® Retro-Link assembly unit allows an existing Rain Bird® ESP-MC controller to be upgraded to a Sentinel field satellite. Retro-Link is 100% compatible with the Sentinel central control software.

SENTINEL RETRO LINK MODEL LIST

Model	Description
SB-RLS-U2-RB	Sentinel Retro-Link Assembly (Rain Bird ESP-MC)



Isn't it nice to know someone's got you covered? Available day or night, you can count on the Toro National Support Network (NSN®) team for total operational confidence.

SPECIFICATIONS

Support for the Sentinel® Central Control

- Every Sentinel central package comes standard with 2-years NSN support
- Unlimited 24-hour toll-free support with 24/7/365 emergency paging
- Technical assistance by email with next business day response
- Remote PC assistance where connectivity is available
- Support of Microsoft® operating system software when purchased from NSN
- NSN lab for field issue duplication and diagnostics
- Technical bulletins
- Remote data storage for duration of subscription period
- Extended warranty on central hardware components with continuous subscription
- User training both hardware and software
- For more information on products, services or training, contact:

Toro NSN
P.O. Box 3339,
Abilene, TX 79604
Phone: 888-676-8676
Website: toronsn.com

FEATURES & BENEFITS

24-Hour, Seven-Day, 365 Support

Worldwide, Toro NSN is always available to answer your questions, troubleshoot your system and solve your problems. And if needed, our 24-hour central computer and component replacement service ensures minimal disruption to the operation of your irrigation system (U.S.).

Industry-Best Training – Classroom and Internet- Based

Classroom instruction is available at regional locations and at the NSN Training Center—where classes feature hands-on computer training and the operation of Toro hardware. NSN's new internet-based Training In Ten™ features critical instruction that can be learned in ten minutes or less and quickly applied right on-the-job!

The Confidence of Working with the Best in the Business

Toro NSN is a Microsoft® Certified Partner. Our support technicians are licensed irrigators. NSN has a diagnostic lab on-site for each irrigation platform, all field hardware, plus ancillary products. The lab is used to duplicate field issues and investigate causes and solutions as part of Toro's commitment to continuous improvement. NSN is dedicated to irrigation—we know your business and expectations.

New System Support, Flexible Options to Renew

Every new Sentinel offering includes Toro NSN support. To protect your Toro investment long-term, choose a renewal option that gives you exactly what you need for continued reliable, cost-effective support and extended warranty, including equipment upgrades to keep your technology current and powerful.



Note: NSN Features vary based on the Sentinel product offering purchased. Contact Toro Sales for details.

Specifying Information—NSN/Sentinel Support Extensions

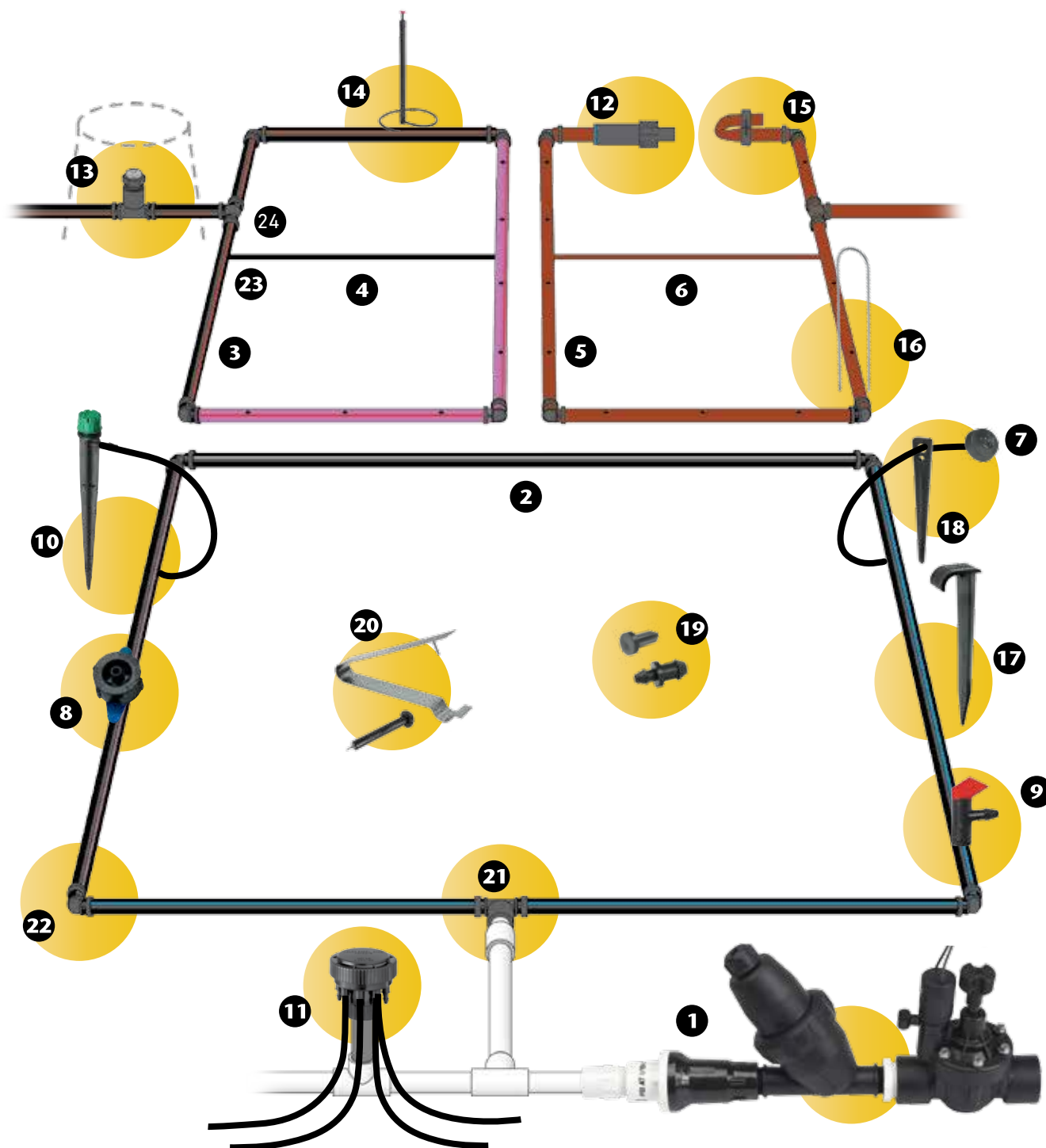
SSE-X-X	
Description	Optional
SSE	-X-X
SSE—Toro NSN Support for Sentinel Subscription Extensions*	T-1—1-year Extension for SGIS-0-1 or SGIS-1-T T-3—3-year Extension for SGIS-0-1 or SGIS-1-T C-1—1-year Extension for SGIS-1-0 (with computer warranty) C-3—3-year Extension for SGIS-1-0 (with computer warranty)

*1- and 3-year NSN extensions can be purchased up-front in conjunction with SGIS packages to provide the end-user with an additional one or three years of NSN support. For example, a customer can order the SGIS-1-0 and the SSE-C-3 which would equal five years of NSN support. These extensions are for original purchases only; existing plan renewals are still purchased through Toro NSN.

LANDSCAPE DRIP

Drip is one of the most efficient methods of irrigation. With innovative products like DL2000® subsurface dripline with ROOTGUARD®, Toro's line of landscape drip products takes watering efficiency to the next level.





- | | | | |
|--|------------------------------------|------------------------------------|-------------------------------------|
| 1. Drip Zone Kit (p. 128) | 7. NGE Emitter (p. 120) | 13. Vacuum Relief Valve (p. 117) | 19. Goof Plugs & Bug Caps (p. 117) |
| 2. Blue Stripe Hose (p. 118) | 8. Turbo-SC Emitter (p. 122) | 14. Operation Indicator (p. 117) | 20. Hole Punchers (p. 117) |
| 3. DL2000 Subsurface Dripline (p. 112) | 9. E2 Emitter (p. 123) | 15. End Clamp (p. 117) | 21. FPT to Loc-Eze Adapter (p. 117) |
| 4. DL2000 Micro-Line (p. 116) | 10. Varistake Emitter (p. 126) | 16. Steel Staple (p. 117) | 22. Loc-Eze Elbow (p. 117) |
| 5. PC Brown Drip-In Dripline (p. 114) | 11. Multi-Outlet Manifold (p. 124) | 17. Plastic Locator Stake (p. 117) | 23. 1/4" Barbed Coupling (p. 117) |
| 6. 1/4" Soakerline Dripline (p. 116) | 12. Flush Valve (p. 117) | 18. 1/4" Locator Stake (p. 117) | 24. Loc-Eze Tee (p. 117) |

Note: The above diagram is not to scale and is intended only to showcase products; as such, it does not necessarily represent recommended installation.





Toro® DL2000 Dripline is the most technologically advanced subsurface irrigation system available. Through its non-toxic ROOTGUARD® technology, only DL2000 delivers optimal water application directly to the root zone while safely inhibiting root intrusion.

FEATURES & BENEFITS

U.S. Government-Approved ROOTGUARD® Protection

The pre-emergent, ROOTGUARD® material, is impregnated into the emitter during the molding process and creates a “force field” effect around the emitter outlet, diverting root growth and assuring long term reliability.

At Grade Or Buried Options

Can be installed at grade or buried 4” – 8” underground, delivering irrigation directly to the plant’s root zone.

Pressure-Compensating Self-cleaning Emitters

Provide precise, trouble-free water application. ROOTGUARD® impregnated emitters are inseparably welded to the inside wall of durable polyethylene dripline tubing during manufacturing.

Environmentally Friendly

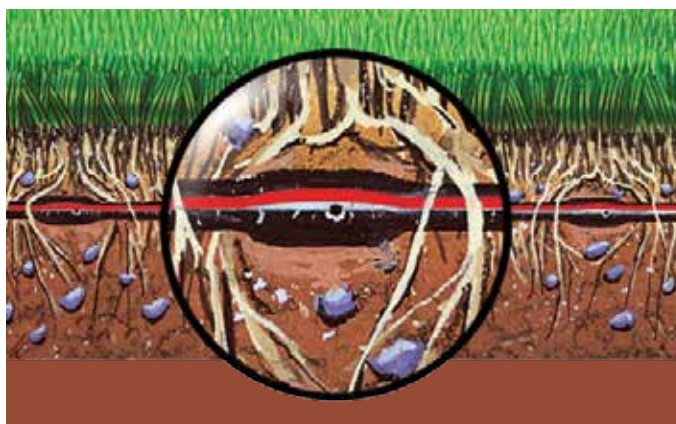
Irrigation takes place at or below grade so there is minimal water loss due to mist, evaporation, run-off or wind. Fertigation needs are reduced because water is applied only at the root zone.

Safety and Liability

When DL2000 is installed below ground, the landscape surface is free from irrigation equipment that may disrupt activities or cause injury. Sub-surface performance also avoids slippery walkways and roadways as well as wet walls, fences and windows.



Effluent
Options
Available



Distinctive red stripe on tubing signifies DL2000 with ROOTGUARD

DL2000 MODEL LIST

Model	Description
5/8" DL 2000 PC DRIPLINE WITH ROOTGUARD	
RGP-212-01	0.5 gph, 12" emitter spacing, 100 ft. coil
RGP-412-01	1.0 gph, 12" emitter spacing, 100 ft. coil
RGP-218-01	0.5 gph, 18" emitter spacing, 100 ft. coil
RGP-418-01	1.0 gph, 18" emitter spacing, 100 ft. coil
RGP-212-05	0.5 gph, 12" emitter spacing, 500 ft. coil
RGP-412-05	1.0 gph, 12" emitter spacing, 500 ft. coil
RGP-218-05	0.5 gph, 18" emitter spacing, 500 ft. coil
RGP-418-05	1.0 gph, 18" emitter spacing, 500 ft. coil
RGP-212-10	0.5 gph, 12" emitter spacing, 1000 ft. coil
RGP-412-10	1.0 gph, 12" emitter spacing, 1000 ft. coil
RGP-218-10	0.5 gph, 18" emitter spacing, 1000 ft. coil
RGP-418-10	1.0 gph, 18" emitter spacing, 1000 ft. coil
5/8" DL2000 PC PURPLE DRIPLINE WITH ROOTGUARD	
RGP-212-05-E	0.5 gph, 12" emitter spacing, 500 ft. coil
RGP-412-05-E	1.0 gph, 12" emitter spacing, 500 ft. coil
RGP-218-05-E	0.5 gph, 18" emitter spacing, 500 ft. coil
RGP-418-05-E	1.0 gph, 18" emitter spacing, 500 ft. coil

5/8" OD		INLET PRESSURE VS. MAXIMUM LENGTH OF RUN IN FEET				
Part No.	Flow Rate (gph)	Emitter Spacing	15 psi	25 psi	30 psi	40 psi
RGP-212	.53	12"	250'	360'	400'	460'
RGP-218	.53	18"	350'	515'	565'	650'
RGP-412	1.0	12"	160'	240'	260'	300'
RGP-418	1.0	18"	240'	340'	375'	430'

DL2000 PERFORMANCE TABLE

Flow Rate	.53/1.00 gph
Inside Diameter	0.620"
Outside Diameter	0.710"
Wall	0.045"
Operating pressure (P)	15–60 psi
Minimum filtration requirement	120 Mesh
Hazen-Williams C factor	140
Barb loss factor (Kd)	.98

SPECIFICATIONS

Operational

- Design flexibility for narrow, odd-shaped landscape areas
- Precise watering puts water where it's needed; avoids water marks on expensive hardscapes, glass or signage
- Distinctive red strip on tubing signifies DL2000 with ROOTGUARD®

Warranty

- Against Root Intrusion: Seven years
- Hose: Five years pro-rated

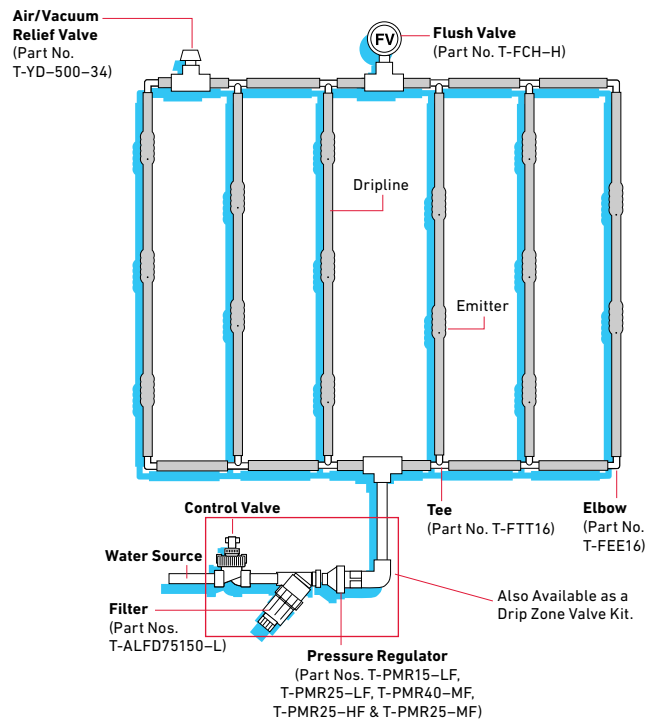
PRECIPITATION RATE FOR EVENLY SPACED LATERALS AND EMITTERS

Precipitation Rate for Drip Laterals (inches/hour)							
Emitter Flow (gph)	Emitter Spacing (in.)	Spacing Between Drip Laterals					
		6 in.	12 in.	18 in.	24 in.	30 in.	36 in.
0.53	12	1.7	0.85	0.57	0.43	0.34	0.28
0.53	18	1.13	0.57	0.38	0.28	0.23	0.19
1.00	12	3.27	1.64	1.09	0.82	0.65	0.55
1.00	18	2.18	1.09	0.73	0.55	0.44	0.36

Precipitation Rate Formula:

$$\text{Precipitation Rate (in./hr.)} = \frac{231.1 \times \text{Emitter Flow (gph)}}{\text{Lateral Spacing (in.)} \times \text{Emitter Spacing (in.)}}$$

Note: This formula applies to evenly spaced drip irrigation laterals and emitters.



Other fittings available:

- Coupling (Part No. T-FCC16)
- Adapter (Part No. T-FAM16)
- Compression Adapter (Part No. T-CA-710)

Specifying Information—DL2000

RGP X-XX-XX-E			
Emitter Flow	Emitter Spacing	Coil Length	Optional
X	XX	XX	E
2—.53 gph 4—1.0 gph	12—12" 18—18"	01—100' 05—500' 10—1000'	E—Purple Tubing for Non-potable Water

Example: A 500' coil of Pressure-compensating Dripline with rootguard, 12" emitter spacing and 0.5 gph, would be specified as: **RGP-212-05**

Note: Specify/use Loc-Eze Fittings or .710 Compression Fittings.



With higher water costs in our future, it makes more sense than ever to use inline tubing in suitable landscape applications. Drip In PC is both an effective and economical choice for at-grade installations.

FEATURES & BENEFITS

Built-in Emitters

Deliver precise water application directly to the root zone.

Fully Pressure-compensating from 15 – 60 psi

The Pressure-compensating design makes it ideal for slopes, high wind areas and areas with limited water supply or low pressure.

High Uniformity

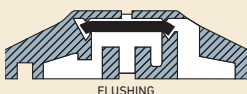
Proven, dependable Pressure-compensating Drip In emitters deliver uniform, precise emitter discharge rates with exceptionally low variability.

Keeps Water Off Hardscapes

Preventing unsightly water stains.



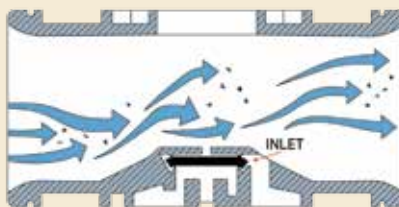
Effluent
Options
Available



FLUSHING



REGULATING



INLET



Unique, Continuous Flushing

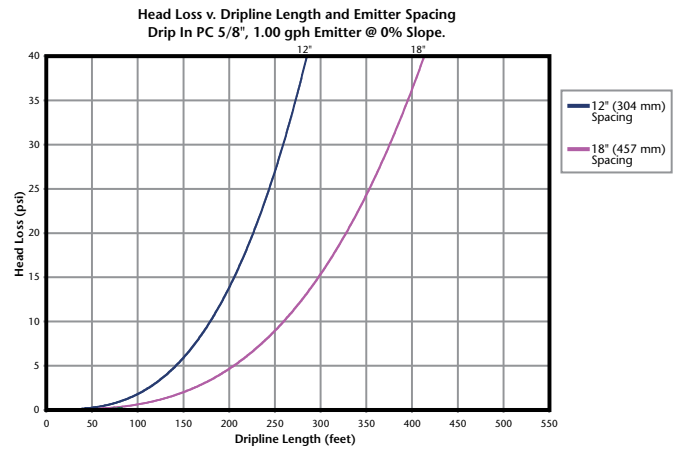
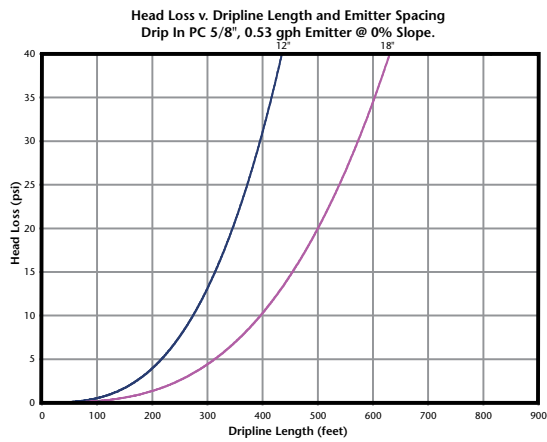
Flushing occurs at low pressure at start up, during the irrigation cycle if the emitter begins to clog and there is a reduction in flow, and as pressure drops during shut-down.

Highly Clog Resistant

Unique, raised internal filtration design deflects debris upward and away from the emitter's inlet. Because the inlet is also raised, sediment won't collect at the inlet while the system is off.

Dual Opposed Outlets

In above ground installations, dual opposing ports in every emitter assure that at least one outlet provides air relief, which prevents back-siphonage of contamination into the emitter.



LENGTH OF RUN CHART

5/8" (0.620" ID / 0.710" OD)				INLET PRESSURE VS. MAX LENGTH OF RUN IN FEET			
Part Number	Tubing Size	Flow Rate	Emitter Spacing	15 psi	25 psi	30 psi	40 psi
T-PCB1853-12	.620" ID	.53 gph	12"	250'	360'	400'	460'
T-PCB1853-18	.620" ID	.53 gph	18"	350'	515'	565'	650'
T-PCB1810-12	.620" ID	1.0 gph	12"	160'	240'	260'	300'
T-PCB1810-18	.620" ID	1.0 gph	18"	240'	340'	375'	430'

DRIPIN PC MODEL LIST

Model	Description
5/8" BROWN PC DRIPLINE – 0.620" ID X 0.710" OD X 0.045" WALL	
T-PCB1853-12-100	0.53 gph, 12" emitter spacing, 100' coil
T-PCB1810-12-100	1.0 gph, 12" emitter spacing, 100' coil
T-PCB1853-18-100	0.53 gph, 18" emitter spacing, 100' coil
T-PCB1810-18-100	1.0 gph, 18" emitter spacing, 100' coil
T-PCB1853-12-250	0.53 gph, 12" emitter spacing, 250' coil
T-PCB1810-12-250	1.0 gph, 12" emitter spacing, 250' coil
T-PCB1853-18-250	0.53 gph, 18" emitter spacing, 250' coil
T-PCB1810-18-250	1.0 gph, 18" emitter spacing, 250' coil
T-PCB1853-12-500	0.53 gph, 12" emitter spacing, 500' coil
T-PCB1810-12-500	1.0 gph, 12" emitter spacing, 500' coil
T-PCB1853-18-500	0.53 gph, 18" emitter spacing, 500' coil
T-PCB1810-18-500	1.0 gph, 18" emitter spacing, 500' coil
5/8" PURPLE PC DRIPLINE (EFFLUENT)	
T-PCE1810-12-500	1.0 gph, 12" emitter spacing, 500' coil

DRIPIN PC BROWN PERFORMANCE TABLE

Flow Rate	.53/1.00 gph
Inside Diameter	0.620"
Outside Diameter	0.710"
Wall	0.045"
Operating Pressure (P)	15–60 psi
Minimum Filtration Requirement	120 Mesh
Hazen-Williams C Factor	140
Barb Loss Factor (Kd)	.98

Specifying Information—DripIn PC

T-PCX-X-18-XX-XX-XXX					
Tubing Type	Skin	Tubing Size	Emitter Flow (@ 30 psi)	Emitter Spacing	Coil Length
T-PC	X	18	XX	XX	XXX
T-PC–Drip In Tubing	B–Brown Drip In Tubing E–Purple Drip In Tubing (Effluent)	18–5/8" (.720 OD X 0.620" ID)	53–0.53 gph 10–1.00 gph	12–12" 18–18"	100–100' 250–250' 500–500'

Example: A coil of 5/8" Pressure-compensating .53 gph emitters spaced at 12" on a 500' coil would be specified as: **T-PCB1853-12-500**

TORO

DL2000™ SERIES MICROLINE WITH ROOTGUARD®



DL2000 MICROLINE PERFORMANCE TABLE

Inside Diameter	0.170"
Outside Diameter	0.250"
Wall	0.040"
Operating Pressure	15–60 psi
Minimum Filtration Requirement	140 Mesh
Nominal Flow Rate (Q)	0.53 gph

NOTE: For information about the effects of temperature on polyethylene drip hose/tubing, please see bottom of pg. 152.

LENGTH OF RUN CHART

Part Number	Tubing Size	Flow Rate	Emitter Spacing	Inlet Pressure	Maximum Length of Run
T-MCRG-206	1/4"	.53 gph	6"	15 psi	19'
T-MCRG-212	1/4"	.53 gph	12"	15 psi	33'

Specifying Information—Microline

Model	Description
T-MCRG-206	DL2000 100' Roll, 1/4" Non-pressure-compensating Microline Dripline with ROOTGUARD®, 6" Emitter Spacing, 0.50 gph
T-MCRG-212	DL2000 100' Roll, 1/4" Non-pressure-compensating Microline Dripline with ROOTGUARD®, 12" Emitter Spacing, 0.50 gph

FEATURES & BENEFITS

ROOTGUARD® Protection

Uses a non-toxic pre-emergent creating a force-field effect guarding against root intrusion into the emitters.

1/4" Tubing With Built-in Emitters

Allows for ease of installation even to the smallest of areas.

TORO

SOAKERLINE™ 1/4" CLASSIC DRIPLINE



SOAKERLINE PERFORMANCE TABLE

Inside Diameter	0.170"
Outside Diameter	0.250"
Wall	0.040"
Operating Pressure	15–60 psi
Minimum Filtration Requirement	140 Mesh
Nominal Flow Rate (Q)	0.53 GPH

NOTE: For information about the effects of temperature on polyethylene drip hose/tubing, please see bottom of pg. 152.

LENGTH OF RUN CHART

Part Number	Tubing Size	Flow Rate	Emitter Spacing	Inlet Pressure	Maximum Length of Run
T-SDB252-6-100	1/4"	.53 gph	6"	15 psi	19'
T-SDB252-12-100	1/4"	.53 gph	12"	15 psi	33'

FEATURES & BENEFITS

Flexible and Sturdy Design

Soakerline 1/4" dripline has a flexible and sturdy design making it ideal for young trees, shrubs, planter boxes and small landscape applications.

Built-in Emitters

Allow for ease of installation.

Brown Color

To blend into landscape areas.

LOC-EZE™ FITTINGS AND ACCESSORIES

TORO

Specifying Information—5/8" Loc-Eze Fittings

Model	Description
T-FTT16	Loc-Eze Tee
T-FEE16	Loc-Eze Elbow
T-FCC16	Loc-Eze Coupling
T-FAM16	Loc-Eze x 1/2" MPT Male Adapter
T-FTF16	Loc-Eze x 1/2" FPT Tee
T-FJA16	Loc-Eze x 3/4" MHT without Cap
T-FJJ16	Loc-Eze x 3/4" MHT with Cap
T-FAS16-1	Loc Eze x 3/4" FHT Swivel with Washer
T-FTS16	Loc-Eze x 3/4" FHT Swivel Tee with Screen
T-FTS16-1	Loc-Eze x 3/4" FHT Swivel Tee with Washer
T-FAS16	Loc Eze x 3/4" FHT Swivel with Screen

Note: 5/8" EHW1645 is an equivalent hose size to DL2000 Dripline.



T-FTT16

T-FEE16

T-FCC16

T-FAM16



T-FTF16

T-FJA16

T-FJJ16

T-FAS16-1



T-FTS16

T-FTS16-1

T-FAS16



T-YD-500-34

T-FCH-H-FIPT

T-FPG02

T-FCH-H-FHT



T-FJQ16

T-IPS1500

T-SS6-50

T-FMP16

T-DL-MP9

Specifying Information Accessories

Model	Description
T-YD-500-34	Air Vent—1/2" MIPT Air Release & Vacuum Relief Valve
T-FCH-H-FIPT	Flush Valve—3/4" FPT (Pipe Thread), 0.8 gpm, 2 psi Sealing Pressure
T-FCH-H-FHT	Flush Valve—3/4" FHT (Hose Thread), 0.8 gpm, 2 psi Sealing Pressure
T-DL-MP9	DL2000 Pop-up Operation Indicator
T-FJQ16	5/8" Figure-eight End Clamp
T-SS6-50	3/4" Steel Soil Staple to Hold Tubing in Place
T-IPS1500	5/8" Plastic Locator Stake to Hold Tubing in Place
T-FPG02	Double-sided Goof Plug
T-FMP16	Stainless Steel Insertion Tool for 1/4" Barbed Fittings and Emitters

Specifying Information—Microline 1/4" Fittings

Model	Description
T-FTT0400	Tee (Barb x Barb)
T-FEE0400	Elbow (Barb x Barb)
T-FCC0400	Coupling (Barb x Barb)
T-FCV-BB	Microflow Valve (Barb x Barb)
T-FMP08	Hose Punch for 1/4" barbed fittings and emitter
T-IPS0104	1/4" plastic locator stake to hold tubing in place



T-FCC0400

T-FTT0400

T-FEE0400

T-FCV-BB



T-FMP08

T-IPS0104



T-CA-710



T-CEFCH-H

Specifying Information—0.710 OD Compression Fittings

Model	Description
T-CA-710	OD Compression Adapter 1/2" Spigot
T-CEFCH-H	OD Compression Adapter with Flush Valve, 0.8 gpm, 2 psi Sealing



Central to any point-source drip installation, is the water delivery system. It needs to be reliable, trouble-free and cost effective. Providing the solution for over 30 years, Toro® Blue Stripe® hose leads the industry as the highest requested hose on the market.

FEATURES & BENEFITS

Manufactured From Premium Grade Linear Low Density Polyethylene

For the most dependable long-lasting operation.

Minimum 2% Carbon Black Added

To provide optimum protection against ultraviolet (UV) deterioration.

Available With Blue, White Or Lavender Stripe

For easy on-site identification of drip zones or applications during installation and operation.

Wide Range Of Choices

Available in a wide range of diameters, wall thicknesses, coil lengths and working pressures.

Loc-eze Fittings Recommended

$\frac{5}{8}$ " Loc-Eze Fittings are designed to work with $\frac{5}{8}$ " hose.



Effluent
Options
Available

BLUE STRIPE® MICRO-DISTRIBUTION HOSE**ID CONTROLLED HOSE**

Part Number	Hose Size	Nominal Hose Size			Coil Length	Coil Ship Weight	Pressure Rating
	ID Inch	ID Inch	OD Inch	Wall Inch	Ft.	Lbs.	psi
Blue Stripe Round Hose - Coil Stretch Wrapped							
T-EHW0437-100	1/4"	0.170	0.250	0.040	1,000	9.64	161
Blue Stripe Round Hose - Coil Banded							
T-EHD0437-010	1/4"	0.170	0.250	0.040	100	1.1	161

BLUE STRIPE® POLYETHYLENE HOSE**ID CONTROLLED HOSE**

Part Number	Hose Size	Nominal Hose Size			Coil Length	Coil Ship Weight	Pressure Rating
	ID Inch	ID Inch	OD Inch	Wall Inch	Ft.	Min. Lbs.	psi
Blue Stripe® Round Hose – Coil Stretch Wrapped							
T-EHW1645-010	5/8"	0.615	0.705	0.045	100	4.0	61
T-EHW1645-050	5/8"	0.615	0.705	0.045	500	19.8	61
Blue Stripe® Round Hose - Coil Banded							
T-EHD1554-050A (palletized)	-	0.570	0.680	0.055	500	21.5	77
PX T-EHD1645-050A (palletized)	5/8"	0.615	0.705	0.045	500	18.9	61
PX T-EHD2057-050A (palletized)	3/4"	0.805	0.920	0.057	500	31.2	59
T-EHD2667-066A (palletized)	1"	1.060	1.195	0.067	660	63.3	53

*Note: For the two designated part numbers above, replace "D" with "P" in the part number to specify Purple Hose for reclaimed water.
For the same two designated part numbers above, replace "D" with "X" in the part number to specify White Stripe Hose.
Note: For information about the effects of temperature on polyethylene drip hose/tubing, please see bottom of pg. 152.*

BLUE STRIPE® POLYETHYLENE HOSE MODEL LIST

Model	Description	Model	Description
MICRO-DISTRIBUTION HOSE – COIL STRETCH WRAPPED		LAVENDER STRIPE ROUND HOSE	
T-EHW0437-100	LLDPE, 1/4", ID: 0.170", OD: 0.250", Wall: 0.040", 1,000' coil	INSIDE DIAMETER (ID) CONTROLLED – COIL BANDED	
MICRO-DISTRIBUTION HOSE – COIL BANDED		T-EHP1645-050A	5/8", ID-0.615", OD-0.705", Wall-0.045", 500' coil (palletized)
T-EHD0437-010	LLDPE, 1/4", ID-0.170", OD-0.250", Wall-0.040", 100' coil	T-EHP2057-050A	3/4", ID-0.805", OD-0.920", Wall-0.057", 500' coil (palletized)
INSIDE DIAMETER (ID) CONTROLLED – COIL STRETCH WRAPPED		WHITE STRIPE® ROUND HOSE	
T-EHW1645-010	5/8", ID: 0.615", OD: 0.705", Wall: 0.045", 100' coil	INSIDE DIAMETER (ID) CONTROLLED – COIL BANDED	
T-EHW1645-050	5/8", ID: 0.615", OD: 0.705", Wall: 0.045", 500' coil	T-EHX1645-050A	5/8", ID-0.615", OD-0.705", Wall-0.045", 500' coil (palletized)
INSIDE DIAMETER (ID) CONTROLLED – COIL BANDED		T-EHX2057-050A	3/4", ID-0.805", OD-0.920", Wall-0.057", 500' coil (palletized)
T-EHD1554-050A	ID: 0.570", OD: 0.680", Wall: 0.055", 500' coil (palletized)		
T-EHD1645-050A	5/8", ID: 0.615", OD: 0.705", Wall: 0.045", 500' coil (palletized)		
T-EHD2057-050A	3/4", ID: 0.805", OD: 0.920", Wall: 0.057", 500' coil (palletized)		
T-EHD2667-066A	1", ID: 1.060", OD: 1.195", Wall: 0.067", 660' coil		

Specifying Information—Blue Stripe® Polyethylene Hose

T-EH-X-XX-XX-XXX-A					
Model	Stripe Color/Packaging	Tubing Size (ID)	Wall Thickness	Coil Length	Optional
T-EH	X	XX	XX	XXX	A
T-EH - Blue Stripe Hose	D - Blue Stripe/Coil Banded W - Blue Stripe/Stretch Wrapped P - Lavender Stripe/Coil Banded X - White Stripe/Coil Banded	04 - .16" 15 - .59" 16 - .63" 20 - .79" 26 - 1.02"	37 - .037" 45 - .045" 54 - .054" 57 - .057" 67 - .067"	010 - 100' 050 - 500' 066 - 660' 100 - 1000'	A- Palletized



Designed for demanding drip irrigation installations, the Toro® New Generation Emitter (NGE) has what it takes to keep your system flowing.

FEATURES & BENEFITS

Uniform Flow Rates

Make the NGE ideal for use in difficult topographical conditions.

Unique Emitter Design And Pressure Compensating Diaphragm

Allows the emitter to self-flush during operation and shut-down to facilitate cleaning. This ensures the emitter is free of debris at start-up and during the emitter operation.

Stops the emitter from draining below 2-3 psi preventing complete drainage of the system. This reduces the time required to refill the system at start-up improving the overall operation.

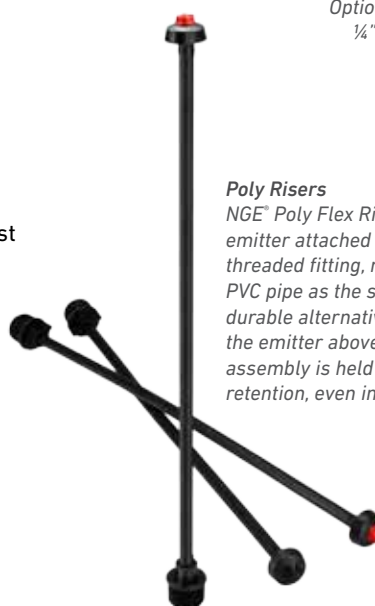
Allows the emitter to close inhibiting back siphoning and preventing the emitter from being contaminated with debris

Low Coefficient Of Variation (CV)

As tested by Toro and independent labs, the NGE is one of the best performing pressure-compensating emitters available.

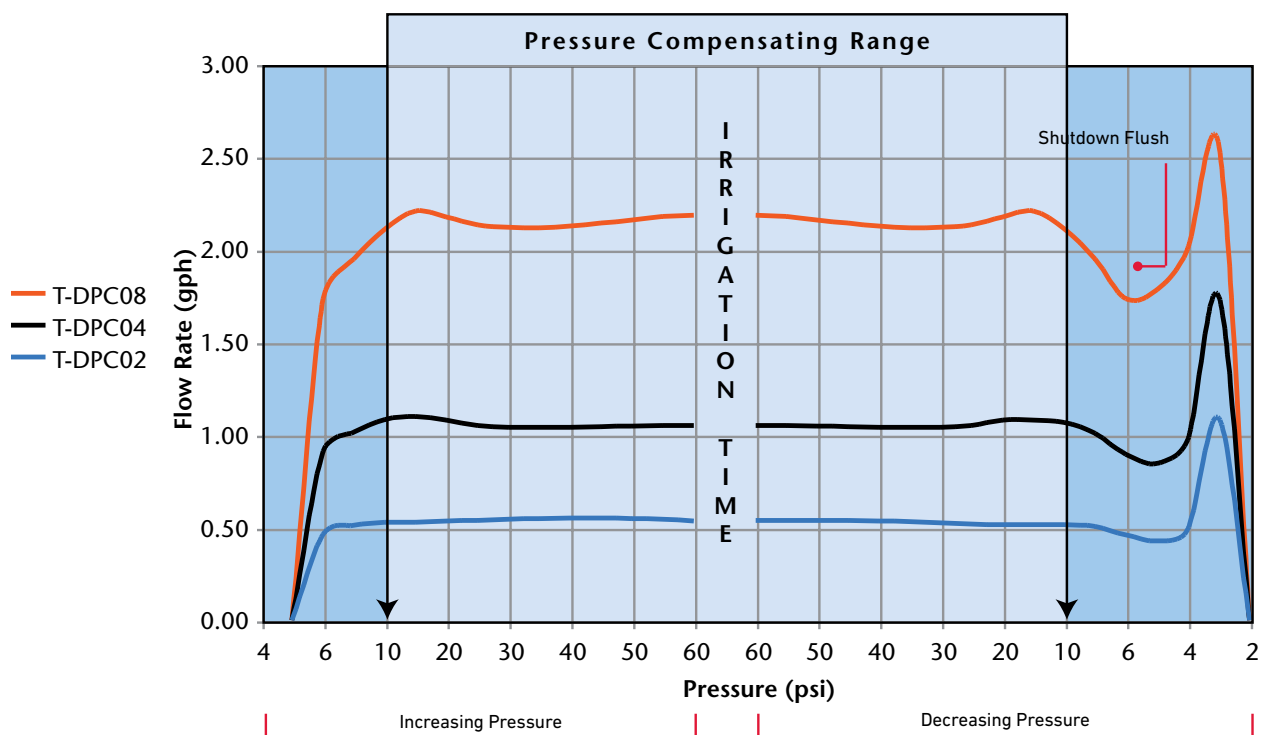


Male Adapter
Option for use with
1/4" exit tubing



Poly Risers

NGE® Poly Flex Risers come pre-assembled with an NGE emitter attached to a 12" poly flex riser and 1/2" male threaded fitting, making for easy installation when using PVC pipe as the supply line on a drip system as a more durable alternative to traditional poly hose, while keeping the emitter above ground for easy maintenance. The assembly is held together with barbed inserts for stronger retention, even in hotter desert climates.



NGE FLOW RATES

Pressure	DPC02	DPC04	DPC08
psi	gph	gph	gph
6	0.46	0.91	1.73
8	0.51	1.01	1.95
10	0.53	1.08	2.11
15	0.53	1.10	2.21
20	0.53	1.08	2.17
25	0.54	1.05	2.13
30*	0.54	1.04	2.12
35	0.55	1.04	2.12
40	0.55	1.04	2.12
45	0.55	1.04	2.14
50	0.55	1.05	2.16
55	0.54	1.05	2.18
60	0.54	1.05	2.18

*Recommended operating pressure

SPECIFICATIONS

Operational

- Recommended operating pressure: 8-60 psi
- Average Flow Rates:
 - T-DPC02 – 0.5 gph
 - T-DPC04 – 1 gph
 - T-DPC08 – 2 gph
- Color-coded snap-on dust cap (0.5 gph Blue; 1 gph Black; 2 gph Red) deters dust and insects from entering the emitter
- Barbed inlet allows emitters to be installed directly onto hose or used with 1/4" tubing

Warranty

- Two years

NGE PERFORMANCE TABLE

		T-DPC02	T-DPC04	T-DPC08
Nominal Flow Rate (Q)	gph	0.5 gph	1.0 gph	2.0 gph
Recom. Pressure Range (P)	psi	8–60 psi		
Emitter Exponent (x)		0.000	0.000	0.002
Coefficient of Variation (Cv)		3%		
Min. Filtration Requirement		140 Mesh (105 Micron)		
Optional Outlet		-MA (Male Adapter) -DC (Snap-on Dust Cap)		
Color (Cap)		Blue	Black	Red

Specifying Information—Sentinel

TS-X-XX-XXX-U	
Model	Description
T-DPC02-MA T-DPC04-MA T-DPC08-MA	NGE SF (Self-flushing) Pressure-compensating Turbulent Flow Emitter with Male Adapter 0.5 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black) 1.0 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black) 2.0 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black)
T-DPC02-DC-BLUE T-DPC04-DC T-DPC08-DC-RED	NGE SF (Self-flushing) Pressure-compensating Turbulent Flow Emitter with Dust Cap 0.5 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (blue) 1.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (black) 2.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (red)
T-DPC04-PR12 T-DPC08-PR12	NGE SF (Self-flushing) Pressure-compensating Turbulent Flow Emitter with Dust Cap on Poly Riser 1.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (black) on Poly Riser 2.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (red) on Poly Riser



SPECIFICATIONS

Operational

- Proven PC (pressure-compensating) emitter design
- Barbed inlet allows emitters to be installed directly onto hose or used with ¼" tubing
- High quality diaphragm for improved pressure compensation and uniformity over a wide range of pressure

Warranty

- One year

From the company that has pioneered so many drip irrigation innovations, the Toro® Turbo SC Plus has an industry track record for proven performance and affordability. Known as the DPJ emitter, Turbo SC Plus offers the two features liked by so many users. Pressure-compensation for system uniformity and “take-apart” for simple on site inspection.

FEATURES & BENEFITS

Take-Apart Feature

Permits fast, easy on-site inspection and cleaning.

Large Self-flushing, Turbulent Flow Path

For higher resistance to plugging where water conditions may be a problem.

Male Adapter With Bug Shield

Deters the entry of insects, but also can be used with ¼" exit tubing for precision water placement.

Color-Coded Base For Easy On-Site Identification

Blue – 0.5 gph; Black – 1.0 gph; Red – 2.0 gph.

FLOW RATE

psi	T-DPJ02-A	T-DPJ04-A	T-DPJ08-A
5	0.42	0.73	1.41
10	0.44	0.97	1.80
15	0.47	0.96	2.00
20	0.49	0.97	2.12
25	0.50	1.00	2.15
*30	0.51	1.01	2.15
35	0.51	1.01	2.11
40	0.50	1.00	2.04
45	0.49	0.98	1.95
50	0.47	0.95	1.84
55	0.45	0.91	

**Recommended operating pressure. Values listed in gallons per hour.*

TURBO-SC PERFORMANCE TABLE

		T-DPJ02-A	T-DPJ04-A	T-DPJ08-A
Nominal Flow Rate (Q)	gph	0.5 gph	1.0 gph	2.0 gph
Recom. Pressure Range (P)	psi	10–50 psi		
Emitter Exponent (x)		0.02	–0.04	0.01
Min. Filtration Requirement		140 Mesh (105 Micron)		
Color (Base)		Blue	Black	Red

Specifying Information—Turbo-SC Plus

Model	Description
T-DPJ02-A-BLUE	0.5 gph Pressure-compensating Emitter w/Male Adapter (Blue)
T-DPJ04-A	1.0 gph Pressure-compensating Emitter w/Male Adapter (Black)
T-DPJ08-A-RED	2.0 gph Pressure-compensating Emitter w/Male Adapter (Red)

E-2™ CLASSIC TAKE APART EMITTER

TORO



1.0 gph

4.0 gph

2.0 gph

First introduced in 1972, the E-2 is considered the take-apart emitter by which all others are measured. While there have been a few improvements over the years, the E-2 emitter still provides accurate watering at an economical price.

FEATURES & BENEFITS

Fast Single Barb Installation

Install directly onto hose.

Large Open Flow Path

For resistance to plugging.

Take-Apart Feature

Allows fast simple field inspection.



SPECIFICATIONS

Operational

- Flow Rates:
 - T-DBK04-100 – 1.0 gph
 - T-DBK08-RED-100 – 2.0 gph
 - T-DBK16-MB-100 – 4.0 gph
- Proven Classic hydraulic design
- Economic emitter for trouble-free applications
- Barbed inlet allows emitters to be installed directly onto hose or used with ¼" leader tubing (T-EHD0437)
- Exit barb may be used with ¼" exit tubing for precision water placement

Warranty

- One year

E-2 EMITTER FLOW RATE

psi	T-DBK04	T-DBK08	T-DBK16
5	0.58	1.03	2.09
10	0.88	1.53	3.08
15	1.12	1.93	3.87
20	1.33	2.27	4.55
25	1.52	2.58	5.15
30	1.70	2.87	5.71
35	1.87	3.13	6.23
40	2.03	3.38	6.71
45	2.17	3.62	7.17
50	2.32	3.84	7.61

*Recommended operating pressure. Values listed in gallons per hour.

		T-DBK04	T-DBK08	T-DBK16
Nominal Flow Rate (Q)	gph @ 15 psi	1.06 gph	2.11 gph	4.23 gph
Flow Coefficient (K)	U.S. Units	0.22	0.41	0.85
Operating Pressure Range (P)	psi	0–50 psi		
Flow Exponent (X)		0.60	0.57	0.56
Coefficient of Variation (Cv)		≤ 5%	≤ 6%	≤ 6.5%
Minimum Filtration Requirement		140 Mesh (105 Micron)		

Specifying Information–E-2 Classic Emitter

Model	Description
T-DBK04-100	1.06 gph E-2 Emitter (Black)
T-DBK08-RED-100	2.11 gph E-2 Emitter (Red)
T-DBK16-MB-100	4.23 gph E-2 Emitter (Maroon)





The T-PR25-9 can be installed on any 1/2" riser or fitting and easily converts traditional spray systems to drip, micro spray, or micro stream bubblers.

FEATURES & BENEFITS

- Built-in 25 psi pressure regulator delivers consistent, reliable, low-volume irrigation
- Barbed outlets (9) accept 1/4" micro-tube & emitters, micro-bubblers or micro-sprays – ideal for mixed planting areas.
- Small shut-off caps provided with unit seal unused outlets.
- When system is off, cover unthreads for access to screen without disturbing 1/4" micro-tube connected to outlets.

Specifying Information—Pressure Regulating Drip Manifold

Model	Description
T-PR25-9	Pressure Regulating 9-outlet Drip Manifold



SPECIFICATIONS

Operational

- 1/2" FPT Inlet
- Operating Pressure: 20 – 100 psi
- Manifold Outlet Pressure: 21 – 28 psi
- Manifold Flow Range: 1 – 210 gph
- Individual Outlet Flow Range: 1 – 20 gph
- Barbed outlets accept 1/4" tubing: ID: .170 - .188

Warranty

- One year



Standard Model

Effluent Model



SPECIFICATIONS

Operational

- Flow Rates: 2.0 gph and 4.0 gph
- Pressure Compensation: 5 – 50 psi
- Minimum Filtration Requirement: 80 Mesh
- 1/2" FIPT inlet; diffuser cap outlet
- Self-sealing screen eliminates need for plumber's tape
- Self-cleaning flush at startup minimizes clogging and maintenance
- Flow rate molded into the identification
- Commercial-grade plastic and chloramine-stabilized silicone diaphragm provide dependable UV- and chemical-resistant performance
- Effluent and non-effluent models

Warranty

- Two years

FEATURES & BENEFITS

Pressure-Compensating

Pressure-compensating to 2 and 4 gph over a range of 5-50 psi.

Easy to Install

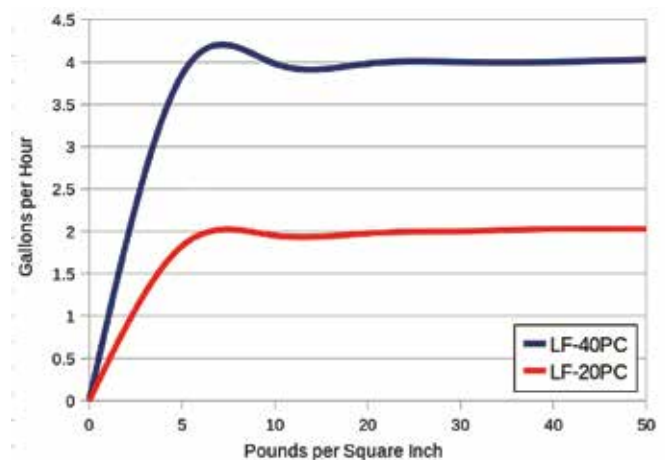
Easily threads on to a 1/2" threaded riser. The self-sealing screen eliminates the cost and labor of having to use plumber's tape on every riser.

Easy to Maintain

Self-cleaning mechanism flushes at every startup, ensuring reliable operation and fewer maintenance headaches.

Durable Construction

Commercial-grade plastic and chloramine-stabilized silicone diaphragm provide dependable UV- and chemical-resistant performance in the least forgiving of environments.



Specifying Information — Drip Bubblers

Model	Description
LF20-PC	2.0 gph PC Bubbler
LF40-PC	4.0 gph PC Bubbler
LF20-PCE	2.0 gph PC Bubbler, Effluent
LF40-PCE	4.0 gph PC Bubbler, Effluent



VARIS AND VARISTAKE ADJUSTABLE EMMITERS MODEL LIST

Diameter of Throw (maximum opening at 30 clicks):		
psi	AT 1" HEIGHT	AT 2.5" HEIGHT
20	6"	8"
30	13 1/2"	15 1/2"
40	21"	27"

Varis and Varistake Flows:	
psi	FLOW RANGE
10	0-7 gph
20	0-10 gph
30	0-11 gph
40	0-14 gph

FEATURES & BENEFITS

Available as Stake Assembly or as Barbed Emitter

Varistake connects to 1/4" micro-tube (T-EHD0437) for precise placement at plant. Varis emitter installs directly onto drip lateral.

Adjustable Flow Rate

Allows for ease of installation even to the smallest of areas.

Easy To Maintain

Green top unthreads completely to permit easy inspection and cleaning.

Specifying Information—Varis and Varistake Emitters

Model	Description
T-DAK05	Varis Adjustable Emitter with 1/4" Barbed Inlet
T-DAK15	Varistake Adjustable Emitter with 4 3/4" Stake and 1/4" Barbed Inlet



Specifying Information—PC Regulators

Model	Description
T-PMR15-LF	3/4", 15 psi, 1/10-8 gpm Low Flow Pressure Regulator
T-PMR25-LF	3/4", 25 psi, 1/10-8 gpm Low Flow Pressure Regulator
T-PMR40-MF	3/4", 40 psi, 2-20 gpm Medium Flow Pressure Regulator
T-PR25-HF	1 1/4" x 1", 25 psi, 10 - 32 gpm, High Flow Pressure Regulator
T-PMR25-MF	3/4", 25 psi, 2 - 20 gpm, Medium Flow Pressure Regulator



Filtration for your drip system doesn't have to be difficult. Since low volume systems require filtration for effective and efficient watering, Toro® F-Series filters are designed to perform.



SPECIFICATIONS

Operational

- Recommended pressure range: 5 – 142 psi
- Flow Rate: 5 – 80 gpm
- 3/4" and 1" screen filters are available in small- and large-size bodies
- Body and cap constructed of nylon
- Locking ring constructed of glass reinforced nylon
- O-ring constructed of Buna-N

Warranty

- One year

FEATURES & BENEFITS

1/2" Male Thread Outlet

With cap for quick flush cleaning.

Easy Element Access

For trouble free maintenance.

Constructed Of Highest Quality Plastics

For durability and corrosion resistance.

Specifying Information—Plastic Y-Filters (Disc)

Model	Size	Maximum Flow	Element	Mesh	Body	Head Loss Curve
T-ALFD75150-L	3/4"	25 gph	Disc	150	Large	B
T-ALFD10150-L	1"	35 gph	Disc	150	Large	C
T-ALFD15150-L	1 1/2"	80 gph	Disc	150	Large	D

Specifying Information—Plastic Y-Filters (Screen)

Model	Size	Maximum Flow	Element	Mesh	Body	Head Loss Curve
T-ALFS75150-S	3/4"	18 gph	Screen	150	Small	A
T-ALFS75150-L	3/4"	25 gph	Screen	150	Large	B
T-ALFS10150-S	1"	25 gph	Screen	150	Small	B
T-ALFS10150-L	1"	35 gph	Screen	150	Large	C
T-ALFS15150-L	1 1/2"	80 gph	Screen	150	Large	D

Specifying Information—Replacement Screen/Disc Filter Elements

Model	Size	Element	Mesh	Body
T-AMP-0004-4F	3/4", 1" and 1 1/2"	Disc	150	Large Body Size Filters
T-AMP0004-15	1/4" and 1"	Screen	150	Small Body Size Filters
T-AMP0004-2F	3/4", 1" and 1 1/2"	Screen	150	Large Body Size Filters



Pre-packaged and ready for installation – Toro® Drip Zone Valve Kits provide everything you need for drip zone automation. No need to specify or purchase separate parts.

FEATURES & BENEFITS

Everything You Need is in the Kit

- Toro Y-Filter – protects against contamination.
- Control Valve – controls the flow of water
- Pressure Regulator – reduces system pressure to levels suitable for drip irrigation

Specially Designed For Low-volume Drip Applications

- These kits are a simple, one-stop package available in 3/4" and 1" sizes
- Less valve kits also available

Reliable Valve Options

- TPV Series, 1" Inline
- EZ-Flo® Plus, 3/4" AVB and 1" Inline
- Irritrol® 700 UltraFlow® Valve, 1" Inline



Low Flow TPV Series Drip Zone Kits

Specifications	TORO EZ-FLO PLUS AVB*		TORO TPV		IRRITROL® 700 ULTRAFLOW IN-LINE	
Part Number	DZK-EZF-075-LF	DZK-EZF-075-MF	DZK-TPV-1-LF	DZK-TPV-1-MF	DZK-700-1-LF	DZK-700-1-MF
Description	Drip Zone Valve Kit, 3/4" EZ-Flo Plus, AVB, Low-flow	Drip Zone Valve Kit, 3/4" EZ-Flo Plus, AVB, Medium-flow	Drip Zone Valve Kit, 1", Low-flow	Drip Zone Valve Kit, 1", Medium-flow	Drip Zone Valve Kit, 1" 700 UltraFlow, In-line, Low-flow	Drip Zone Valve Kit, 1" 700 UltraFlow, In-line, Medium-flow
Connection Size	3/4"	3/4"	1"	1"	1"	1"
Control Valve Solenoid	24VAC, Inrush: 0.4 amps, 11.5 VA, Holding 0.20 amps, 5.75 VA					
Minimum Flow Rate	0.25 gph	2 gph	0.10 gph	2 gph	0.10 gph	2 gph
Maximum Flow Rate	8 gph	20 gph	8 gph	20 gph	8 gph	20 gph
Maximum Pressure	150 psi	150 psi	150 psi	150 psi	150 psi	150 psi
Y-Filter Degree of Filtration	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns
Regulator-Preset Pressure	25 psi	25 psi	25 psi	25 psi	25 psi	25 psi
Thread Connection-Upstream	Female NPT	Female NPT	Female NPT	Female NPT	Female NPT	Female NPT
Thread Connection-Downstream	Female NPT	Female NPT	Male NPT	Female NPT	Male NPT	Female NPT
Minimum Number of Emitters:						
0.5 gph	30	240	12	240	12	240
1 gph	15	120	6	120	6	120
2 gph	8	60	3	60	3	60
Maximum Number of Emitters:						
0.5 gph	960	2400	960	2400	960	2400
1 gph	490	1200	490	1200	490	1200
2 gph	240	600	240	600	240	600

Note: Consult your local plumbing code for backflow prevention requirements.
 *AVB = Atmospheric Vacuum Breaker (Anti-siphon Valve).

FLOW VS. FRICTION LOSS

Part Number	gpm (Flow)	0.25	5	8	15	20
DZK-EZF-075-LF	Friction Loss (psi)	3	5	5	n/a	n/a
	Min. Inlet Press. (psi)	30	32	32	34	39
DZK-EZF-075-MF	Friction Loss (psi)	3	5	5	7	13
	Min. Inlet Press. (psi)	30	32	32	34	39
DZK-TPV-1-LF	Friction Loss (psi)	2	3.5	3.7	3	3.3
	Min. Inlet Press. (psi)	30	32	32	34	39
DZK-TPV-1-MF	Friction Loss (psi)	2	3.5	3.7	3	3.3
	Min. Inlet Press. (psi)	30	32	32	32	35
DZK-700-1-LF	Friction Loss (psi)	3	3	3	n/a	n/a
	Min. Inlet Press. (psi)	30	30	30	32	34
DZK-700-1-MF	Friction Loss (psi)	3	3	3	4.5	7
	Min. Inlet Press. (psi)	30	30	30	32	34

DRIP ZONE VALVE KITS MODEL LIST

Model	Description
DZK-EZF-075-LF	3/4" EZ-Flo Plus Valve, AVB, Filter, Low-flow Regulator & Fittings
DZK-EZF-075-MF	3/4" EZ-Flo Plus Valve, AVB, Filter, Medium-flow Regulator & Fittings
DZK-EZF-1-LF	1" EZ-Flo Plus, Filter, Low-flow Regulator & Fittings
DZK-EZF-1-MF	1" EZ-Flo Plus, Filter, Medium Flow Regulator & Fittings
DZK-TPV-1-LF	1" TPV, Filter, Low-flow Regulator & Fittings
DZK-TPV-1-MF	1" TPV, Filter, Medium-flow Regulator & Fittings
DZK-700-1-LF	1" 700 UltraFlow Inline Valve, Filter, Low-flow Regulator & Fittings
DZK-700-1-MF	1" 700 UltraFlow Inline Valve, Filter, Medium-flow Regulator & Fittings
DZK-X-075-LF	Drip Zone Kit Less Valve with Filter, Low-flow Regulator & Fittings
DZK-X-075-MF	Drip Zone Kit Less Valve with Filter, Medium-flow Regulator & Fittings

Specifying Information—Drip Zone Valve Kits

DZK-XXXXXX-XX			
Kit	Valve Type		Flow Rate
DZK	XXXXXX		XX
DZK—Drip Zone Kit	EZF-075—3/4" EZ-Flo Plus AVB EZF-1—1" EZ-Flo Plus AVB TPV-1—1" TPV	700-1—1" In-line X-075—3/4", No Valve	LF—Low Flow MF—Medium Flow

Example: A Drip Zone Kit with a 700 Series UltraFlow, 1" commercial valve would be specified as: **DZK-700-1-LF**



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www.torowatersmart.com

Precipitation Rates

U.S. (Spacing in feet)

Equilateral Triangular Spacing

$$\text{P.R.} = \frac{(\text{GPM of 360}) \times 96.25}{(\text{in/hr}) (\text{Head Spacing})^2 \times .866}$$

Square/Rectangular Spacing

$$\text{P.R.} = \frac{(\text{GPM of 360}) \times 96.25}{(\text{in/hr}) \text{Head Spacing} \times \text{Row Spacing}}$$

Square/Rectangular Spacing for Specific Arc

$$\text{P.R.} = \frac{34650 \times \text{GPM (for any arc)}}{(\text{in/hr}) \text{Degrees of Arc} \times \text{Head Spacing} \times \text{Row Spacing}}$$

Metric (Spacing in meters)

$$\text{P.R.} = \frac{\text{m}^3/\text{hr of 360} \times 1000}{(\text{mm/hr}) (\text{Head Spacing})^2 \times .866}$$

$$\text{P.R.} = \frac{\text{m}^3/\text{hr of 360} \times 1000}{(\text{mm/hr}) \text{Head Spacing} \times \text{Row Spacing}}$$

$$\text{P.R.} = \frac{\text{m}^3/\text{hr (for any arc)} \times 1000}{(\text{mm/hr}) \text{Degrees of Arc} \times \text{Head Spacing} \times \text{Row Spacing}}$$

Horsepower

$$\text{H.P.} = \frac{\text{GPM} \times \text{Ft of Head}}{3,960 \times \text{Pump Efficiency (expressed as a decimal)}}$$

$$\text{H.P.} = \frac{\text{LPM} \times \text{Meters of Head}}{3,433 \times \text{Pump Efficiency (expressed as a decimal)}}$$

Station Run Time

$$\text{S.R.T.} = \frac{\text{Total Weekly Req'd (inch/wk)} \times 60 (\text{min/hr})}{(\text{min/wk}) \text{Precipitation Rate (in/hr)}}$$

$$\text{S.R.T.} = \frac{\text{Total Weekly Req'd (mm/wk)} \times 60 (\text{min/hr})}{(\text{min/wk}) \text{Precipitation Rate (mm/hr)}}$$

Pipe Velocity

$$\text{V} = \frac{0.4085 \times \text{Flow (GPM)}}{(\text{ft/sec}) (\text{Inside Pipe Diameter in Inches})^2}$$

$$\text{V} = \frac{1273.24 \times \text{Flow (l/sec)}}{(\text{m/sec}) (\text{Inside Pipe Diameter in Millimeters})^2}$$

Slope

$$\text{S} = \frac{\text{Rise (Measure of Length)}}{\text{Run (Measure of Length)}}$$

To Convert	From	To	Multiply By
Area	acres	feet ²	43560
	acres	meters ²	4046.8
	meters ²	feet ²	10.764
	feet ²	inches ²	144
	inches ²	centimeters ²	6.452
	hectares	meters ²	10,000
	hectares	acres	2.471
Power	kilowatts	horsepower	1.3410
Flow	feet ³ /minutes	meters ³ /second	0.0004719
	feet ³ /second	meters ³ /second	.02832
	yards ³ /minute	meters ³ /second	.01274
	gallons/minute	meters ³ /hour	.22716
	gallons/minute	liters/minute	3.7854
	gallons/minutes	liters/second	.06309
	meters ³ /hour	liters/minute	16.645
	meters ³ /hour	liters/second	.2774
	liters/minute	liters/second	60
Length	feet	inches	12
	inches	centimeters	2.540
	feet	meters	.30481
	kilometers	miles	.6214
	miles	feet	5280
	miles	meters	1609.34
	millimeters	inch	.03937

To Convert	From	To	Multiply By
Pressure	psi	kilopascals	6.89476
	psi	bars	.068948
	bars	kilopascals	100
	psi	feet of head	2.31
Velocity	feet/second	meters/second	.3048
Volume	feet ³	gallons	7.481
	feet ³	liters	28.32
	meters ³	feet ³	35.31
	meters ³	yard ³	1.3087
	yards ³	feet ³	27
	yards ³	gallons	202
	acres/feet	feet ³	43,560
	gallons	meters ³	.003785
	gallons	liters	3.785
	imperial gallons	gallons	1.833





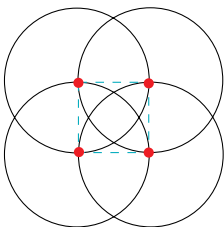
SPRINKLER SPACING & WINTERIZATION SPECIFICATIONS

The Toro Company does not recommend designing for 0 mph wind conditions.
Design in consideration of the worst wind conditions.

PRECIPITATION RATE FORMULAS

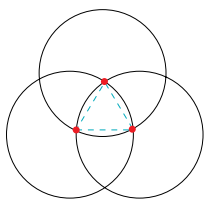
Square-spaced sprinklers in pattern:

$$\frac{\text{gpm of full circle} \times 96.3}{(\text{Spacing})^2}$$



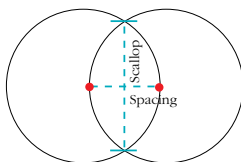
Triangular-spaced sprinklers in pattern:

$$\frac{\text{gpm of full circle} \times 96.3}{(\text{Spacing})^2 (0.866)}$$



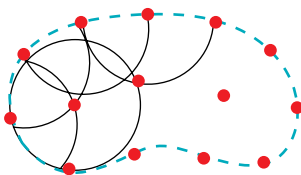
Single row:

$$\frac{\text{gpm of full circle} \times 96.3}{(\text{Spacing}) (\text{Scallop})}$$



Area and flow:

$$\frac{\text{Total gpm of zone} \times 96.3}{\text{Total irrigated square feet of zone}}$$



WINTERIZATION SPECIFICATIONS

In freezing climates, sprinklers and valves should be properly winterized to prevent freeze-related damage.

FRICTION LOSS FORMULAS

Hazen-Williams Equation:

$$H_f = (0.2083) (100 / C)^{1.852} (Q^{1.852} / D^{4.866})$$

(The result is multiplied by .433 to give psi loss for 100 feet of pipe)

The Velocity Values were Derived Using the Following:

$$V = (0.408 \times Q_{\text{gpm}}) / d^2$$

(The average inside diameter of OD controlled pipe was based upon subtracting two times the minimum wall thickness plus one-half of the wall thickness tolerance from the outside diameter.)

- Pressure ratings for plastic pipes are based on 23° C or 73.4° F
- Head loss decreases (increases) approximately 1% for every 3 degrees F above (below) the reference temperature (73.4° F)

FRICION LOSS CHARACTERISTICS



LOSSES IN PSI PER 100 FEET OF HOSE (PSI/100 FT.) FOR HOSE SIZES: .509" ID THROUGH .627" ID

Part No.		EHD1335		EHD1348		EHD1350		EHD1443		EHD1554		EHD1635		EHD1642		EHD1645	
Nom. ID		0.509"		0.510"		0.520"		0.550"		0.572"		0.616"		0.627"		0.616"	
Min. ID		0.506"		0.510"		0.516"		0.547"		0.569"		0.613"		0.624"		0.613"	
Min. Wall		0.035"		0.048"		0.050"		0.043"		0.054"		0.035"		0.042"		0.045"	
Flow		Velocity		Loss		Velocity		Loss		Velocity		Loss		Velocity		Loss	
gph	gph	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi
0.5	30	0.80	0.37	0.79	0.35	0.77	0.34	0.68	0.25	0.63	0.21	0.54	0.14	0.52	0.13	0.54	0.14
1.0	60	1.60	1.33	1.57	1.28	1.53	1.21	1.37	0.91	1.26	0.75	1.09	0.52	1.05	0.48	1.09	0.52
1.5	90	2.39	2.82	2.36	2.71	2.30	2.56	2.05	1.93	1.89	1.59	1.63	1.11	1.57	1.02	1.63	1.11
2.0	120	3.19	4.80	3.14	4.62	3.07	4.37	2.73	3.29	2.52	2.71	2.17	1.89	2.10	1.73	2.17	1.89
2.5	150	3.99	7.26	3.93	6.99	3.84	6.60	3.41	4.97	3.15	4.10	2.72	2.85	2.62	2.62	2.72	2.85
3.0	180	4.79	10.18	4.71	9.80	4.60	9.26	4.10	6.97	3.79	5.75	3.26	4.00	3.15	3.67	3.26	4.00
3.5	210	5.58	13.55	5.50	13.04	5.37	12.31	4.78	9.27	4.42	7.65	3.80	5.32	3.67	4.88	3.80	5.32
4.0	240	6.38	17.35	6.28	16.69	6.14	15.77	5.46	11.87	5.05	9.79	4.35	6.81	4.20	6.25	4.35	6.81
4.5	270	7.18	21.57	7.07	20.76	6.90	19.61	6.14	14.76	5.68	12.18	4.89	8.48	4.72	7.77	4.89	8.48
5.0	300	7.98	26.22	7.85	25.24	7.67	23.84	6.83	17.94	6.31	14.81	5.44	10.30	5.25	9.45	5.44	10.30
6.0	360	9.57	36.75	9.42	35.37	9.21	33.41	8.19	25.15	7.57	20.75	6.52	14.44	6.29	13.24	6.52	14.44
7.0	420	11.17	48.90	10.99	47.06	10.74	44.45	9.56	33.46	8.83	27.61	7.61	19.21	7.34	17.62	7.61	19.21
8.0	480			12.56	60.26	12.27	56.92	10.92	42.85	10.09	35.36	8.70	24.60	8.39	22.56	8.70	24.60
9.0	540			14.13	74.95	13.81	70.80	12.29	53.29	11.36	43.98	9.78	30.60	9.44	28.06	9.78	30.60
10.0	600							13.65	64.77	12.62	53.45	10.87	37.19	10.49	34.11	10.87	37.19
11.0	660									13.88	63.77	11.96	44.37	11.54	40.69	11.96	44.37
ID120	720									15.14	74.93			12.59	47.81	13.05	52.13

LOSSES IN PSI PER 100 FEET OF HOSE (PSI/100 FT.) FOR HOSE SIZES: .509" ID THROUGH .627" ID

Part No.		EHD1845		EHD1847		EHD1850		EHD2052		EHD2057		EHD2662		EHD2667		EHD3580	
Nom. ID		0.710"		0.729"		0.729"		0.807"		0.807"		1.060"		1.060"		1.365"	
Min. ID		0.707"		0.726"		0.726"		0.804"		0.804"		1.056"		1.056"		1.360"	
Min. Wall		0.045"		0.047"		0.050"		0.052"		0.057"		0.062"		0.067"		0.084"	
Flow		Velocity		Loss		Velocity		Loss		Velocity		Loss		Velocity		Loss	
gph	gph	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi
1	60	0.82	0.26	0.78	0.23	0.78	0.23	0.63	0.14	0.63	0.14	0.37	0.04	0.37	0.04	0.22	0.01
2	120	1.63	0.94	1.55	0.83	1.55	0.83	1.26	0.50	1.26	0.50	0.73	0.13	0.73	0.13	0.44	0.04
3	180	2.45	2.00	2.33	1.75	2.33	1.75	1.90	1.07	1.90	1.07	1.10	0.28	1.10	0.28	0.66	0.08
4	240	3.27	3.40	3.10	2.99	3.10	2.99	2.53	1.82	2.53	1.82	1.47	0.48	1.47	0.48	0.88	0.14
5	300	4.09	5.14	3.88	4.52	3.88	4.52	3.16	2.75	3.16	2.75	1.83	0.73	1.83	0.73	1.10	0.21
6	360	4.90	7.21	4.65	6.34	4.65	6.34	3.79	3.85	3.79	3.85	2.20	1.02	2.20	1.02	1.33	0.30
7	420	5.72	9.59	5.43	8.43	5.43	8.43	4.42	5.13	4.42	5.13	2.56	1.36	2.56	1.36	1.55	0.40
8	480	6.54	12.28	6.20	10.79	6.20	10.79	5.06	6.57	5.06	6.57	2.93	1.74	2.93	1.74	1.77	0.51
9	540	7.36	15.27	6.98	13.42	6.98	13.42	5.69	8.17	5.69	8.17	3.30	2.16	3.30	2.16	1.99	0.63
10	600	8.17	18.57	7.75	16.32	7.75	16.32	6.32	9.93	6.32	9.93	3.66	2.63	3.66	2.63	2.21	0.77
11	660	8.99	22.15	8.53	19.47	8.53	19.47	6.95	11.84	6.95	11.84	4.03	3.14	4.03	3.14	2.43	0.92
12	720	9.81	26.02	9.30	22.87	9.30	22.87	7.58	13.91	7.58	13.91	4.40	3.69	4.40	3.69	2.65	1.08
13	780	10.62	30.18	10.08	26.52	10.08	26.52	8.22	16.14	8.22	16.14	4.76	4.28	4.76	4.28	2.87	1.25
14	858	11.69	36.04	11.09	31.68	11.09	31.68	9.04	19.27	9.04	19.27	5.24	5.11	5.24	5.11	3.16	1.49
15	920	12.54	41.01	11.89	36.04	11.89	36.04	9.69	21.93	9.69	21.93	5.62	5.81	5.62	5.81	3.39	1.70
16	982	13.38	46.27	12.69	40.66	12.69	40.66	10.35	24.74	10.35	24.74	6.00	6.56	6.00	6.56	3.62	1.91
17	1,044	14.23	51.82	13.49	45.54	13.49	45.54	11.00	27.71	11.00	27.71	6.38	7.34	6.38	7.34	3.84	2.14
18	1,080			13.95	48.46	13.95	48.46	11.38	29.48	11.38	29.48	6.59	7.81	6.59	7.81	3.98	2.28
19	1,140			14.73	53.56	14.73	53.56	12.01	32.59	12.01	32.59	6.96	8.64	6.96	8.64	4.20	2.52
20	1,200							12.64	35.83	12.64	35.83	7.33	9.50	7.33	9.50	4.42	2.77
22	1,320							13.90	42.75	13.90	42.75	8.06	11.33	8.06	11.33	4.86	3.31
24	1,440							15.17	50.23	15.17	50.23	8.79	13.31	8.79	13.31	5.30	3.88
26	1,560							16.43	58.25	16.43	58.25	9.52	15.44	9.52	15.44	5.74	4.50
28	1,680							17.69	66.82	17.69	66.82	10.26	17.71	10.26	17.71	6.18	5.17
30	1,800							18.96	75.93	18.96	75.93	10.99	20.13	10.99	20.13	6.63	5.87
32	1,920									20.22	85.57	11.72	22.68	11.72	22.68	7.07	6.62
34	2,040											12.45	25.38	12.45	25.38	7.51	7.40
36	2,160											13.19	28.21	13.19	28.21	7.95	8.23
38	2,280											13.92	31.18	13.92	31.18	8.39	9.10
40	2,400											14.65	34.29	14.65	34.29	8.83	10.00
45	2,700											16.48	42.65	16.48	42.65	9.94	12.44
50	3,000											18.32	51.84	18.32	51.84	11.04	15.12
55	3,300											20.15	61.84	20.15	61.84	12.15	18.04
60	3,600											21.98	72.66	21.98	72.66	13.25	21.19
65	3,900													23.81	84.27	14.36	24.58
70	4,200															15.46	28.19
75	4,500															16.56	32.04
80	4,800															17.67	36.11
85	5,100															18.77	40.40
90	5,400															19.88	44.91
95	5,700															20.98	49.64

Friction losses are calculated using Hazen-Williams equation (C = 140) and minimum inside diameter. See pg 132 for friction loss formulas.



FRICITION LOSS CHARACTERISTICS

LOSSES IN PSI PER 100 FEET OF HOSE (PSI/100 FT.) FOR HOSE SIZES: .596" (16MM) ID THROUGH .870" (22MM) ID

Part No.		EHO1650		EHO2055		EHO2060		HDO2255	
Nom. ID		0.600"		0.830"		0.820"		0.870"	
Min. ID		0.596"		0.821"		0.811"		0.870"	
Nom. Wall		0.050"		0.055"		0.060"		0.055"	
Flow		Velocity	Loss	Velocity	Loss	Velocity	Loss	Velocity	Loss
GPM	GPH	FPS	PSI	FPS	PSI	FPS	PSI	FPS	PSI
0.5	30	0.58	0.17	0.30	0.03	0.31	0.04	0.27	0.03
1.0	60	1.15	0.60	0.61	0.13	0.62	0.13	0.54	0.10
1.5	90	1.73	1.27	0.91	0.27	0.93	0.28	0.81	0.20
2.0	120	2.30	2.16	1.21	0.46	1.24	0.48	1.08	0.34
2.5	150	2.88	3.27	1.52	0.69	1.55	0.73	1.35	0.52
3.0	180	3.45	4.59	1.82	0.96	1.86	1.02	1.62	0.73
3.5	210	4.03	6.10	2.12	1.28	2.17	1.36	1.89	0.97
4.0	240	4.60	7.82	2.42	1.64	2.48	1.74	2.16	1.24
4.5	270	5.18	9.72	2.73	2.04	2.79	2.17	2.43	1.54
5.0	300	5.75	11.81	3.03	2.48	3.11	2.64	2.70	1.87
6.0	360	6.90	16.56	3.64	3.48	3.73	3.69	3.24	2.62
7.0	420	8.05	22.03	4.24	4.63	4.35	4.92	3.78	3.49
8.0	480	9.20	28.21	4.85	5.93	4.97	6.29	4.32	4.47
9.0	540	10.35	35.09	5.45	7.38	5.59	7.83	4.86	5.56
10.0	600	11.50	42.65	6.06	8.96	6.21	9.52	5.40	6.76
11.0	660	12.65	50.89	6.67	10.70	6.83	11.35	5.94	8.06
12.0	720	13.80	59.78	7.27	12.57	7.45	13.34	6.48	9.47
13.0	780			7.88	14.57	8.07	15.47	7.02	10.99
14.0	840			8.48	16.72	8.70	17.75	7.56	12.61
15.0	900			9.09	19.00	9.32	20.16	8.10	14.32
16.0	960			9.70	21.41	9.94	22.72	8.64	16.14
17.0	1,020			10.30	23.95	10.56	25.42	9.17	18.06
18.0	1,080			10.91	26.63	11.18	28.26	9.71	20.08
19.0	1,140			11.51	29.43	11.80	31.24	10.25	22.19
20.0	1,200			12.12	32.36	12.42	34.35	10.79	24.40
22.0	1,320			13.33	38.61	13.66	40.98	11.87	29.11
24.0	1,440			14.55	45.36	14.91	48.15	12.95	34.20
26.0	1,560			15.76	52.61	16.15	55.84	14.03	39.67
28.0	1,680			16.97	60.35			15.11	45.51
30.0	1,800							16.19	51.71
32.0	1,920							17.27	58.27

Shaded area represents
velocities over 5 fps.
Use with caution.

Friction losses are calculated using Hazen-Williams equation (C = 140) and minimum inside diameter. See pg 132 for friction loss formulas.

POLYETHYLENE (PE) PLASTIC PIPE ID CONTROLLED

Size: ½" thru 4" Flow: 1 thru 500GPM
PE 3408 ASTM D-2239 C=140 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

Size	½"		¾"		1"		1¼"		1½"		2"		2½"		3"		4"	
Avg ID	0.622		0.824		1.049		1.380		1.610		2.067		2.469		3.068		4.026	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.05	0.49	0.60	0.12	0.37	0.04	0.21	0.01	0.16	0.00								
2	2.11	1.76	1.20	0.45	0.74	0.14	0.43	0.04	0.31	0.02	0.19	0.01						
3	3.16	3.73	1.80	0.95	1.11	0.29	0.64	0.08	0.47	0.04	0.29	0.01						
4	4.22	6.35	2.40	1.62	1.48	0.50	0.86	0.13	0.63	0.06	0.38	0.02	0.27	0.01				
5	5.27	9.60	3.00	2.44	1.85	0.76	1.07	0.20	0.79	0.09	0.48	0.03	0.33	0.01				
6	6.33	13.46	3.61	3.43	2.22	1.06	1.29	0.28	0.94	0.13	0.57	0.04	0.40	0.02	0.26	0.01		
7	7.38	17.91	4.21	4.56	2.60	1.41	1.50	0.37	1.10	0.18	0.67	0.05	0.47	0.02	0.30	0.01		
8	8.44	22.93	4.81	5.84	2.97	1.80	1.71	0.47	1.26	0.22	0.76	0.07	0.54	0.03	0.35	0.01		
9	9.49	28.52	5.41	7.26	3.34	2.24	1.93	0.59	1.42	0.28	0.86	0.08	0.60	0.03	0.39	0.01		
10	10.55	34.67	6.01	8.82	3.71	2.73	2.14	0.72	1.57	0.34	0.95	0.10	0.67	0.04	0.43	0.01		
12			7.21	12.37	4.45	3.82	2.57	1.01	1.89	0.48	1.15	0.14	0.80	0.06	0.52	0.02		
14			8.41	16.45	5.19	5.08	3.00	1.34	2.20	0.63	1.34	0.19	0.94	0.08	0.61	0.03		
16			9.61	21.07	5.93	6.51	3.43	1.71	2.52	0.81	1.53	0.24	1.07	0.10	0.69	0.04	0.40	0.01
18			10.82	26.21	6.67	8.10	3.86	2.13	2.83	1.01	1.72	0.30	1.20	0.13	0.78	0.04	0.45	0.01
20			12.02	31.85	7.42	9.84	4.28	2.59	3.15	1.22	1.91	0.36	1.34	0.15	0.87	0.05	0.50	0.01
22					8.16	11.74	4.71	3.09	3.46	1.46	2.10	0.43	1.47	0.18	0.95	0.06	0.55	0.02
24					8.90	13.79	5.14	3.63	3.78	1.72	2.29	0.51	1.61	0.21	1.04	0.07	0.60	0.02
26					9.64	16.00	5.57	4.21	4.09	1.99	2.48	0.59	1.74	0.25	1.13	0.09	0.65	0.02
28					10.38	18.35	6.00	4.83	4.41	2.28	2.67	0.68	1.87	0.28	1.21	0.10	0.70	0.03
30					11.12	20.85	6.43	5.49	4.72	2.59	2.86	0.77	2.01	0.32	1.30	0.11	0.76	0.03
32					11.86	23.50	6.86	6.19	5.04	2.92	3.06	0.87	2.14	0.36	1.39	0.13	0.81	0.03
34					12.61	26.29	7.28	6.92	5.35	3.27	3.25	0.97	2.28	0.41	1.47	0.14	0.86	0.04
36							7.71	7.69	5.67	3.63	3.44	1.08	2.41	0.45	1.56	0.16	0.91	0.04
38							8.14	8.50	5.98	4.02	3.63	1.19	2.54	0.50	1.65	0.17	0.96	0.05
40							8.57	9.35	6.30	4.42	3.82	1.31	2.68	0.55	1.73	0.19	1.01	0.05
42							9.00	10.24	6.61	4.83	4.01	1.43	2.81	0.60	1.82	0.21	1.06	0.06
44							9.43	11.16	6.93	5.27	4.20	1.56	2.94	0.66	1.91	0.23	1.11	0.06
46							9.86	12.12	7.24	5.72	4.39	1.70	3.08	0.71	1.99	0.25	1.16	0.07
48							10.28	13.11	7.56	6.19	4.58	1.84	3.21	0.77	2.08	0.27	1.21	0.07
50							10.71	14.14	7.87	6.68	4.77	1.98	3.35	0.83	2.17	0.29	1.26	0.08
55							11.78	16.87	8.66	7.97	5.25	2.36	3.68	0.99	2.38	0.35	1.38	0.09
60							12.85	19.82	9.44	9.36	5.73	2.77	4.02	1.17	2.60	0.41	1.51	0.11
65									10.23	10.86	6.21	3.22	4.35	1.36	2.82	0.47	1.64	0.13
70									11.02	12.45	6.68	3.69	4.69	1.55	3.03	0.54	1.76	0.14
75									11.81	14.15	7.16	4.19	5.02	1.77	3.25	0.61	1.89	0.16
80									12.59	15.95	7.64	4.73	5.35	1.99	3.47	0.69	2.01	0.18
85									13.38	17.84	8.12	5.29	5.69	2.23	3.68	0.77	2.14	0.21
90											8.59	5.88	6.02	2.48	3.90	0.86	2.27	0.23
95											9.07	6.50	6.36	2.74	4.12	0.95	2.39	0.25
100											9.55	7.15	6.69	3.01	4.33	1.05	2.52	0.28
110											10.50	8.53	7.36	3.59	4.77	1.25	2.77	0.33
120											11.46	10.02	8.03	4.22	5.20	1.47	3.02	0.39
130											12.41	11.62	8.70	4.89	5.63	1.70	3.27	0.45
140											13.37	13.33	9.37	5.61	6.07	1.95	3.52	0.52
150													10.04	6.38	6.50	2.22	3.78	0.59
160													10.71	7.19	6.94	2.50	4.03	0.67
170													11.38	8.04	7.37	2.79	4.28	0.74
180													12.05	8.94	7.80	3.11	4.53	0.83
190													12.72	9.88	8.24	3.43	4.78	0.92
200													13.39	10.87	8.67	3.78	5.03	1.01
220			Shaded area represents velocities over 5 fps. Use with caution.												9.54	4.50	5.54	1.20
240															10.40	5.29	6.04	1.41
260															11.27	6.14	6.54	1.64
280															12.14	7.04	7.05	1.88
300															13.00	8.00	7.55	2.13
320															13.87	9.02	8.05	2.40
340																	8.56	2.69
360																	9.06	2.99
380																	9.57	3.30
400																	10.07	3.63
420																	10.57	3.98
440																	11.08	4.33
460																	11.58	4.71
480																	12.08	5.09
500																	12.59	5.49

See pg 132 for friction loss formulas



FRICION LOSS CHARACTERISTICS

PVC CLASS 200 IPS PLASTIC PIPE

Size: ½" thru 6" Flow: 1 thru 500GPM

ASTM D-2241 (1120, 1220) SDR 21 C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"
Avg.ID	0.696	0.910	1.169	1.482	1.700	2.129	2.581	3.146	4.046	5.955
Pipe OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625
Avg Wall	0.072	0.070	0.073	0.089	0.100	0.123	0.147	0.177	0.227	0.335
MinWall	0.062	0.060	0.063	0.079	0.090	0.113	0.137	0.167	0.214	0.316
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	0.84	0.25	0.49	0.07	0.30	0.02	0.19	0.01	0.14	0.00
2	1.68	0.90	0.99	0.24	0.60	0.07	0.37	0.02	0.28	0.01
3	2.53	1.90	1.48	0.52	0.90	0.15	0.56	0.05	0.42	0.02
4	3.37	3.24	1.97	0.88	1.19	0.26	0.74	0.08	0.56	0.04
5	4.21	4.89	2.46	1.33	1.49	0.39	0.93	0.12	0.71	0.06
6	5.05	6.86	2.96	1.86	1.79	0.55	1.11	0.17	0.85	0.09
7	5.90	9.12	3.45	2.47	2.09	0.73	1.30	0.23	0.99	0.12
8	6.74	11.68	3.94	3.17	2.39	0.94	1.49	0.30	1.13	0.15
9	7.58	14.53	4.43	3.94	2.69	1.17	1.67	0.37	1.27	0.19
10	8.42	17.66	4.93	4.79	2.99	1.42	1.86	0.45	1.41	0.23
12	10.11	24.75	5.91	6.71	3.58	1.98	2.23	0.63	1.69	0.32
14	11.79	32.93	6.90	8.93	4.18	2.64	2.60	0.83	1.98	0.43
16	13.48	42.16	7.88	11.44	4.78	3.38	2.97	1.07	2.26	0.55
18	15.16	52.44	8.87	14.23	5.37	4.21	3.34	1.33	2.54	0.68
20			9.85	17.29	5.97	5.11	3.72	1.61	2.82	0.83
22			10.84	20.63	6.57	6.10	4.09	1.92	3.11	0.99
24			11.82	24.24	7.17	7.17	4.46	2.26	3.39	1.16
26			12.81	28.11	7.76	8.31	4.83	2.62	3.67	1.34
28			13.80	32.25	8.36	9.53	5.20	3.01	3.95	1.54
30			14.78	36.64	8.96	10.83	5.57	3.41	4.24	1.75
32					9.55	12.21	5.94	3.85	4.52	1.97
34					10.15	13.66	6.32	4.31	4.80	2.21
36					10.75	15.18	6.69	4.79	5.08	2.45
38					11.35	16.78	7.06	5.29	5.36	2.71
40					11.94	18.45	7.43	5.82	5.65	2.98
42					12.54	20.20	7.80	6.37	5.93	3.27
44					13.14	22.02	8.17	6.94	6.21	3.56
46					13.73	23.91	8.55	7.54	6.49	3.86
48					14.33	25.87	8.92	8.15	6.78	4.18
50					14.93	27.90	9.29	8.79	7.06	4.51
55							10.22	10.49	7.76	5.38
60							11.15	12.33	8.47	6.32
65							12.07	14.30	9.18	7.33
70							13.00	16.40	9.88	8.41
75							13.93	18.63	10.59	9.56
80							14.86	21.00	11.29	10.77
85									12.00	12.05
90									12.71	13.40
95									13.41	14.81
100									14.12	16.28
110									9.90	6.50
120									10.80	7.63
130									11.70	8.85
140									12.60	10.16
150									13.50	11.54
160									14.40	13.01
170										
180										
190										
200										
220									13.47	9.19
240									14.70	10.80
260										
280										
300										
320									13.19	7.02
340									14.02	7.86
360									14.84	8.73
380										
400										
420									10.47	3.42
440									10.97	3.72
460									11.46	4.04
480									11.96	4.37
500									12.46	4.72

See pg 132 for friction loss formulas

PVC CLASS 200 IPS PLASTIC PIPE

Size: 6" thru 18"

Flow: 20 thru 4700GPM

ANSI/ASAE S376.2 ASTM 2241 SDR21 C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

Size	6"		8"		10"		12"		14"		16"		18"	
Avg.ID	5.955		7.755		9.666		11.464		12.588		14.384		15.246	
Pipe OD	6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg Wall	0.335		0.435		0.542		0.643		0.706		0.808		1.377	
Min Wall	0.316		0.410		0.511		0.606		0.666		0.762		0.857	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
20	0.23	0.00	0.14	0.00	0.09	0.00	0.06	0.00	0.05	0.00	0.04	0.00	0.04	0.00
40	0.46	0.01	0.27	0.00	0.17	0.00	0.12	0.00	0.10	0.00	0.08	0.00	0.07	0.00
60	0.69	0.01	0.41	0.00	0.26	0.00	0.19	0.00	0.15	0.00	0.12	0.00	0.11	0.00
80	0.92	0.02	0.54	0.01	0.35	0.00	0.25	0.00	0.21	0.00	0.16	0.00	0.14	0.00
100	1.15	0.04	0.68	0.01	0.44	0.00	0.31	0.00	0.26	0.00	0.20	0.00	0.18	0.00
150	1.73	0.08	1.02	0.02	0.66	0.01	0.47	0.00	0.39	0.00	0.30	0.00	0.26	0.00
200	2.30	0.13	1.36	0.04	0.87	0.01	0.62	0.01	0.51	0.00	0.39	0.00	0.35	0.00
250	2.88	0.20	1.70	0.06	1.09	0.02	0.78	0.01	0.64	0.01	0.49	0.00	0.44	0.00
300	3.45	0.28	2.04	0.08	1.31	0.03	0.93	0.01	0.77	0.01	0.59	0.00	0.53	0.00
350	4.03	0.37	2.37	0.10	1.53	0.04	1.09	0.02	0.90	0.01	0.69	0.01	0.61	0.00
400	4.60	0.48	2.71	0.13	1.75	0.05	1.24	0.02	1.03	0.01	0.79	0.01	0.70	0.00
450	5.18	0.59	3.05	0.16	1.97	0.06	1.40	0.02	1.16	0.02	0.89	0.01	0.79	0.01
500	5.75	0.72	3.39	0.20	2.18	0.07	1.55	0.03	1.29	0.02	0.99	0.01	0.88	0.01
550	6.33	0.86	3.73	0.24	2.40	0.08	1.71	0.04	1.42	0.02	1.08	0.01	0.97	0.01
600	6.90	1.01	4.07	0.28	2.62	0.10	1.86	0.04	1.54	0.03	1.18	0.01	1.05	0.01
650	7.48	1.17	4.41	0.32	2.84	0.11	2.02	0.05	1.67	0.03	1.28	0.02	1.14	0.01
700	8.05	1.34	4.75	0.37	3.06	0.13	2.17	0.06	1.80	0.04	1.38	0.02	1.23	0.01
750	8.63	1.52	5.09	0.42	3.28	0.14	2.33	0.06	1.93	0.04	1.48	0.02	1.32	0.02
800	9.20	1.72	5.43	0.48	3.49	0.16	2.48	0.07	2.06	0.04	1.58	0.02	1.40	0.02
850	9.78	1.92	5.77	0.53	3.71	0.18	2.64	0.08	2.19	0.05	1.68	0.03	1.49	0.02
900			6.11	0.59	3.93	0.20	2.79	0.09	2.32	0.06	1.77	0.03	1.58	0.02
950			6.44	0.65	4.15	0.22	2.95	0.10	2.45	0.06	1.87	0.03	1.67	0.02
1000			6.78	0.72	4.37	0.25	3.10	0.11	2.57	0.07	1.97	0.04	1.76	0.03
1050			7.12	0.79	4.59	0.27	3.26	0.12	2.70	0.07	2.07	0.04	1.84	0.03
1100			7.46	0.86	4.80	0.29	3.41	0.13	2.83	0.08	2.17	0.04	1.93	0.03
1150					5.02	0.32	3.57	0.14	2.96	0.09	2.27	0.05	2.02	0.03
1200					5.24	0.34	3.73	0.15	3.09	0.10	2.37	0.05	2.11	0.04
1250					5.46	0.37	3.88	0.16	3.22	0.10	2.46	0.05	2.19	0.04
1300					5.68	0.40	4.04	0.17	3.35	0.11	2.56	0.06	2.28	0.04
1350					5.90	0.43	4.19	0.19	3.48	0.12	2.66	0.06	2.37	0.05
1400					6.11	0.46	4.35	0.20	3.60	0.13	2.76	0.07	2.46	0.05
1450					6.33	0.49	4.50	0.21	3.73	0.14	2.86	0.07	2.55	0.05
1500					6.55	0.52	4.66	0.23	3.86	0.14	2.96	0.08	2.63	0.06
1600					6.99	0.59	4.97	0.26	4.12	0.16	3.16	0.08	2.81	0.06
1700					7.42	0.66	5.28	0.29	4.38	0.18	3.35	0.09	2.98	0.07
1800							5.59	0.32	4.63	0.20	3.55	0.11	3.16	0.08
1900							5.90	0.35	4.89	0.22	3.75	0.12	3.34	0.09
2000							6.21	0.39	5.15	0.25	3.94	0.13	3.51	0.10
2100							6.52	0.42	5.41	0.27	4.14	0.14	3.69	0.11
2200							6.83	0.46	5.66	0.29	4.34	0.15	3.86	0.12
2300							7.14	0.50	5.92	0.32	4.54	0.17	4.04	0.13
2400							7.45	0.54	6.18	0.34	4.73	0.18	4.21	0.14
2500							7.76	0.59	6.44	0.37	4.93	0.19	4.39	0.15
2600							8.07	0.63	6.69	0.40	5.13	0.21	4.56	0.16
2700							8.38	0.67	6.95	0.43	5.32	0.22	4.74	0.17
2800							8.69	0.72	7.21	0.46	5.52	0.24	4.91	0.18
2900							9.00	0.77	7.47	0.49	5.72	0.26	5.09	0.19
3000							9.31	0.82	7.72	0.52	5.92	0.27	5.27	0.20
3100							9.62	0.87	7.98	0.55	6.11	0.29	5.44	0.22
3200							9.93	0.92	8.24	0.59	6.31	0.31	5.62	0.23
3300									8.50	0.62	6.51	0.32	5.79	0.24
3400									8.75	0.66	6.70	0.34	5.97	0.26
3500									9.01	0.69	6.90	0.36	6.14	0.27
3600									9.27	0.73	7.10	0.38	6.32	0.29
3700									9.53	0.77	7.30	0.40	6.49	0.30
3800											7.49	0.42	6.67	0.32
3900											7.69	0.44	6.85	0.33
4000											7.89	0.46	7.02	0.35
4100											8.09	0.48	7.20	0.37
4200											8.28	0.51	7.37	0.38
4300													7.55	0.40
4400													7.72	0.42
4500													7.90	0.43
4600													8.07	0.45
4700													8.25	0.47

Shaded area represents velocities over 5 fps.
Use with caution.

See pg 132 for friction loss formulas



FRICION LOSS CHARACTERISTICS

PVC CLASS 315 IPS PLASTIC PIPE

Size: ½" thru 6"

Flow: 1 thru 500GPM

ASTM D-2239 (1120, 1220) SDR 13.5 C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

Size	½"		¾"		1"		1¼"		1½"		2"		2½"		3"		4"		6"	
Avg.ID	0.696		0.874		1.101		1.394		1.598		1.983		2.423		2.948		3.794		5.583	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg Wall	0.072		0.088		0.107		0.133		0.151		0.196		0.226		0.274		0.353		0.521	
Min Wall	0.062		0.078		0.097		0.123		0.141		0.176		0.213		0.259		0.333		0.491	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	0.84	0.25	0.53	0.08	0.34	0.03	0.21	0.01	0.16	0.00										
2	1.68	0.90	1.07	0.30	0.67	0.10	0.42	0.03	0.32	0.02	0.21	0.01								
3	2.53	1.90	1.60	0.63	1.01	0.20	0.63	0.06	0.48	0.03	0.31	0.01								
4	3.37	3.24	2.14	1.07	1.35	0.35	0.84	0.11	0.64	0.06	0.42	0.02	0.28	0.01						
5	4.21	4.89	2.67	1.61	1.68	0.53	1.05	0.17	0.80	0.09	0.52	0.03	0.35	0.01						
6	5.05	6.86	3.20	2.26	2.02	0.74	1.26	0.23	0.96	0.12	0.62	0.04	0.42	0.02	0.28	0.01				
7	5.90	9.12	3.74	3.01	2.36	0.98	1.47	0.31	1.12	0.16	0.73	0.06	0.49	0.02	0.33	0.01				
8	6.74	11.68	4.27	3.86	2.69	1.25	1.68	0.40	1.28	0.20	0.83	0.07	0.56	0.03	0.38	0.01				
9	7.58	14.53	4.81	4.80	3.03	1.56	1.89	0.49	1.44	0.25	0.93	0.09	0.63	0.03	0.42	0.01				
10	8.42	17.66	5.34	5.83	3.37	1.90	2.10	0.60	1.60	0.31	1.04	0.11	0.69	0.04	0.47	0.02				
12	10.11	24.75	6.41	8.17	4.04	2.66	2.52	0.84	1.92	0.43	1.25	0.15	0.83	0.06	0.56	0.02				
14	11.79	32.93	7.48	10.87	4.71	3.53	2.94	1.12	2.24	0.58	1.45	0.20	0.97	0.08	0.66	0.03				
16	13.48	42.16	8.55	13.92	5.39	4.53	3.36	1.44	2.56	0.74	1.66	0.26	1.11	0.10	0.75	0.04	0.45	0.01		
18	15.16	52.44	9.61	17.32	6.06	5.63	3.78	1.79	2.88	0.92	1.87	0.32	1.25	0.12	0.85	0.05	0.51	0.01		
20			10.68	21.05	6.73	6.84	4.20	2.17	3.20	1.12	2.08	0.39	1.39	0.15	0.94	0.06	0.57	0.02		
22			11.75	25.11	7.40	8.16	4.62	2.59	3.52	1.33	2.28	0.47	1.53	0.18	1.03	0.07	0.62	0.02		
24			12.82	29.50	8.08	9.59	5.04	3.04	3.83	1.57	2.49	0.55	1.67	0.21	1.13	0.08	0.68	0.02		
26			13.89	34.21	8.75	11.12	5.46	3.53	4.15	1.82	2.70	0.64	1.81	0.24	1.22	0.09	0.74	0.03		
28			14.96	39.25	9.42	12.76	5.88	4.05	4.47	2.08	2.91	0.73	1.95	0.27	1.31	0.11	0.79	0.03		
30			16.02	44.60	10.10	14.50	6.30	4.60	4.79	2.37	3.11	0.83	2.08	0.31	1.41	0.12	0.85	0.04		
32					10.77	16.34	6.72	5.18	5.11	2.67	3.32	0.93	2.22	0.35	1.50	0.14	0.91	0.04	0.42	0.01
34					11.44	18.28	7.14	5.80	5.43	2.98	3.53	1.04	2.36	0.39	1.60	0.15	0.96	0.04	0.45	0.01
36					12.12	20.32	7.56	6.45	5.75	3.32	3.74	1.16	2.50	0.44	1.69	0.17	1.02	0.05	0.47	0.01
38					12.79	22.46	7.98	7.13	6.07	3.67	3.94	1.28	2.64	0.48	1.78	0.19	1.08	0.05	0.50	0.01
40					13.46	24.70	8.40	7.84	6.39	4.03	4.15	1.41	2.78	0.53	1.88	0.20	1.13	0.06	0.52	0.01
42					14.14	27.04	8.82	8.58	6.71	4.41	4.36	1.54	2.92	0.58	1.97	0.22	1.19	0.07	0.55	0.01
44					14.81	29.47	9.24	9.35	7.03	4.81	4.57	1.68	3.06	0.63	2.07	0.24	1.25	0.07	0.58	0.01
46					15.48	32.00	9.66	10.15	7.35	5.22	4.77	1.83	3.20	0.69	2.16	0.27	1.30	0.08	0.60	0.01
48					16.16	34.62	10.08	10.98	7.67	5.65	4.98	1.98	3.34	0.75	2.25	0.29	1.36	0.08	0.63	0.01
50					16.83	37.34	10.50	11.85	7.99	6.09	5.19	2.13	3.47	0.80	2.35	0.31	1.42	0.09	0.65	0.01
55							11.55	14.13	8.79	7.27	5.71	2.54	3.82	0.96	2.58	0.37	1.56	0.11	0.72	0.02
60							12.60	16.60	9.59	8.54	6.23	2.99	4.17	1.13	2.82	0.43	1.70	0.13	0.79	0.02
65							13.65	19.26	10.39	9.91	6.74	3.47	4.52	1.31	3.05	0.50	1.84	0.15	0.85	0.02
70							14.70	22.09	11.18	11.37	7.26	3.98	4.86	1.50	3.29	0.58	1.98	0.17	0.92	0.03
75							15.75	25.10	11.98	12.91	7.78	4.52	5.21	1.70	3.52	0.66	2.13	0.19	0.98	0.03
80							16.80	28.29	12.78	14.55	8.30	5.09	5.56	1.92	3.76	0.74	2.27	0.22	1.05	0.03
85									13.58	16.28	8.82	5.70	5.91	2.15	3.99	0.83	2.41	0.24	1.11	0.04
90									14.38	18.10	9.34	6.33	6.25	2.39	4.23	0.92	2.55	0.27	1.18	0.04
95									15.18	20.01	9.86	7.00	6.60	2.64	4.46	1.02	2.69	0.30	1.24	0.05
100									15.98	22.00	10.38	7.70	6.95	2.90	4.69	1.12	2.83	0.33	1.31	0.05
110											11.41	9.18	7.64	3.46	5.16	1.33	3.12	0.39	1.44	0.06
120											12.45	10.79	8.34	4.07	5.63	1.57	3.40	0.46	1.57	0.07
130											13.49	12.51	9.03	4.72	6.10	1.82	3.68	0.53	1.70	0.08
140											14.53	14.35	9.73	5.41	6.57	2.08	3.97	0.61	1.83	0.09
150											15.56	16.31	10.42	6.15	7.04	2.37	4.25	0.69	1.96	0.11
160											16.60	18.38	11.12	6.93	7.51	2.67	4.54	0.78	2.09	0.12
170													11.81	7.76	7.98	2.99	4.82	0.87	2.23	0.13
180													12.51	8.62	8.45	3.32	5.10	0.97	2.36	0.15
190													13.20	9.53	8.92	3.67	5.39	1.08	2.49	0.16
200													13.90	10.48	9.39	4.03	5.67	1.18	2.62	0.18
220													15.29	12.50	10.33	4.81	6.24	1.41	2.88	0.22
240													16.68	14.69	11.27	5.66	6.80	1.66	3.14	0.25
260															12.21	6.56	7.37	1.92	3.40	0.29
280															13.15	7.52	7.94	2.20	3.67	0.34
300															14.08	8.55	8.50	2.50	3.93	0.38
320															15.02	9.64	9.07	2.82	4.19	0.43
340															15.96	10.78	9.64	3.16	4.45	0.48
360															16.90	11.98	10.20	3.51	4.71	0.54
380																	10.77	3.88	4.97	0.59
400																	11.34	4.27	5.24	0.65
420																	11.90	4.67	5.50	0.71
440																	12.47	5.09	5.76	0.78
460																	13.04	5.53	6.02	0.84
480																	13.61	5.98	6.28	0.91
500																	14.17	6.45	6.54	0.98

See pg 132 for friction loss formulas

SCHEDULE 40 PVC IPS PLASTIC PIPE

Size: ½" thru 6" Flow: 1 thru 500GPM

ASTM D-1785 (1120, 1220) C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	½"		¾"		1"		1¼"		1½"		2"		2½"		3"		4"		6"	
Avg ID	0.602		0.804		1.029		1.360		1.590		2.047		2.445		3.042		3.998		6.031	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg Wall	0.119		0.123		0.143		0.150		0.155		0.164		0.215		0.229		0.251		0.297	
Min Wall	0.109		0.113		0.133		0.140		0.145		0.154		0.203		0.216		0.237		0.280	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.13	0.50	0.63	0.12	0.39	0.04	0.22	0.01	0.16	0.00										
2	2.25	1.82	1.26	0.44	0.77	0.13	0.44	0.03	0.32	0.02	0.19	0.00								
3	3.38	3.85	1.89	0.94	1.16	0.28	0.66	0.07	0.48	0.03	0.29	0.01								
4	4.50	6.55	2.52	1.60	1.54	0.48	0.88	0.12	0.65	0.06	0.39	0.02	0.27	0.01						
5	5.63	9.91	3.16	2.42	1.93	0.73	1.10	0.19	0.81	0.09	0.49	0.03	0.34	0.01						
6	6.75	13.89	3.79	3.40	2.31	1.02	1.32	0.26	0.97	0.12	0.58	0.04	0.41	0.02	0.26	0.01				
7	7.88	18.48	4.42	4.52	2.70	1.36	1.54	0.35	1.13	0.16	0.68	0.05	0.48	0.02	0.31	0.01				
8	9.01	23.66	5.05	5.79	3.08	1.74	1.76	0.45	1.29	0.21	0.78	0.06	0.55	0.03	0.35	0.01				
9	10.13	29.43	5.68	7.20	3.47	2.17	1.99	0.56	1.45	0.26	0.88	0.08	0.61	0.03	0.40	0.01				
10	11.26	35.77	6.31	8.75	3.85	2.63	2.21	0.68	1.61	0.32	0.97	0.09	0.68	0.04	0.44	0.01				
12	13.51	50.14	7.57	12.27	4.62	3.69	2.65	0.95	1.94	0.44	1.17	0.13	0.82	0.05	0.53	0.02				
14	15.76	66.71	8.84	16.32	5.39	4.91	3.09	1.26	2.26	0.59	1.36	0.17	0.96	0.07	0.62	0.03				
16	18.01	85.42	10.10	20.90	6.17	6.29	3.53	1.62	2.58	0.76	1.56	0.22	1.09	0.09	0.71	0.03	0.41	0.01		
18	20.26	106.3	11.36	25.99	6.94	7.82	3.97	2.01	2.90	0.94	1.75	0.28	1.23	0.12	0.79	0.04	0.46	0.01		
20			12.62	31.59	7.71	9.51	4.41	2.45	3.23	1.14	1.95	0.33	1.36	0.14	0.88	0.05	0.51	0.01		
22			13.89	37.69	8.48	11.35	4.85	2.92	3.55	1.37	2.14	0.40	1.50	0.17	0.97	0.06	0.56	0.02		
24			15.15	44.28	9.25	13.33	5.29	3.43	3.87	1.60	2.34	0.47	1.64	0.20	1.06	0.07	0.61	0.02		
26			16.41	51.36	10.02	15.46	5.74	3.98	4.20	1.86	2.53	0.54	1.77	0.23	1.15	0.08	0.66	0.02		
28			17.67	58.91	10.79	17.73	6.18	4.56	4.52	2.13	2.73	0.62	1.91	0.26	1.23	0.09	0.71	0.02		
30			18.94	66.94	11.56	20.15	6.62	5.19	4.84	2.42	2.92	0.71	2.05	0.30	1.32	0.10	0.77	0.03		
32					12.33	22.71	7.06	5.85	5.16	2.73	3.12	0.80	2.18	0.34	1.41	0.12	0.82	0.03	0.36	0.00
34					13.10	25.41	7.50	6.54	5.49	3.06	3.31	0.89	2.32	0.38	1.50	0.13	0.87	0.03	0.38	0.00
36					13.87	28.24	7.94	7.27	5.81	3.40	3.51	0.99	2.46	0.42	1.59	0.14	0.92	0.04	0.40	0.01
38					14.64	31.22	8.38	8.04	6.13	3.76	3.70	1.10	2.59	0.46	1.68	0.16	0.97	0.04	0.43	0.01
40					15.41	34.33	8.82	8.84	6.46	4.13	3.89	1.21	2.73	0.51	1.76	0.18	1.02	0.05	0.45	0.01
42					16.18	37.58	9.26	9.67	6.78	4.52	4.09	1.32	2.87	0.56	1.85	0.19	1.07	0.05	0.47	0.01
44					16.95	40.96	9.71	10.54	7.10	4.93	4.28	1.44	3.00	0.61	1.94	0.21	1.12	0.06	0.49	0.01
46					17.73	44.47	10.15	11.45	7.42	5.35	4.48	1.57	3.14	0.66	2.03	0.23	1.17	0.06	0.52	0.01
48					18.50	48.12	10.59	12.39	7.75	5.79	4.67	1.69	3.28	0.71	2.12	0.25	1.23	0.07	0.54	0.01
50					19.27	51.90	11.03	13.36	8.07	6.25	4.87	1.83	3.41	0.77	2.20	0.27	1.28	0.07	0.56	0.01
55							12.13	15.94	8.88	7.45	5.36	2.18	3.75	0.92	2.42	0.32	1.40	0.08	0.62	0.01
60							13.24	18.72	9.68	8.75	5.84	2.56	4.09	1.08	2.65	0.37	1.53	0.10	0.67	0.01
65							14.34	21.72	10.49	10.15	6.33	2.97	4.44	1.25	2.87	0.43	1.66	0.11	0.73	0.02
70							15.44	24.91	11.30	11.65	6.82	3.41	4.78	1.43	3.09	0.50	1.79	0.13	0.79	0.02
75							16.54	28.31	12.10	13.23	7.30	3.87	5.12	1.63	3.31	0.56	1.91	0.15	0.84	0.02
80							17.65	31.90	12.91	14.91	7.79	4.36	5.46	1.84	3.53	0.63	2.04	0.17	0.90	0.02
85									13.72	16.69	8.28	4.88	5.80	2.06	3.75	0.71	2.17	0.19	0.95	0.03
90									14.52	18.55	8.76	5.43	6.14	2.29	3.97	0.79	2.30	0.21	1.01	0.03
95									15.33	20.50	9.25	6.00	6.48	2.53	4.19	0.87	2.42	0.23	1.07	0.03
100									16.14	22.55	9.74	6.59	6.82	2.78	4.41	0.96	2.55	0.25	1.12	0.03
110											10.71	7.87	7.51	3.31	4.85	1.14	2.81	0.30	1.23	0.04
120											11.68	9.24	8.19	3.89	5.29	1.34	3.06	0.36	1.35	0.05
130											12.66	10.72	8.87	4.52	5.73	1.56	3.32	0.41	1.46	0.06
140											13.63	12.30	9.55	5.18	6.17	1.79	3.57	0.47	1.57	0.06
150											14.61	13.97	10.24	5.89	6.61	2.03	3.83	0.54	1.68	0.07
160											15.58	15.75	10.92	6.63	7.05	2.29	4.08	0.61	1.79	0.08
170													11.60	7.42	7.50	2.56	4.34	0.68	1.91	0.09
180													12.28	8.25	7.94	2.85	4.59	0.75	2.02	0.10
190													12.97	9.12	8.38	3.15	4.85	0.83	2.13	0.11
200													13.65	10.03	8.82	3.46	5.11	0.92	2.24	0.12
220													15.01	11.96	9.70	4.13	5.62	1.09	2.47	0.15
240													16.38	14.06	10.58	4.85	6.13	1.28	2.69	0.17
260															11.46	5.63	6.64	1.49	2.92	0.20
280															12.35	6.46	7.15	1.71	3.14	0.23
300															13.23	7.34	7.66	1.94	3.37	0.26
320															14.11	8.27	8.17	2.19	3.59	0.30
340															14.99	9.25	8.68	2.45	3.81	0.33
360															15.87	10.29	9.19	2.72	4.04	0.37
380																	9.70	3.01	4.26	0.41
400																	10.21	3.31	4.49	0.45
420																	10.72	3.62	4.71	0.49
440																	11.23	3.95	4.94	0.53
460																	11.74	4.28	5.16	0.58
480																	12.25	4.64	5.38	0.63
500																	12.76	5.00	5.61	0.68

Shaded area represents velocities over 5 fps.
Use with caution.

See pg 132 for friction loss formulas



FRICITION LOSS CHARACTERISTICS

PVC SCHEDULE 40 IPS PLASTIC PIPE

Size: 4" thru 12" Flow: 10 thru 3000GPM
 ASTM D1785 C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	4"		6"		8"		10"		12"	
Avg.ID	3.998		6.031		7.942		9.976		11.889	
Pipe OD	4.500		6.625		8.625		10.750		12.750	
Avg Wall	0.251		0.297		0.342		0.387		0.431	
Min Wall	0.237		0.280		0.322		0.365		0.406	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
10	0.26	0.00	0.11	0.00	0.06	0.00	0.04	0.00	0.03	0.00
20	0.51	0.01	0.22	0.00	0.13	0.00	0.08	0.00	0.06	0.00
30	0.77	0.03	0.34	0.00	0.19	0.00	0.12	0.00	0.09	0.00
40	1.02	0.05	0.45	0.01	0.26	0.00	0.16	0.00	0.12	0.00
50	1.28	0.07	0.56	0.01	0.32	0.00	0.20	0.00	0.14	0.00
60	1.53	0.10	0.67	0.01	0.39	0.00	0.25	0.00	0.17	0.00
70	1.79	0.13	0.79	0.02	0.45	0.00	0.29	0.00	0.20	0.00
80	2.04	0.17	0.90	0.02	0.52	0.01	0.33	0.00	0.23	0.00
90	2.30	0.21	1.01	0.03	0.58	0.01	0.37	0.00	0.26	0.00
100	2.55	0.25	1.12	0.03	0.65	0.01	0.41	0.00	0.29	0.00
120	3.06	0.36	1.35	0.05	0.78	0.01	0.49	0.00	0.35	0.00
140	3.57	0.47	1.57	0.06	0.91	0.02	0.57	0.01	0.40	0.00
160	4.08	0.61	1.79	0.08	1.03	0.02	0.66	0.01	0.46	0.00
180	4.59	0.75	2.02	0.10	1.16	0.03	0.74	0.01	0.52	0.00
200	5.11	0.92	2.24	0.12	1.29	0.03	0.82	0.01	0.58	0.00
225	5.74	1.14	2.52	0.15	1.46	0.04	0.92	0.01	0.65	0.01
250	6.38	1.39	2.80	0.19	1.62	0.05	1.02	0.02	0.72	0.01
275	7.02	1.65	3.08	0.22	1.78	0.06	1.13	0.02	0.79	0.01
300	7.66	1.94	3.37	0.26	1.94	0.07	1.23	0.02	0.87	0.01
325	8.30	2.25	3.65	0.30	2.10	0.08	1.33	0.03	0.94	0.01
350	8.93	2.58	3.93	0.35	2.26	0.09	1.43	0.03	1.01	0.01
375			4.21	0.40	2.43	0.10	1.54	0.03	1.08	0.01
400			4.49	0.45	2.59	0.12	1.64	0.04	1.15	0.02
425			4.77	0.50	2.75	0.13	1.74	0.04	1.23	0.02
450			5.05	0.56	2.91	0.15	1.84	0.05	1.30	0.02
475			5.33	0.62	3.07	0.16	1.95	0.05	1.37	0.02
500			5.61	0.68	3.23	0.18	2.05	0.06	1.44	0.02
550			6.17	0.81	3.56	0.21	2.25	0.07	1.59	0.03
600			6.73	0.95	3.88	0.25	2.46	0.08	1.73	0.03
650			7.29	1.10	4.20	0.29	2.66	0.09	1.88	0.04
700			7.85	1.26	4.53	0.33	2.87	0.11	2.02	0.05
750					4.85	0.38	3.07	0.12	2.16	0.05
800					5.17	0.42	3.28	0.14	2.31	0.06
850					5.50	0.47	3.48	0.16	2.45	0.07
900					5.82	0.53	3.69	0.17	2.60	0.07
950					6.15	0.58	3.89	0.19	2.74	0.08
1000					6.47	0.64	4.10	0.21	2.89	0.09
1050					6.79	0.70	4.30	0.23	3.03	0.10
1150					7.44	0.83	4.71	0.27	3.32	0.12
1200					7.76	0.90	4.92	0.30	3.46	0.13
1250							5.12	0.32	3.61	0.14
1300							5.33	0.34	3.75	0.15
1350							5.53	0.37	3.90	0.16
1400							5.74	0.39	4.04	0.17
1500							6.15	0.45	4.33	0.19
1550							6.35	0.47	4.47	0.20
1600							6.56	0.50	4.62	0.21
1650							6.76	0.53	4.76	0.23
1700							6.97	0.56	4.91	0.24
1750							7.17	0.59	5.05	0.25
1800									5.20	0.27
1850									5.34	0.28
1900									5.48	0.29
1950									5.63	0.31
2000									5.77	0.32
2100			Shaded area represents velocities over 5 fps. Use with caution.						6.06	0.35
2200									6.35	0.39
2300									6.64	0.42
2400									6.93	0.45
2500									7.22	0.49
2600										
2700										
2800										
2900										
3000										

See pg 132 for friction loss formulas

FRICION LOSS CHARACTERISTICS



SCHEDULE 80 PVC IPS PLASTIC PIPE

Size: ½" thru 6" Flow: 1 thru 500GPM

ASTM D-1785 (1120, 1220) C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

Size	½"		¾"		1"		1¼"		1½"		2"		2½"		3"		4"		6"	
Avg ID	0.526		0.722		0.935		1.254		1.476		1.913		2.289		2.864		3.786		5.709	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg Wall	0.157		0.164		0.190		0.203		0.212		0.231		0.293		0.318		0.357		0.458	
Min Wall	0.147		0.154		0.179		0.191		0.200		0.218		0.276		0.300		0.337		0.432	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.47	0.97	0.78	0.21	0.47	0.06	0.26	0.01	0.19	0.01										
2	2.95	3.50	1.57	0.75	0.93	0.21	0.52	0.05	0.37	0.02	0.22	0.01								
3	4.42	7.42	2.35	1.59	1.40	0.45	0.78	0.11	0.56	0.05	0.33	0.01								
4	5.90	12.64	3.13	2.71	1.87	0.77	1.04	0.18	0.75	0.08	0.45	0.02	0.31	0.01						
5	7.37	19.11	3.91	4.09	2.33	1.16	1.30	0.28	0.94	0.13	0.56	0.04	0.39	0.01						
6	8.85	26.78	4.70	5.74	2.80	1.63	1.56	0.39	1.12	0.18	0.67	0.05	0.47	0.02	0.30	0.01				
7	10.32	35.63	5.48	7.63	3.27	2.17	1.82	0.52	1.31	0.24	0.78	0.07	0.55	0.03	0.35	0.01				
8	11.80	45.63	6.26	9.77	3.73	2.78	2.08	0.67	1.50	0.30	0.89	0.09	0.62	0.04	0.40	0.01				
9	13.27	56.75	7.04	12.15	4.20	3.45	2.34	0.83	1.69	0.37	1.00	0.11	0.70	0.04	0.45	0.01				
10	14.75	68.98	7.83	14.77	4.67	4.20	2.59	1.01	1.87	0.46	1.11	0.13	0.78	0.05	0.50	0.02				
12			9.39	20.70	5.60	5.88	3.11	1.41	2.25	0.64	1.34	0.18	0.93	0.08	0.60	0.03				
14			10.96	27.55	6.53	7.83	3.63	1.88	2.62	0.85	1.56	0.24	1.09	0.10	0.70	0.03				
16			12.52	35.27	7.47	10.03	4.15	2.40	3.00	1.09	1.78	0.31	1.25	0.13	0.80	0.04	0.46	0.01		
18			14.09	43.87	8.40	12.47	4.67	2.99	3.37	1.35	2.01	0.38	1.40	0.16	0.90	0.05	0.51	0.01		
20			15.65	53.32	9.33	15.16	5.19	3.63	3.75	1.64	2.23	0.47	1.56	0.19	0.99	0.07	0.57	0.02		
22					10.27	18.08	5.71	4.33	4.12	1.96	2.45	0.56	1.71	0.23	1.09	0.08	0.63	0.02		
24					11.20	21.24	6.23	5.09	4.49	2.30	2.68	0.65	1.87	0.27	1.19	0.09	0.68	0.02		
26					12.13	24.64	6.75	5.91	4.87	2.67	2.90	0.76	2.02	0.32	1.29	0.11	0.74	0.03		
28					13.07	28.26	7.26	6.77	5.24	3.06	3.12	0.87	2.18	0.36	1.39	0.12	0.80	0.03		
30					14.00	32.12	7.78	7.70	5.62	3.48	3.34	0.99	2.34	0.41	1.49	0.14	0.85	0.04		
32					14.93	36.19	8.30	8.68	5.99	3.92	3.57	1.11	2.49	0.46	1.59	0.16	0.91	0.04	0.40	0.01
34					15.87	40.49	8.82	9.71	6.37	4.39	3.79	1.24	2.65	0.52	1.69	0.17	0.97	0.04	0.43	0.01
36							9.34	10.79	6.74	4.88	4.01	1.38	2.80	0.58	1.79	0.19	1.02	0.05	0.45	0.01
38							9.86	11.93	7.12	5.40	4.24	1.53	2.96	0.64	1.89	0.21	1.08	0.06	0.48	0.01
40							10.38	13.11	7.49	5.93	4.46	1.68	3.11	0.70	1.99	0.24	1.14	0.06	0.50	0.01
42							10.90	14.35	7.87	6.49	4.68	1.84	3.27	0.77	2.09	0.26	1.20	0.07	0.53	0.01
44							11.42	15.65	8.24	7.08	4.91	2.00	3.43	0.84	2.19	0.28	1.25	0.07	0.55	0.01
46							11.94	16.99	8.61	7.69	5.13	2.18	3.58	0.91	2.29	0.31	1.31	0.08	0.58	0.01
48							12.45	18.38	8.99	8.32	5.35	2.35	3.74	0.98	2.39	0.33	1.37	0.08	0.60	0.01
50							12.97	19.83	9.36	8.97	5.57	2.54	3.89	1.06	2.49	0.36	1.42	0.09	0.63	0.01
55							14.27	23.65	10.30	10.70	6.13	3.03	4.28	1.27	2.74	0.43	1.57	0.11	0.69	0.01
60							15.57	27.79	11.24	12.57	6.69	3.56	4.67	1.49	2.98	0.50	1.71	0.13	0.75	0.02
65									12.17	14.58	7.25	4.13	5.06	1.72	3.23	0.58	1.85	0.15	0.81	0.02
70									13.11	16.73	7.80	4.74	5.45	1.98	3.48	0.66	1.99	0.17	0.88	0.02
75									14.05	19.01	8.36	5.38	5.84	2.25	3.73	0.76	2.13	0.19	0.94	0.03
80									14.98	21.42	8.92	6.06	6.23	2.53	3.98	0.85	2.28	0.22	1.00	0.03
85									15.92	23.96	9.48	6.78	6.62	2.83	4.23	0.95	2.42	0.24	1.06	0.03
90											10.03	7.54	7.01	3.15	4.48	1.06	2.56	0.27	1.13	0.04
95											10.59	8.34	7.40	3.48	4.73	1.17	2.70	0.30	1.19	0.04
100											11.15	9.17	7.79	3.83	4.97	1.29	2.85	0.33	1.25	0.04
110											12.26	10.94	8.57	4.57	5.47	1.53	3.13	0.39	1.38	0.05
120											13.38	12.85	9.34	5.37	5.97	1.80	3.42	0.46	1.50	0.06
130											14.49	14.90	10.12	6.22	6.47	2.09	3.70	0.54	1.63	0.07
140											15.61	17.09	10.90	7.14	6.96	2.40	3.98	0.62	1.75	0.08
150													11.68	8.11	7.46	2.73	4.27	0.70	1.88	0.10
160													12.46	9.14	7.96	3.07	4.55	0.79	2.00	0.11
170													13.24	10.23	8.46	3.44	4.84	0.88	2.13	0.12
180													14.02	11.37	8.95	3.82	5.12	0.98	2.25	0.13
190													14.80	12.57	9.45	4.22	5.41	1.09	2.38	0.15
200													15.57	13.82	9.95	4.64	5.69	1.19	2.50	0.16
220			Shaded area represents velocities over 5 fps. Use with caution.												10.94	5.54	6.26	1.42	2.75	0.19
240															11.94	6.51	6.83	1.67	3.00	0.23
260															12.93	7.55	7.40	1.94	3.25	0.26
280															13.93	8.66	7.97	2.23	3.51	0.30
300															14.92	9.84	8.54	2.53	3.76	0.34
320															15.92	11.09	9.11	2.85	4.01	0.39
340																	9.68	3.19	4.26	0.43
360																	10.25	3.55	4.51	0.48
380																	10.82	3.92	4.76	0.53
400																	11.39	4.31	5.01	0.58
420																	11.95	4.72	5.26	0.64
440																	12.52	5.14	5.51	0.70
460																	13.09	5.59	5.76	0.76
480																	13.66	6.04	6.01	0.82
500																	14.23	6.52	6.26	0.88

See pg 132 for friction loss formulas





FRICION LOSS CHARACTERISTICS

PVC SCHEDULE 80 IPS PLASTIC PIPE

Size: 4" thru 12"

Flow: 10 thru 3000GPM

ASTM D1785 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	4"		6"		8"		10"		12"	
Avg.ID	3.786		5.709		7.565		9.493		11.294	
Pipe OD	4.500		6.625		8.625		10.750		12.750	
Avg Wall	0.357		0.458		0.530		0.629		0.728	
Min Wall	0.337		0.432		0.500		0.593		0.687	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
10	0.28	0.00	0.13	0.00	0.07	0.00	0.05	0.00	0.03	0.00
20	0.57	0.02	0.25	0.00	0.14	0.00	0.09	0.00	0.06	0.00
30	0.85	0.04	0.38	0.00	0.21	0.00	0.14	0.00	0.10	0.00
40	1.14	0.06	0.50	0.01	0.29	0.00	0.18	0.00	0.13	0.00
50	1.42	0.09	0.63	0.01	0.36	0.00	0.23	0.00	0.16	0.00
60	1.71	0.13	0.75	0.02	0.43	0.00	0.27	0.00	0.19	0.00
70	1.99	0.17	0.88	0.02	0.50	0.01	0.32	0.00	0.22	0.00
80	2.28	0.22	1.00	0.03	0.57	0.01	0.36	0.00	0.26	0.00
90	2.56	0.27	1.13	0.04	0.64	0.01	0.41	0.00	0.29	0.00
100	2.85	0.33	1.25	0.04	0.71	0.01	0.45	0.00	0.32	0.00
120	3.42	0.46	1.50	0.06	0.86	0.02	0.54	0.01	0.38	0.00
140	3.98	0.62	1.75	0.08	1.00	0.02	0.63	0.01	0.45	0.00
160	4.55	0.79	2.00	0.11	1.14	0.03	0.72	0.01	0.51	0.00
180	5.12	0.98	2.25	0.13	1.28	0.03	0.81	0.01	0.58	0.00
200	5.69	1.19	2.50	0.16	1.43	0.04	0.91	0.01	0.64	0.01
225	6.40	1.49	2.82	0.20	1.60	0.05	1.02	0.02	0.72	0.01
250	7.12	1.81	3.13	0.24	1.78	0.06	1.13	0.02	0.80	0.01
275	7.83	2.15	3.44	0.29	1.96	0.07	1.25	0.02	0.88	0.01
300	8.54	2.53	3.76	0.34	2.14	0.09	1.36	0.03	0.96	0.01
325	9.25	2.94	4.07	0.40	2.32	0.10	1.47	0.03	1.04	0.01
350	9.96	3.37	4.38	0.46	2.50	0.12	1.58	0.04	1.12	0.02
375			4.69	0.52	2.67	0.13	1.70	0.04	1.20	0.02
400			5.01	0.58	2.85	0.15	1.81	0.05	1.28	0.02
425			5.32	0.65	3.03	0.17	1.92	0.06	1.36	0.02
450			5.63	0.73	3.21	0.18	2.04	0.06	1.44	0.03
475			5.95	0.80	3.39	0.20	2.15	0.07	1.52	0.03
500			6.26	0.88	3.56	0.22	2.26	0.07	1.60	0.03
550			6.88	1.05	3.92	0.27	2.49	0.09	1.76	0.04
600			7.51	1.24	4.28	0.31	2.72	0.10	1.92	0.04
650			8.14	1.44	4.63	0.36	2.94	0.12	2.08	0.05
700			8.76	1.65	4.99	0.42	3.17	0.14	2.24	0.06
750					5.35	0.48	3.40	0.16	2.40	0.07
800					5.70	0.54	3.62	0.18	2.56	0.08
850					6.06	0.60	3.85	0.20	2.72	0.09
900					6.42	0.67	4.07	0.22	2.88	0.09
950					6.77	0.74	4.30	0.24	3.04	0.10
1000					7.13	0.81	4.53	0.27	3.20	0.12
1050					7.49	0.89	4.75	0.29	3.36	0.13
1150					8.20	1.05	5.21	0.35	3.68	0.15
1200					8.56	1.14	5.43	0.38	3.84	0.16
1250							5.66	0.41	4.00	0.17
1300							5.89	0.44	4.16	0.19
1350							6.11	0.47	4.32	0.20
1400							6.34	0.50	4.48	0.22
1500							6.79	0.57	4.80	0.24
1550							7.02	0.60	4.96	0.26
1600							7.24	0.64	5.12	0.28
1650							7.47	0.68	5.28	0.29
1700							7.70	0.72	5.44	0.31
1750							7.92	0.76	5.60	0.33
1800			Shaded area represents velocities over 5 fps. Use with caution.						5.76	0.34
1850									5.92	0.36
1900									6.08	0.38
1950									6.24	0.40
2000									6.40	0.42
2100									6.72	0.46
2200									7.04	0.50
2300									7.36	0.54
2400									7.68	0.58
2500									8.00	0.63
2600										
2700										
2800										
2900										
3000										

See pg 132 for friction loss formulas

TYPE 'K' COPPER TUBING

Size: 1/2" thru 3" Flow: 1 thru 600 GPM
ASTM B 88 C=140 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
Avg ID	0.527		0.652		0.745		0.995		1.245		1.481		1.959		2.435		2.907	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg Wall	0.049		0.049		0.065		0.065		0.065		0.072		0.083		0.095		0.109	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.47	1.09	0.96	0.39	0.74	0.20	0.41	0.05	0.26	0.02								
2	2.94	3.94	1.92	1.40	1.47	0.73	0.82	0.18	0.53	0.06								
3	4.41	8.35	2.88	2.97	2.21	1.55	1.24	0.38	0.79	0.13								
4	5.88	14.23	3.84	5.05	2.94	2.64	1.65	0.65	1.05	0.22								
5	7.35	21.51	4.80	7.64	3.68	3.99	2.06	0.98	1.32	0.33								
6	8.81	30.15	5.76	10.70	4.41	5.59	2.47	1.37	1.58	0.46	1.12	0.20						
7	10.28	40.12	6.72	14.24	5.15	7.44	2.88	1.82	1.84	0.61	1.30	0.26						
8	11.75	51.37	7.68	18.24	5.88	9.53	3.30	2.33	2.11	0.78	1.49	0.34						
9	13.22	63.90	8.64	22.68	6.62	11.85	3.71	2.90	2.37	0.97	1.67	0.42						
10	14.69	77.66	9.60	27.57	7.35	14.41	4.12	3.52	2.63	1.18	1.86	0.51						
12			11.52	38.64	8.82	20.20	4.95	4.94	3.16	1.66	2.23	0.71	1.28	0.18				
14			13.44	51.41	10.29	26.87	5.77	6.57	3.69	2.21	2.60	0.95	1.49	0.24				
16			15.36	65.83	11.76	34.41	6.59	8.42	4.21	2.83	2.98	1.22	1.70	0.31				
18			17.28	81.88	13.23	42.80	7.42	10.47	4.74	3.52	3.35	1.51	1.91	0.39				
20					14.70	52.02	8.24	12.72	5.26	4.28	3.72	1.84	2.13	0.47				
22					16.17	62.06	9.07	15.18	5.79	5.10	4.09	2.19	2.34	0.56	1.51	0.19	1.06	0.08
24					17.64	72.91	9.89	17.84	6.32	5.99	4.46	2.58	2.55	0.66	1.65	0.23	1.16	0.10
26							10.71	20.69	6.84	6.95	4.84	2.99	2.76	0.77	1.79	0.27	1.26	0.11
28							11.54	23.73	7.37	7.97	5.21	3.43	2.98	0.88	1.93	0.30	1.35	0.13
30							12.36	26.96	7.90	9.06	5.58	3.89	3.19	1.00	2.06	0.35	1.45	0.15
32							13.19	30.39	8.42	10.21	5.95	4.39	3.40	1.12	2.20	0.39	1.54	0.16
34							14.01	34.00	8.95	11.42	6.32	4.91	3.61	1.26	2.34	0.44	1.64	0.18
36							14.84	37.79	9.48	12.70	6.70	5.46	3.83	1.40	2.48	0.49	1.74	0.20
38							15.66	41.77	10.00	14.04	7.07	6.03	4.04	1.55	2.61	0.54	1.83	0.23
40							16.48	45.94	10.53	15.43	7.44	6.63	4.25	1.70	2.75	0.59	1.93	0.25
42							17.31	50.28	11.06	16.89	7.81	7.26	4.47	1.86	2.89	0.65	2.03	0.27
44									11.58	18.41	8.18	7.91	4.68	2.03	3.03	0.70	2.12	0.30
46									12.11	19.99	8.56	8.59	4.89	2.20	3.17	0.76	2.22	0.32
48									12.63	21.63	8.93	9.30	5.10	2.38	3.30	0.83	2.32	0.35
50									13.16	23.33	9.30	10.03	5.32	2.57	3.44	0.89	2.41	0.38
55									14.48	27.84	10.23	11.96	5.85	3.07	3.78	1.06	2.66	0.45
60									15.79	32.70	11.16	14.05	6.38	3.60	4.13	1.25	2.90	0.53
65									17.11	37.93	12.09	16.30	6.91	4.18	4.47	1.45	3.14	0.61
70									18.43	43.51	13.02	18.70	7.44	4.79	4.82	1.66	3.38	0.70
75											13.95	21.24	7.97	5.45	5.16	1.89	3.62	0.80
80											14.88	23.94	8.51	6.14	5.50	2.13	3.86	0.90
85											15.81	26.79	9.04	6.87	5.85	2.38	4.10	1.01
90											16.74	29.78	9.57	7.63	6.19	2.65	4.35	1.12
95											17.67	32.91	10.10	8.44	6.54	2.93	4.59	1.24
100											18.60	36.19	10.63	9.28	6.88	3.22	4.83	1.36
110			Shaded area represents velocities over 7 fps. Use with caution, where water hammer is a concern.										11.69	11.07	7.57	3.84	5.31	1.62
120													12.76	13.01	8.26	4.51	5.79	1.91
130													13.82	15.08	8.95	5.23	6.28	2.21
140													14.88	17.30	9.63	6.00	6.76	2.54
150													15.95	19.66	10.32	6.82	7.24	2.88
160													17.01	22.16	11.01	7.69	7.72	3.25
170													18.07	24.79	11.70	8.60	8.21	3.63
180															12.39	9.56	8.69	4.04
190															13.07	10.57	9.17	4.46
200															13.76	11.62	9.66	4.91
220															15.14	13.87	10.62	5.86
240															16.51	16.29	11.59	6.88
260															17.89	18.90	12.55	7.98
280															19.27	21.68	13.52	9.15
300																	14.48	10.40
320																		
340																	16.42	13.11
360																	17.38	14.58
380																	18.35	16.11
400																		
420																		
440																		
460																		
480																		
500																		

See pg 132 for friction loss formulas



FRICION LOSS CHARACTERISTICS

TYPE 'L' COPPER TUBING

Size: ½" thru 3" Flow: 1 thru 500GPM
C=140 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	½"		5/8"		¾"		1"		1"		1½"		2"		2½"		3"	
Avg.ID	0.545		0.666		0.785		1.025		1.265		1.505		1.985		2.465		2.945	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg Wall	0.040		0.042		0.045		0.050		0.055		0.060		0.070		0.080		0.090	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.37	0.93	0.92	0.35	0.66	0.16	0.39	0.04	0.25	0.02								
2	2.75	3.35	1.84	1.26	1.32	0.57	0.78	0.15	0.51	0.06								
3	4.12	7.09	2.76	2.67	1.99	1.20	1.17	0.33	0.76	0.12								
4	5.49	12.09	3.68	4.56	2.65	2.05	1.55	0.56	1.02	0.20								
5	6.87	18.27	4.60	6.89	3.31	3.09	1.94	0.85	1.27	0.30								
6	8.24	25.61	5.52	9.65	3.97	4.34	2.33	1.18	1.53	0.43	1.08	0.18						
7	9.62	34.07	6.44	12.84	4.63	5.77	2.72	1.58	1.78	0.57	1.26	0.24						
8	10.99	43.63	7.36	16.45	5.30	7.39	3.11	2.02	2.04	0.72	1.44	0.31						
9	12.36	54.26	8.28	20.45	5.96	9.19	3.50	2.51	2.29	0.90	1.62	0.39						
10	13.74	65.95	9.20	24.86	6.62	11.17	3.88	3.05	2.55	1.10	1.80	0.47						
12			11.04	34.85	7.95	15.66	4.66	4.28	3.06	1.54	2.16	0.66	1.24	0.17				
14			12.88	46.36	9.27	20.83	5.44	5.69	3.57	2.04	2.52	0.88	1.45	0.23				
16			14.72	59.37	10.59	26.68	6.21	7.28	4.08	2.62	2.88	1.12	1.66	0.29				
18			16.56	73.84	11.92	33.18	6.99	9.06	4.59	3.25	3.24	1.40	1.86	0.36				
20					13.24	40.33	7.77	11.01	5.10	3.96	3.60	1.70	2.07	0.44				
22					14.57	48.11	8.54	13.14	5.61	4.72	3.96	2.03	2.28	0.53	1.48	0.18	1.03	0.08
24					15.89	56.53	9.32	15.44	6.12	5.55	4.32	2.38	2.49	0.62	1.61	0.22	1.13	0.09
26							10.10	17.90	6.63	6.43	4.68	2.76	2.69	0.72	1.75	0.25	1.22	0.11
28							10.87	20.54	7.14	7.38	5.04	3.17	2.90	0.82	1.88	0.29	1.32	0.12
30							11.65	23.33	7.65	8.38	5.40	3.60	3.11	0.94	2.01	0.33	1.41	0.14
32							12.43	26.30	8.16	9.45	5.76	4.06	3.31	1.05	2.15	0.37	1.51	0.15
34							13.20	29.42	8.67	10.57	6.12	4.54	3.52	1.18	2.28	0.41	1.60	0.17
36							13.98	32.71	9.18	11.75	6.48	5.05	3.73	1.31	2.42	0.46	1.69	0.19
38							14.76	36.15	9.69	12.99	6.84	5.58	3.93	1.45	2.55	0.51	1.79	0.21
40							15.53	39.75	10.20	14.28	7.21	6.13	4.14	1.59	2.69	0.56	1.88	0.23
42							16.31	43.51	10.71	15.63	7.57	6.71	4.35	1.75	2.82	0.61	1.98	0.26
44									11.22	17.04	7.93	7.32	4.56	1.90	2.95	0.66	2.07	0.28
46									11.73	18.50	8.29	7.94	4.76	2.07	3.09	0.72	2.16	0.30
48									12.24	20.02	8.65	8.60	4.97	2.24	3.22	0.78	2.26	0.33
50									12.75	21.59	9.01	9.27	5.18	2.41	3.36	0.84	2.35	0.35
55									14.02	25.76	9.91	11.06	5.70	2.88	3.69	1.00	2.59	0.42
60									15.30	30.26	10.81	13.00	6.21	3.38	4.03	1.18	2.82	0.50
65									16.57	35.10	11.71	15.07	6.73	3.92	4.36	1.37	3.06	0.57
70									17.85	40.26	12.61	17.29	7.25	4.50	4.70	1.57	3.29	0.66
75											13.51	19.65	7.77	5.11	5.04	1.78	3.53	0.75
80											14.41	22.14	8.28	5.76	5.37	2.01	3.76	0.84
85											15.31	24.77	8.80	6.44	5.71	2.25	4.00	0.94
90											16.21	27.54	9.32	7.16	6.04	2.50	4.23	1.05
95											17.11	30.44	9.84	7.91	6.38	2.76	4.47	1.16
100											18.01	33.47	10.35	8.70	6.71	3.03	4.70	1.28
110													11.39	10.38	7.39	3.62	5.17	1.52
120													12.43	12.20	8.06	4.25	5.65	1.79
130													13.46	14.15	8.73	4.93	6.12	2.07
140													14.50	16.23	9.40	5.66	6.59	2.38
150													15.53	18.44	10.07	6.43	7.06	2.70
160													16.57	20.78	10.74	7.24	7.53	3.05
170													17.60	23.25	11.41	8.11	8.00	3.41
180															12.09	9.01	8.47	3.79
190															12.76	9.96	8.94	4.19
200															13.43	10.95	9.41	4.61
220															14.77	13.07	10.35	5.50
240															16.12	15.35	11.29	6.46
260															17.46	17.80	12.23	7.49
280															18.80	20.42	13.17	8.59
300																	14.11	9.76
320																	15.05	11.00
340																	15.99	12.31
360																	16.94	13.69
380																	17.88	15.13
400																		
420																		
440																		
460																		
480																		
500																		

See pg 132 for friction loss formulas

TYPE 'M' COPPER TUBING

Size: ½" thru 3" Flow: 1 thru 500GPM
C=140 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	½"		5/8"		¾"		1"		1¼"		1½"		2"		2½"		3"	
Avg.ID	0.569		0.690		0.811		1.055		1.291		1.527		2.009		2.495		2.981	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg Wall	0.028		0.030		0.032		0.035		0.042		0.049		0.058		0.065		0.072	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
1	1.26	0.75	0.86	0.29	0.62	0.13	0.37	0.04	0.24	0.01								
2	2.52	2.71	1.71	1.06	1.24	0.48	0.73	0.13	0.49	0.05								
3	3.78	5.75	2.57	2.25	1.86	1.03	1.10	0.29	0.73	0.11								
4	5.04	9.80	3.43	3.83	2.48	1.75	1.47	0.49	0.98	0.18								
5	6.30	14.81	4.28	5.80	3.10	2.64	1.83	0.73	1.22	0.27								
6	7.56	20.76	5.14	8.13	3.72	3.70	2.20	1.03	1.47	0.39	1.05	0.17						
7	8.82	27.62	6.00	10.81	4.34	4.92	2.57	1.37	1.71	0.51	1.22	0.23						
8	10.08	35.37	6.86	13.84	4.96	6.31	2.93	1.75	1.96	0.66	1.40	0.29						
9	11.34	44.00	7.71	17.22	5.58	7.84	3.30	2.18	2.20	0.82	1.57	0.36						
10	12.60	53.48	8.57	20.93	6.20	9.53	3.67	2.65	2.45	0.99	1.75	0.44						
12			10.28	29.33	7.44	13.36	4.40	3.72	2.94	1.39	2.10	0.61	1.21	0.16				
14			12.00	39.02	8.68	17.78	5.13	4.94	3.43	1.85	2.45	0.82	1.42	0.22				
16			13.71	49.97	9.93	22.77	5.87	6.33	3.92	2.37	2.80	1.05	1.62	0.28				
18			15.43	62.15	11.17	28.32	6.60	7.87	4.41	2.95	3.15	1.30	1.82	0.34				
20			17.14	75.55	12.41	34.42	7.33	9.57	4.90	3.58	3.50	1.58	2.02	0.42				
22					13.65	41.06	8.06	11.42	5.39	4.28	3.85	1.89	2.22	0.50	1.44	0.17	1.01	0.07
24					14.89	48.24	8.80	13.41	5.88	5.02	4.20	2.22	2.43	0.58	1.57	0.20	1.10	0.09
26							9.53	15.56	6.36	5.83	4.55	2.57	2.63	0.68	1.70	0.24	1.19	0.10
28							10.26	17.85	6.85	6.68	4.90	2.95	2.83	0.78	1.84	0.27	1.29	0.11
30							11.00	20.28	7.34	7.59	5.25	3.35	3.03	0.88	1.97	0.31	1.38	0.13
32							11.73	22.85	7.83	8.56	5.60	3.78	3.23	0.99	2.10	0.35	1.47	0.15
34							12.46	25.57	8.32	9.57	5.95	4.23	3.44	1.11	2.23	0.39	1.56	0.16
36							13.20	28.42	8.81	10.64	6.30	4.70	3.64	1.24	2.36	0.43	1.65	0.18
38							13.93	31.42	9.30	11.76	6.65	5.20	3.84	1.37	2.49	0.48	1.74	0.20
40							14.66	34.55	9.79	12.94	7.00	5.71	4.04	1.50	2.62	0.52	1.84	0.22
42							15.40	37.81	10.28	14.16	7.35	6.26	4.25	1.65	2.75	0.57	1.93	0.24
44									10.77	15.43	7.70	6.82	4.45	1.79	2.88	0.63	2.02	0.26
46									11.26	16.76	8.05	7.40	4.65	1.95	3.01	0.68	2.11	0.29
48									11.75	18.13	8.40	8.01	4.85	2.11	3.15	0.73	2.20	0.31
50									12.24	19.56	8.75	8.64	5.05	2.27	3.28	0.79	2.30	0.33
55									13.46	23.33	9.62	10.31	5.56	2.71	3.60	0.95	2.53	0.40
60									14.69	27.41	10.50	12.11	6.07	3.19	3.93	1.11	2.75	0.47
65									15.91	31.79	11.37	14.04	6.57	3.70	4.26	1.29	2.98	0.54
70									17.14	36.47	12.25	16.11	7.08	4.24	4.59	1.48	3.21	0.62
75									13.12	18.31	7.58	4.82	4.92	1.68	3.44	0.71		
80											14.00	20.63	8.09	5.43	5.24	1.89	3.67	0.80
85											14.87	23.08	8.59	6.07	5.57	2.12	3.90	0.89
90											15.75	25.66	9.10	6.75	5.90	2.35	4.13	0.99
95											16.62	28.36	9.60	7.46	6.23	2.60	4.36	1.09
100											17.50	31.19	10.11	8.21	6.55	2.86	4.59	1.20
110													11.12	9.79	7.21	3.41	5.05	1.44
120													12.13	11.51	7.87	4.01	5.51	1.69
130													13.14	13.34	8.52	4.65	5.97	1.96
140													14.15	15.31	9.18	5.33	6.43	2.24
150													15.16	17.39	9.83	6.06	6.89	2.55
160													16.17	19.60	10.49	6.83	7.35	2.87
170													17.18	21.93	11.14	7.64	7.81	3.21
180															11.80	8.50	8.26	3.57
190															12.45	9.39	8.72	3.95
200															13.11	10.33	9.18	4.34
220															14.42	12.32	10.10	5.18
240															15.73	14.47	11.02	6.09
260															17.04	16.79	11.94	7.06
280															18.35	19.25	12.86	8.10
300																	13.77	9.20
320																	14.69	10.37
340																	15.61	11.60
360																	16.53	12.90
380																	17.45	14.26
400																		
420																		
440																		
460																		
480																		
500																		

See pg 132 for friction loss formulas



FRICION LOSS CHARACTERISTICS

HDPE DR 7 265 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18"

Flow: 50 thru 4000GPM

ANSI/ASAE S376.3 PE3408, ASTM D2239 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg.ID	2.440		3.136		4.589		6.013		7.494		8.890		9.760		11.156		12.550	
Pipe OD	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg Wall	0.530		0.682		1.018		1.306		1.628		1.930		2.120		2.422		2.725	
Min Wall	0.500		0.643		0.946		1.232		1.536		1.821		2.000		2.286		2.571	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
50	3.43	0.78	2.07	0.23	0.97	0.04	0.56	0.01	0.36	0.00	0.26	0.00	0.21	0.00	0.16	0.00	0.13	0.00
60	4.11	1.09	2.49	0.32	1.16	0.05	0.68	0.01	0.44	0.00	0.31	0.00	0.26	0.00	0.20	0.00	0.16	0.00
70	4.80	1.45	2.90	0.43	1.36	0.07	0.79	0.02	0.51	0.01	0.36	0.00	0.30	0.00	0.23	0.00	0.18	0.00
80	5.48	1.86	3.32	0.55	1.55	0.09	0.90	0.02	0.58	0.01	0.41	0.00	0.34	0.00	0.26	0.00	0.21	0.00
90	6.17	2.31	3.73	0.68	1.74	0.11	1.02	0.03	0.65	0.01	0.46	0.00	0.39	0.00	0.30	0.00	0.23	0.00
100	6.85	2.81	4.15	0.83	1.94	0.13	1.13	0.03	0.73	0.01	0.52	0.01	0.43	0.00	0.33	0.00	0.26	0.00
120	8.22	3.93	4.98	1.16	2.32	0.18	1.35	0.05	0.87	0.02	0.62	0.01	0.51	0.00	0.39	0.00	0.31	0.00
140	9.59	5.23	5.81	1.54	2.71	0.24	1.58	0.06	1.02	0.02	0.72	0.01	0.60	0.01	0.46	0.00	0.36	0.00
160	10.96	6.70	6.64	1.98	3.10	0.31	1.81	0.08	1.16	0.03	0.83	0.01	0.69	0.01	0.52	0.00	0.41	0.00
180			7.47	2.46	3.49	0.39	2.03	0.10	1.31	0.04	0.93	0.02	0.77	0.01	0.59	0.01	0.47	0.00
200			8.30	2.99	3.87	0.47	2.26	0.13	1.45	0.04	1.03	0.02	0.86	0.01	0.66	0.01	0.52	0.00
220			9.13	3.56	4.26	0.56	2.48	0.15	1.60	0.05	1.14	0.02	0.94	0.01	0.72	0.01	0.57	0.00
240			9.96	4.19	4.65	0.66	2.71	0.18	1.74	0.06	1.24	0.03	1.03	0.02	0.79	0.01	0.62	0.00
260			10.79	4.86	5.04	0.76	2.93	0.20	1.89	0.07	1.34	0.03	1.11	0.02	0.85	0.01	0.67	0.01
280			11.62	5.57	5.42	0.87	3.16	0.23	2.03	0.08	1.45	0.03	1.20	0.02	0.92	0.01	0.73	0.01
300					5.81	0.99	3.39	0.27	2.18	0.09	1.55	0.04	1.28	0.03	0.98	0.01	0.78	0.01
320					6.20	1.12	3.61	0.30	2.32	0.10	1.65	0.04	1.37	0.03	1.05	0.01	0.83	0.01
340					6.59	1.25	3.84	0.34	2.47	0.12	1.76	0.05	1.46	0.03	1.11	0.02	0.88	0.01
360					6.97	1.39	4.06	0.37	2.62	0.13	1.86	0.06	1.54	0.04	1.18	0.02	0.93	0.01
380					7.36	1.54	4.29	0.41	2.76	0.14	1.96	0.06	1.63	0.04	1.25	0.02	0.98	0.01
400					7.75	1.69	4.51	0.45	2.91	0.16	2.06	0.07	1.71	0.04	1.31	0.02	1.04	0.01
450					8.72	2.10	5.08	0.56	3.27	0.19	2.32	0.08	1.93	0.05	1.48	0.03	1.17	0.02
500					9.69	2.56	5.64	0.69	3.63	0.24	2.58	0.10	2.14	0.06	1.64	0.03	1.30	0.02
550					10.66	3.05	6.21	0.82	4.00	0.28	2.84	0.12	2.36	0.08	1.80	0.04	1.42	0.02
600					11.62	3.58	6.77	0.96	4.36	0.33	3.10	0.14	2.57	0.09	1.97	0.05	1.55	0.03
650							7.33	1.12	4.72	0.38	3.36	0.17	2.78	0.11	2.13	0.06	1.68	0.03
700							7.90	1.28	5.09	0.44	3.61	0.19	3.00	0.12	2.29	0.06	1.81	0.04
750							8.46	1.45	5.45	0.50	3.87	0.22	3.21	0.14	2.46	0.07	1.94	0.04
800							9.03	1.64	5.81	0.56	4.13	0.24	3.43	0.16	2.62	0.08	2.07	0.05
850							9.59	1.83	6.18	0.63	4.39	0.27	3.64	0.17	2.79	0.09	2.20	0.05
900							10.16	2.04	6.54	0.70	4.65	0.30	3.85	0.19	2.95	0.10	2.33	0.06
950							10.72	2.25	6.90	0.77	4.90	0.34	4.07	0.21	3.11	0.11	2.46	0.06
1000							11.28	2.48	7.26	0.85	5.16	0.37	4.28	0.23	3.28	0.12	2.59	0.07
1050							11.85	2.71	7.63	0.93	5.42	0.40	4.50	0.26	3.44	0.13	2.72	0.08
1100									7.99	1.01	5.68	0.44	4.71	0.28	3.61	0.15	2.85	0.08
1150							8.35	1.10	5.94	0.48	4.93	0.30	3.77	0.16	2.98	0.16	2.98	0.09
1200							8.72	1.19	6.19	0.52	5.14	0.33	3.93	0.17	3.11	0.17	3.11	0.10
1250							9.08	1.28	6.45	0.56	5.35	0.35	4.10	0.19	3.24	0.19	3.24	0.10
1300							9.44	1.38	6.71	0.60	5.57	0.38	4.26	0.20	3.37	0.20	3.37	0.11
1350							9.81	1.48	6.97	0.64	5.78	0.41	4.43	0.21	3.50	0.21	3.50	0.12
1400							10.17	1.58	7.23	0.69	6.00	0.44	4.59	0.23	3.63	0.23	3.63	0.13
1450							10.53	1.69	7.49	0.74	6.21	0.47	4.75	0.24	3.76	0.24	3.76	0.14
1500							10.90	1.80	7.74	0.78	6.42	0.50	4.92	0.26	3.89	0.26	3.89	0.15
1550							11.26	1.91	8.00	0.83	6.64	0.53	5.08	0.28	4.02	0.28	4.02	0.16
1600							11.62	2.03	8.26	0.88	6.85	0.56	5.25	0.29	4.14	0.29	4.14	0.16
1650											8.52	0.93	7.07	0.59	5.41	0.31	4.27	0.17
1700											8.78	0.99	7.28	0.63	5.57	0.33	4.40	0.18
1750											9.03	1.04	7.50	0.66	5.74	0.35	4.53	0.19
1800											9.29	1.10	7.71	0.70	5.90	0.36	4.66	0.21
1900											9.81	1.21	8.14	0.77	6.23	0.40	4.92	0.23
2000											10.32	1.33	8.57	0.85	6.56	0.44	5.18	0.25
2100											10.84	1.46	8.99	0.93	6.88	0.48	5.44	0.27
2200											11.36	1.59	9.42	1.01	7.21	0.53	5.70	0.30
2300											11.87	1.73	9.85	1.10	7.54	0.57	5.96	0.32
2400													10.28	1.19	7.87	0.62	6.22	0.35
2500													10.71	1.28	8.20	0.67	6.48	0.38
2600													11.14	1.38	8.52	0.72	6.74	0.41
2700													11.56	1.48	8.85	0.77	6.99	0.43
2800													11.99	1.58	9.18	0.82	7.25	0.46
2900															9.51	0.88	7.51	0.50
3000															9.83	0.94	7.77	0.53
3300															10.82	1.12	8.55	0.63
3600															11.80	1.31	9.33	0.74
3900																	10.10	0.86
4000																	10.36	0.90

See pg 132 for friction loss formulas

FRICION LOSS CHARACTERISTICS



HDPE DR 9 200 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18"

Flow: 50 thru 4000GPM

ANSI/ASAE S376.3 PE3408, ASTM D2239 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg.ID	2.674		3.440		5.065		6.593		8.218		9.746		10.700		12.230		13.760	
Pipe OD	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg Wall	0.413		0.530		0.780		1.016		1.266		1.502		1.650		1.885		2.120	
Min Wall	0.389		0.500		0.736		0.958		1.194		1.417		1.556		1.778		2.000	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
50	2.85	0.50	1.72	0.15	0.80	0.02												
60	3.42	0.70	2.07	0.20	0.95	0.03												
70	3.99	0.93	2.41	0.27	1.11	0.04												
80	4.56	1.19	2.76	0.35	1.27	0.05												
90	5.14	1.48	3.10	0.43	1.43	0.07												
100	5.71	1.80	3.45	0.53	1.59	0.08	0.94	0.02										
120	6.85	2.52	4.14	0.74	1.91	0.11	1.13	0.03										
140	7.99	3.35	4.83	0.98	2.23	0.15	1.31	0.04										
160	9.13	4.29	5.52	1.26	2.54	0.19	1.50	0.05	0.97	0.02								
180			6.21	1.57	2.86	0.24	1.69	0.07	1.09	0.02								
200			6.90	1.90	3.18	0.29	1.88	0.08	1.21	0.03								
220			7.59	2.27	3.50	0.35	2.06	0.10	1.33	0.03								
240			8.27	2.67	3.82	0.41	2.25	0.11	1.45	0.04	1.03	0.02						
260			8.96	3.10	4.13	0.47	2.44	0.13	1.57	0.04	1.12	0.02						
280			9.65	3.55	4.45	0.54	2.63	0.15	1.69	0.05	1.20	0.02						
300					4.77	0.61	2.82	0.17	1.81	0.06	1.29	0.03	1.07	0.02				
320					5.09	0.69	3.00	0.19	1.93	0.07	1.37	0.03	1.14	0.02				
340					5.41	0.77	3.19	0.21	2.05	0.07	1.46	0.03	1.21	0.02				
360					5.73	0.86	3.38	0.24	2.17	0.08	1.55	0.04	1.28	0.02				
380					6.04	0.95	3.57	0.26	2.30	0.09	1.63	0.04	1.35	0.02				
400					6.36	1.05	3.75	0.29	2.42	0.10	1.72	0.04	1.43	0.03				
450					7.16	1.30	4.22	0.36	2.72	0.12	1.93	0.05	1.60	0.03	1.23	0.02		
500					7.95	1.58	4.69	0.44	3.02	0.15	2.15	0.07	1.78	0.04	1.36	0.02		
550					8.75	1.89	5.16	0.52	3.32	0.18	2.36	0.08	1.96	0.05	1.50	0.03		
600					9.54	2.22	5.63	0.61	3.62	0.21	2.58	0.09	2.14	0.06	1.64	0.03	1.29	0.02
650							6.10	0.71	3.93	0.24	2.79	0.11	2.32	0.07	1.77	0.04	1.40	0.02
700							6.57	0.82	4.23	0.28	3.01	0.12	2.49	0.08	1.91	0.04	1.51	0.02
750							7.04	0.93	4.53	0.32	3.22	0.14	2.67	0.09	2.05	0.05	1.62	0.03
800							7.51	1.05	4.83	0.36	3.44	0.16	2.85	0.10	2.18	0.05	1.72	0.03
850							7.98	1.17	5.14	0.40	3.65	0.17	3.03	0.11	2.32	0.06	1.83	0.03
900							8.45	1.30	5.44	0.45	3.87	0.19	3.21	0.12	2.45	0.06	1.94	0.04
950							8.92	1.44	5.74	0.49	4.08	0.21	3.39	0.14	2.59	0.07	2.05	0.04
1000							9.39	1.58	6.04	0.54	4.30	0.24	3.56	0.15	2.73	0.08	2.15	0.04
1050							9.86	1.73	6.34	0.59	4.51	0.26	3.74	0.16	2.86	0.09	2.26	0.05
1100									6.65	0.65	4.72	0.28	3.92	0.18	3.00	0.09	2.37	0.05
1150									6.95	0.70	4.94	0.31	4.10	0.19	3.14	0.10	2.48	0.06
1200									7.25	0.76	5.15	0.33	4.28	0.21	3.27	0.11	2.59	0.06
1250									7.55	0.82	5.37	0.36	4.45	0.23	3.41	0.12	2.69	0.07
1300									7.85	0.88	5.58	0.38	4.63	0.24	3.55	0.13	2.80	0.07
1350									8.16	0.94	5.80	0.41	4.81	0.26	3.68	0.14	2.91	0.08
1400									8.46	1.01	6.01	0.44	4.99	0.28	3.82	0.15	3.02	0.08
1450									8.76	1.08	6.23	0.47	5.17	0.30	3.96	0.16	3.12	0.09
1500									9.06	1.15	6.44	0.50	5.35	0.32	4.09	0.17	3.23	0.09
1550									9.36	1.22	6.66	0.53	5.52	0.34	4.23	0.18	3.34	0.10
1600									9.67	1.29	6.87	0.56	5.70	0.36	4.36	0.19	3.45	0.11
1650									9.97	1.37	7.09	0.60	5.88	0.38	4.50	0.20	3.56	0.11
1700											7.30	0.63	6.06	0.40	4.64	0.21	3.66	0.12
1750											7.52	0.67	6.24	0.42	4.77	0.22	3.77	0.12
1800											7.73	0.70	6.41	0.45	4.91	0.23	3.88	0.13
1900											8.16	0.78	6.77	0.49	5.18	0.26	4.09	0.14
2000											8.59	0.85	7.13	0.54	5.46	0.28	4.31	0.16
2100											9.02	0.93	7.48	0.59	5.73	0.31	4.53	0.17
2200											9.45	1.02	7.84	0.65	6.00	0.34	4.74	0.19
2300											9.88	1.10	8.20	0.70	6.27	0.37	4.96	0.21
2400													8.55	0.76	6.55	0.40	5.17	0.22
2500													8.91	0.82	6.82	0.43	5.39	0.24
2600													9.27	0.88	7.09	0.46	5.60	0.26
2700													9.62	0.94	7.36	0.49	5.82	0.28
2800													9.98	1.01	7.64	0.53	6.03	0.30
2900															7.91	0.56	6.25	0.32
3000															8.18	0.60	6.46	0.34
3300															9.00	0.71	7.11	0.40
3600															9.82	0.84	7.76	0.47
3900																	8.40	0.55
4000																	8.62	0.57

Shaded area represents velocities over 5 fps.
Use with caution.

See pg 132 for friction loss formulas





FRICION LOSS CHARACTERISTICS

HDPE DR 11 160 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18"

Flow: 50 thru 4000GPM

ANSI/ASAE S376.3 PE3408, ASTM D2239 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg.ID	2.826		3.632		5.349		6.963		8.678		10.292		11.300		12.914		14.532	
Pipe OD	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg Wall	0.337		0.434		0.638		0.831		1.036		1.229		1.350		1.543		1.734	
Min Wall	0.318		0.409		0.602		0.784		0.977		1.159		1.273		1.455		1.636	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
50	2.55	0.38	1.55	0.11	0.71	0.02												
60	3.07	0.53	1.86	0.16	0.86	0.02												
70	3.58	0.71	2.17	0.21	1.00	0.03												
80	4.09	0.91	2.47	0.27	1.14	0.04												
90	4.60	1.13	2.78	0.33	1.28	0.05												
100	5.11	1.37	3.09	0.40	1.43	0.06	0.84	0.02										
120	6.13	1.92	3.71	0.57	1.71	0.09	1.01	0.02										
140	7.15	2.56	4.33	0.76	2.00	0.11	1.18	0.03										
160	8.17	3.28	4.95	0.97	2.28	0.15	1.35	0.04										
180	9.20	4.08	5.57	1.20	2.57	0.18	1.51	0.05										
200	10.22	4.96	6.19	1.46	2.85	0.22	1.68	0.06	1.08	0.02	0.77	0.01						
220	11.24	5.91	6.80	1.74	3.14	0.27	1.85	0.07	1.19	0.03	0.85	0.01						
240	12.26	6.95	7.42	2.05	3.42	0.31	2.02	0.09	1.30	0.03	0.92	0.01						
260			8.04	2.38	3.71	0.36	2.19	0.10	1.41	0.03	1.00	0.01						
280			8.66	2.73	3.99	0.41	2.36	0.11	1.52	0.04	1.08	0.02						
300			9.28	3.10	4.28	0.47	2.52	0.13	1.63	0.04	1.16	0.02						
320			9.90	3.49	4.56	0.53	2.69	0.15	1.73	0.05	1.23	0.02						
340			10.52	3.91	4.85	0.59	2.86	0.16	1.84	0.06	1.31	0.02	1.09	0.02				
360			11.13	4.34	5.13	0.66	3.03	0.18	1.95	0.06	1.39	0.03	1.15	0.02				
380					5.42	0.73	3.20	0.20	2.06	0.07	1.46	0.03	1.21	0.02				
400					5.70	0.80	3.37	0.22	2.17	0.08	1.54	0.03	1.28	0.02				
450					6.42	1.00	3.79	0.28	2.44	0.09	1.73	0.04	1.44	0.03				
500					7.13	1.21	4.21	0.34	2.71	0.12	1.93	0.05	1.60	0.03	1.22	0.02		
550					7.84	1.45	4.63	0.40	2.98	0.14	2.12	0.06	1.76	0.04	1.35	0.02		
600					8.56	1.70	5.05	0.47	3.25	0.16	2.31	0.07	1.92	0.04	1.47	0.02		
650					9.27	1.97	5.47	0.55	3.52	0.19	2.50	0.08	2.08	0.05	1.59	0.03		
700					9.98	2.26	5.89	0.63	3.79	0.21	2.70	0.09	2.24	0.06	1.71	0.03	1.35	0.02
750					10.69	2.57	6.31	0.71	4.06	0.24	2.89	0.11	2.40	0.07	1.83	0.04	1.45	0.02
800							6.73	0.80	4.33	0.27	3.08	0.12	2.56	0.08	1.96	0.04	1.55	0.02
850							7.15	0.90	4.61	0.31	3.27	0.13	2.72	0.09	2.08	0.04	1.64	0.03
900							7.57	1.00	4.88	0.34	3.47	0.15	2.88	0.09	2.20	0.05	1.74	0.03
950							7.99	1.10	5.15	0.38	3.66	0.16	3.04	0.10	2.32	0.05	1.84	0.03
1000							8.42	1.21	5.42	0.42	3.85	0.18	3.20	0.12	2.45	0.06	1.93	0.03
1050							8.84	1.33	5.69	0.45	4.04	0.20	3.36	0.13	2.57	0.07	2.03	0.04
1100							9.26	1.45	5.96	0.50	4.24	0.22	3.51	0.14	2.69	0.07	2.13	0.04
1150							9.68	1.57	6.23	0.54	4.43	0.23	3.67	0.15	2.81	0.08	2.22	0.04
1200							10.10	1.70	6.50	0.58	4.62	0.25	3.83	0.16	2.94	0.08	2.32	0.05
1250							10.52	1.83	6.77	0.63	4.81	0.27	3.99	0.17	3.06	0.09	2.42	0.05
1300									7.04	0.68	5.01	0.29	4.15	0.19	3.18	0.10	2.51	0.05
1350									7.31	0.72	5.20	0.32	4.31	0.20	3.30	0.10	2.61	0.06
1400									7.58	0.78	5.39	0.34	4.47	0.21	3.43	0.11	2.70	0.06
1450									7.86	0.83	5.59	0.36	4.63	0.23	3.55	0.12	2.80	0.07
1500									8.13	0.88	5.78	0.38	4.79	0.24	3.67	0.13	2.90	0.07
1550									8.40	0.94	5.97	0.41	4.95	0.26	3.79	0.14	2.99	0.08
1600									8.67	0.99	6.16	0.43	5.11	0.27	3.91	0.14	3.09	0.08
1650									8.94	1.05	6.36	0.46	5.27	0.29	4.04	0.15	3.19	0.09
1700									9.21	1.11	6.55	0.48	5.43	0.31	4.16	0.16	3.28	0.09
1750									9.48	1.17	6.74	0.51	5.59	0.32	4.28	0.17	3.38	0.10
1800									9.75	1.23	6.93	0.54	5.75	0.34	4.40	0.18	3.48	0.10
1900									10.29	1.36	7.32	0.59	6.07	0.38	4.65	0.20	3.67	0.11
2000			Shaded area represents velocities over 5 fps. Use with caution.								7.70	0.65	6.39	0.42	4.89	0.22	3.86	0.12
2100											8.09	0.72	6.71	0.45	5.14	0.24	4.06	0.13
2200											8.47	0.78	7.03	0.50	5.38	0.26	4.25	0.15
2300											8.86	0.85	7.35	0.54	5.63	0.28	4.44	0.16
2400													7.67	0.58	5.87	0.30	4.64	0.17
2500													7.99	0.63	6.12	0.33	4.83	0.18
2600													8.31	0.68	6.36	0.35	5.02	0.20
2700													8.63	0.72	6.61	0.38	5.22	0.21
2800													8.95	0.77	6.85	0.40	5.41	0.23
2900															7.09	0.43	5.60	0.24
3000															7.34	0.46	5.80	0.26
3300															8.07	0.55	6.38	0.31
3600															8.81	0.64	6.96	0.36
3900																	7.53	0.42
4000																	7.73	0.44

See pg 132 for friction loss formulas

FRICION LOSS CHARACTERISTICS



HDPE DR 13.5 128 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18"

Flow: 1 thru 4000GPM

ANSI/ASAE S376.2 PE3408, ASTM D2239 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg.ID	2.950		3.794		5.583		7.269		9.062		10.748		11.802		13.488		15.174	
Pipe OD	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg Wall	0.275		0.353		0.521		0.678		0.844		1.001		1.099		1.256		1.413	
Min Wall	0.259		0.333		0.491		0.639		0.796		0.944		1.037		1.185		1.333	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
50	2.34	0.31	1.42	0.09	0.65	0.01												
60	2.81	0.43	1.70	0.13	0.79	0.02												
70	3.28	0.58	1.98	0.17	0.92	0.03												
80	3.75	0.74	2.27	0.22	1.05	0.03												
90	4.22	0.92	2.55	0.27	1.18	0.04												
100	4.69	1.11	2.83	0.33	1.31	0.05	0.77	0.01										
120	5.63	1.56	3.40	0.46	1.57	0.07	0.93	0.02										
140	6.56	2.08	3.97	0.61	1.83	0.09	1.08	0.03										
160	7.50	2.66	4.54	0.78	2.09	0.12	1.24	0.03										
180	8.44	3.31	5.10	0.97	2.36	0.15	1.39	0.04										
200			5.67	1.18	2.62	0.18	1.54	0.05	0.99	0.02	0.71	0.01						
220			6.24	1.41	2.88	0.22	1.70	0.06	1.09	0.02	0.78	0.01						
240			6.80	1.66	3.14	0.25	1.85	0.07	1.19	0.02	0.85	0.01						
260			7.37	1.92	3.40	0.29	2.01	0.08	1.29	0.03	0.92	0.01						
280			7.94	2.20	3.67	0.34	2.16	0.09	1.39	0.03	0.99	0.01						
300					3.93	0.38	2.32	0.11	1.49	0.04	1.06	0.02						
320					4.19	0.43	2.47	0.12	1.59	0.04	1.13	0.02						
340					4.45	0.48	2.63	0.13	1.69	0.05	1.20	0.02	1.00	0.01				
360					4.71	0.54	2.78	0.15	1.79	0.05	1.27	0.02	1.05	0.01				
380					4.97	0.59	2.93	0.16	1.89	0.06	1.34	0.02	1.11	0.02				
400					5.24	0.65	3.09	0.18	1.99	0.06	1.41	0.03	1.17	0.02				
450					5.89	0.81	3.47	0.22	2.24	0.08	1.59	0.03	1.32	0.02				
500					6.54	0.98	3.86	0.27	2.48	0.09	1.77	0.04	1.46	0.03	1.12	0.01		
550					7.20	1.17	4.25	0.33	2.73	0.11	1.94	0.05	1.61	0.03	1.23	0.02		
600					7.85	1.38	4.63	0.38	2.98	0.13	2.12	0.06	1.76	0.04	1.35	0.02		
650					8.51	1.60	5.02	0.44	3.23	0.15	2.30	0.07	1.90	0.04	1.46	0.02		
700							5.41	0.51	3.48	0.17	2.47	0.08	2.05	0.05	1.57	0.03	1.24	0.01
750							5.79	0.58	3.73	0.20	2.65	0.09	2.20	0.05	1.68	0.03	1.33	0.02
800							6.18	0.65	3.97	0.22	2.83	0.10	2.34	0.06	1.79	0.03	1.42	0.02
850							6.56	0.73	4.22	0.25	3.00	0.11	2.49	0.07	1.91	0.04	1.51	0.02
900							6.95	0.81	4.47	0.28	3.18	0.12	2.64	0.08	2.02	0.04	1.59	0.02
950							7.34	0.90	4.72	0.31	3.36	0.13	2.78	0.08	2.13	0.04	1.68	0.02
1000							7.72	0.98	4.97	0.34	3.53	0.15	2.93	0.09	2.24	0.05	1.77	0.03
1050							8.11	1.08	5.22	0.37	3.71	0.16	3.08	0.10	2.35	0.05	1.86	0.03
1100									5.47	0.40	3.89	0.18	3.22	0.11	2.47	0.06	1.95	0.03
1150									5.71	0.44	4.06	0.19	3.37	0.12	2.58	0.06	2.04	0.04
1200									5.96	0.47	4.24	0.21	3.52	0.13	2.69	0.07	2.13	0.04
1250									6.21	0.51	4.41	0.22	3.66	0.14	2.80	0.07	2.21	0.04
1300									6.46	0.55	4.59	0.24	3.81	0.15	2.92	0.08	2.30	0.04
1350									6.71	0.59	4.77	0.26	3.95	0.16	3.03	0.08	2.39	0.05
1400									6.96	0.63	4.94	0.27	4.10	0.17	3.14	0.09	2.48	0.05
1450									7.20	0.67	5.12	0.29	4.25	0.19	3.25	0.10	2.57	0.05
1500									7.45	0.71	5.30	0.31	4.39	0.20	3.36	0.10	2.66	0.06
1550									7.70	0.76	5.47	0.33	4.54	0.21	3.48	0.11	2.75	0.06
1600									7.95	0.80	5.65	0.35	4.69	0.22	3.59	0.12	2.84	0.07
1650									8.20	0.85	5.83	0.37	4.83	0.24	3.70	0.12	2.92	0.07
1700											6.00	0.39	4.98	0.25	3.81	0.13	3.01	0.07
1750											6.18	0.41	5.13	0.26	3.92	0.14	3.10	0.08
1800											6.36	0.44	5.27	0.28	4.04	0.14	3.19	0.08
1900											6.71	0.48	5.57	0.31	4.26	0.16	3.37	0.09
2000											7.06	0.53	5.86	0.34	4.49	0.18	3.54	0.10
2100											7.42	0.58	6.15	0.37	4.71	0.19	3.72	0.11
2200											7.77	0.63	6.44	0.40	4.93	0.21	3.90	0.12
2300											8.12	0.69	6.74	0.44	5.16	0.23	4.08	0.13
2400													7.03	0.47	5.38	0.25	4.25	0.14
2500													7.32	0.51	5.61	0.27	4.43	0.15
2600													7.62	0.55	5.83	0.29	4.61	0.16
2700													7.91	0.59	6.06	0.31	4.78	0.17
2800													8.20	0.63	6.28	0.33	4.96	0.18
2900															6.50	0.35	5.14	0.20
3000															6.73	0.37	5.32	0.21
3300															7.40	0.44	5.85	0.25
3600															8.07	0.52	6.38	0.29
3900																	6.91	0.34
4000																	7.09	0.36

Shaded area represents velocities over 5 fps.
Use with caution.

See pg 132 for friction loss formulas



FRICION LOSS CHARACTERISTICS

C900 DR 18 CLASS 150 (C.I.O.D.)

Size: 4" thru 12"

Flow: 25 thru 8500GPM

AWWA C900 ASTM D1784 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	4"		6"		8"		10"		12"	
Avg.ID	4.234		6.088		7.984		9.792		11.646	
Pipe OD	4.800		6.900		9.050		11.100		13.200	
Avg Wall	0.283		0.406		0.533		0.654		0.777	
Min Wall	0.267		0.383		0.503		0.617		0.733	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
25	0.57	0.01	0.28	0.00	0.16	0.00	0.11	0.00	0.08	0.00
50	1.14	0.05	0.55	0.01	0.32	0.00	0.21	0.00	0.15	0.00
75	1.71	0.11	0.83	0.02	0.48	0.01	0.32	0.00	0.23	0.00
100	2.28	0.19	1.10	0.03	0.64	0.01	0.43	0.00	0.30	0.00
125	2.84	0.29	1.38	0.05	0.80	0.01	0.53	0.00	0.38	0.00
150	3.41	0.41	1.65	0.07	0.96	0.02	0.64	0.01	0.45	0.00
175	3.98	0.54	1.93	0.09	1.12	0.02	0.74	0.01	0.53	0.00
200	4.55	0.69	2.20	0.12	1.28	0.03	0.85	0.01	0.60	0.01
225	5.12	0.86	2.48	0.15	1.44	0.04	0.96	0.01	0.68	0.01
250	5.69	1.05	2.75	0.18	1.60	0.05	1.06	0.02	0.75	0.01
275	6.26	1.25	3.03	0.21	1.76	0.06	1.17	0.02	0.83	0.01
300	6.83	1.47	3.30	0.25	1.92	0.07	1.28	0.02	0.90	0.01
325	7.40	1.70	3.58	0.29	2.08	0.08	1.38	0.03	0.98	0.01
350	7.97	1.95	3.85	0.33	2.24	0.09	1.49	0.03	1.05	0.01
375	8.53	2.22	4.13	0.38	2.40	0.10	1.60	0.04	1.13	0.02
400	9.10	2.50	4.40	0.43	2.56	0.11	1.70	0.04	1.20	0.02
450			4.95	0.53	2.88	0.14	1.91	0.05	1.35	0.02
500			5.50	0.65	3.20	0.17	2.13	0.06	1.50	0.03
550			6.05	0.77	3.52	0.21	2.34	0.08	1.65	0.03
600			6.60	0.91	3.84	0.24	2.55	0.09	1.80	0.04
700			7.71	1.20	4.48	0.32	2.98	0.12	2.11	0.05
800			8.81	1.54	5.12	0.41	3.40	0.15	2.41	0.07
900			9.91	1.92	5.76	0.51	3.83	0.19	2.71	0.08
1000					6.40	0.62	4.26	0.23	3.01	0.10
1100					7.04	0.74	4.68	0.28	3.31	0.12
1200					7.68	0.87	5.11	0.32	3.61	0.14
1300					8.32	1.01	5.53	0.38	3.91	0.16
1400					8.96	1.16	5.96	0.43	4.21	0.19
1500					9.60	1.32	6.38	0.49	4.51	0.21
1600					10.24	1.49	6.81	0.55	4.81	0.24
1700							7.23	0.62	5.11	0.27
1800							7.66	0.69	5.41	0.29
1900							8.08	0.76	5.72	0.33
2000							8.51	0.83	6.02	0.36
2100							8.94	0.91	6.32	0.39
2200							9.36	0.99	6.62	0.43
2300									6.92	0.46
2400									7.22	0.50
2500									7.52	0.54
2600									7.82	0.58
2700									8.12	0.63
2800										
2900										
3000										
3100										
3200										
3300										
3400										
3500										
3600										
3800			Shaded area represents velocities over 5 fps. Use with caution.							
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

See pg 132 for friction loss formulas

C900 DR 25 CLASS 100 (C.I.O.D.)

Size: 4" thru 12"

Flow: 25 thru 8500GPM

AWWA C900 ASTM D1784 C=150

PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	4"		6"		8"		10"		12"	
Avg.ID	4.392		6.314		8.282		10.158		12.080	
Pipe OD	4.800		6.900		9.050		11.100		13.200	
Avg Wall	0.204		0.293		0.384		0.471		0.560	
Min Wall	0.192		0.276		0.362		0.444		0.528	
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss
25	0.53	0.01	0.26	0.00	0.15	0.00	0.10	0.00	0.07	0.00
50	1.06	0.04	0.51	0.01	0.30	0.00	0.20	0.00	0.14	0.00
75	1.59	0.09	0.77	0.02	0.45	0.00	0.30	0.00	0.21	0.00
100	2.12	0.16	1.02	0.03	0.59	0.01	0.40	0.00	0.28	0.00
125	2.64	0.24	1.28	0.04	0.74	0.01	0.49	0.00	0.35	0.00
150	3.17	0.34	1.54	0.06	0.89	0.02	0.59	0.01	0.42	0.00
175	3.70	0.45	1.79	0.08	1.04	0.02	0.69	0.01	0.49	0.00
200	4.23	0.58	2.05	0.10	1.19	0.03	0.79	0.01	0.56	0.00
225	4.76	0.72	2.30	0.12	1.34	0.03	0.89	0.01	0.63	0.01
250	5.29	0.88	2.56	0.15	1.49	0.04	0.99	0.01	0.70	0.01
275	5.82	1.05	2.81	0.18	1.64	0.05	1.09	0.02	0.77	0.01
300	6.35	1.23	3.07	0.21	1.78	0.06	1.19	0.02	0.84	0.01
325	6.87	1.43	3.33	0.24	1.93	0.07	1.29	0.02	0.91	0.01
350	7.40	1.63	3.58	0.28	2.08	0.07	1.38	0.03	0.98	0.01
375			3.84	0.32	2.23	0.08	1.48	0.03	1.05	0.01
400			4.09	0.36	2.38	0.10	1.58	0.04	1.12	0.02
450			4.61	0.45	2.68	0.12	1.78	0.04	1.26	0.02
500			5.12	0.54	2.97	0.14	1.98	0.05	1.40	0.02
550			5.63	0.65	3.27	0.17	2.17	0.06	1.54	0.03
600			6.14	0.76	3.57	0.20	2.37	0.08	1.68	0.03
700			7.16	1.01	4.16	0.27	2.77	0.10	1.96	0.04
800			8.19	1.29	4.76	0.35	3.16	0.13	2.24	0.05
900			9.21	1.61	5.35	0.43	3.56	0.16	2.52	0.07
1000			10.23	1.95	5.95	0.52	3.95	0.19	2.80	0.08
1100					6.54	0.62	4.35	0.23	3.08	0.10
1200					7.14	0.73	4.74	0.27	3.36	0.12
1300					7.73	0.85	5.14	0.31	3.63	0.14
1400					8.33	0.97	5.54	0.36	3.91	0.16
1500					8.92	1.11	5.93	0.41	4.19	0.18
1600					9.52	1.25	6.33	0.46	4.47	0.20
1700							6.72	0.52	4.75	0.22
1800							7.12	0.57	5.03	0.25
1900							7.51	0.63	5.31	0.27
2000							7.91	0.70	5.59	0.30
2100							8.30	0.76	5.87	0.33
2200							8.70	0.83	6.15	0.36
2300									6.43	0.39
2400									6.71	0.42
2500									6.99	0.45
2600									7.27	0.49
2700									7.55	0.52
2800									7.83	0.56
2900									8.11	0.60
3000									8.39	0.64
3100									8.67	0.68
3200		Shaded area represents velocities over 5 fps. Use with caution.								
3300										
3400										
3500										
3600										
3800										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

See pg 132 for friction loss formulas



Number of Emitters per Plant

$$\text{Emitters per tree} = \frac{\text{canopy area (sq. ft.)} \times 0.75}{\text{wetted area per emitter (sq. ft.)}}$$

Soil Type	Wetted Area	
	Diameter (ft.)	Area (sq. ft.)
Sand	2 – 3	3 – 7
Sandy Loam	3 – 4.5	7 – 16
Loam	3 – 5	7 – 20
Clay-Loam	4 – 6	13 – 28
Clay	5 – 7	20 – 38

Flow per zone

$$\text{Flow per zone (gpm)} = \frac{\text{Total number of drippers} \times \text{dripper flow rate (gph)}}{60 \text{ (minutes)}}$$

Precipitation Rate for Evenly Spaced Laterals and Emitters

Precipitation Rate for Drip Laterals (inches/hour)							
Emitter Flow	Emitter Spacing	Spacing Between Drip Laterals					
		6 in.	12 in.	18 in.	24 in.	30 in.	36 in.
0.53 gph	12 in.	1.62	0.81	0.54	0.40	0.32	0.27
0.53 gph	18 in.	1.08	0.54	0.36	0.27	0.22	0.18
0.53 gph	24 in.	0.81	0.40	0.27	0.20	0.16	0.13
1.02 gph	12 in.	3.11	1.56	1.04	0.78	0.62	0.52
1.02 gph	18 in.	2.07	1.04	0.69	0.52	0.41	0.35
1.02 gph	24 in.	1.56	0.78	0.52	0.39	0.31	0.26

Precipitation Rate Formula:

$$\text{Precipitation Rate (in./hr.)} = \frac{231.1 \times \text{Emitter Flow (gph)}}{\text{Lateral Spacing (in.)} \times \text{Emitter Spacing (in.)}}$$

Note: This formula applies to evenly spaced drip irrigation laterals and emitters

Precipitation Rate for a Single Lateral

Precipitation Rate (in./hr) of a Single Row of Dripline in a Contained Landscape						
Emitter Flow	Emitter Spacing	Width of Contained Landscape				
		1 ft.	2 ft.	3 ft.	4 ft.	5 ft.
0.53 gph	12 in.	0.81	0.40	0.27	0.20	0.16
0.53 gph	18 in.	0.54	0.27	0.18	0.13	0.11
0.53 gph	24 in.	0.40	0.20	0.13	0.10	0.08
1.02 gph	12 in.	1.56	0.78	0.52	0.39	0.31
1.02 gph	18 in.	1.04	0.52	0.35	0.26	0.21
1.02 gph	24 in.	0.78	0.39	0.26	0.19	0.16

Precipitation Rate Formula:

$$\text{Precipitation Rate (in./hr.)} = \frac{231.1 \times \text{Emitter Flow (gph)}}{\text{Width of Contained Area (in.)} \times \text{Emitter Spacing (in.)}}$$

Thermal Effects on Drip Hose and Dripline

For recurring, ambient temperatures above 73°F (23°C), multiply PSI rating of selected tubing by the appropriate FACTOR from the table below. Result will be the temp-corrected maximum PSI rating for the tubing selected. For temperatures not shown, but between 73°F & 140°F (23°C & 60°C), interpolate to obtain the temp-corrected maximum PSI. Use this information to select the appropriate pressure regulator to assure tubing life expectancy and warranty coverage.

°F	°C	FACTOR
73°	23°	1.00
80°	27°	0.92
90°	32°	0.81
100°	38°	0.70
110°	43°	0.60
120°	49°	0.45
130°	54°	0.32
140°	60°	0.18

Below Grade Drip Hose & Dripline Installations

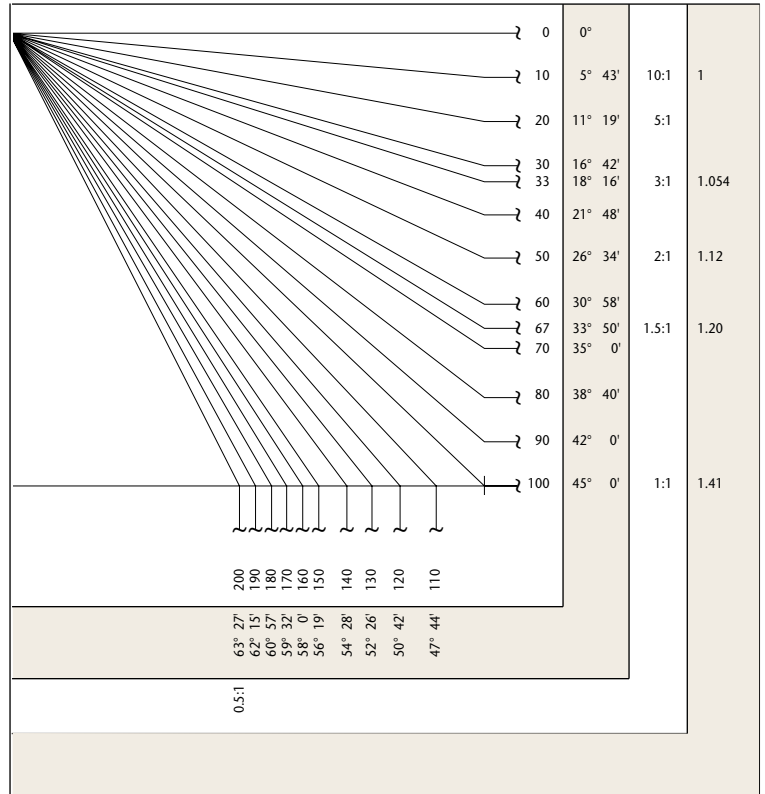
When installing Blue Stripe drip hose below grade, consult ANSI/ASAE S376.2: Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipelines for installation protocols regarding trench conditions, water packing of the drip hose prior to backfill & the quality of backfill material. Failure to follow these installation protocols will shorten the life of the tubing and may void the warranty.

PRECIPITATION RATE REFERENCE CHARTS

Pressure Loss—psi

FLOW GPM	NOMINAL SIZE						
	3/8"	1/2"	1"	1 1/2"	2"	3"	4"
1	0.2	0.1					
2	0.3	0.2					
3	0.4	0.3					
4	0.6	0.5	0.1				
5	0.9	0.6	0.2				
6	1.3	0.7	0.3				
7	1.8	0.8	0.4				
8	2.3	1.0	0.5				
9	3.0	1.3	0.6				
10	3.7	1.6	0.7				
11	4.4	1.9	0.8				
12	5.1	2.2	0.9				
13	6.1	2.6	1.0				
14	7.2	3.1	1.1				
15	8.3	3.6	1.2				
16	9.4	4.1	1.4	0.4			
17	10.7	4.6	1.6	0.5			
18	12.0	5.2	1.8	0.6			
19	13.4	5.8	2.0	0.7			
20	15.0	6.5	2.2	0.8			
22		7.9	2.8	1.0			
24		9.5	3.4	1.2			
26		11.2	4.0	1.4			
28		13.0	4.6	1.6			
30		15.0	5.3	1.8	0.7		
32			6.0	2.1	0.8		
34			6.9	2.4	0.9		
36			7.8	2.7	1.0		
38			8.7	3.0	1.2		
40			9.6	3.3	1.3		
42			10.6	3.6	1.4		
44			11.7	3.9	1.5		
46			12.8	4.2	1.6		
48			13.9	4.5	1.7		
50			15.0	4.9	1.9	0.7	
52				5.3	2.1		
54				5.7	2.2		
56				6.2	2.3		
58				6.7	2.5		
60				7.2	2.7	1.0	
65				8.3	3.2	1.1	
70				9.8	3.7	1.3	
75				11.3	4.3	1.5	
80				12.8	4.9	1.6	0.7
90				16.1	6.2	2.0	0.8
100				20.0	7.8	2.5	0.9
110					9.5	2.9	1.0
120					11.3	3.4	1.2
130					13.0	3.9	1.4
140					15.1	4.5	1.6
150					17.3	5.1	1.8
160					20.0	5.8	2.1
170						6.5	2.4
180						7.2	2.7
190						8.0	3.0
200						9.0	3.2
220						11.0	3.9
240						13.0	4.7
260						15.0	5.5
280						17.3	6.3
300						20.0	7.2
350							10.0
400							13.0
450							16.2
500							20.0

Slope, Angle & Ratio Precipitation Rates



Maximum Precipitation Rates

Soil Texture	Maximum Precipitation Rates: Inches Per Hour							
	0 to 5% slope		5 to 8% slope		8 to 12% slope		12% + slope	
	Cover	Bare	Cover	Bare	Cover	Bare	Cover	Bare
Coarse sandy soils	2.00	2.00	2.00	1.50	1.50	1.0	1.0	0.50
Coarse sandy soils over compact subsoils	1.75	1.50	1.25	1.00	1.00	0.75	0.75	0.40
Uniform light sandy loams	1.75	1.00	1.25	0.80	1.00	0.60	0.75	0.40
Light sandy loams over compact subsoils	1.25	0.75	1.00	0.50	0.75	0.40	0.50	0.30
Uniform silt loams	1.00	0.50	0.80	0.40	0.60	0.30	0.40	0.20
Silt loams over compact subsoil	0.60	0.30	0.50	0.25	0.40	0.15	0.30	0.10
Heavy clay or clay loam	0.20	0.15	0.15	0.10	0.12	0.08	0.10	0.06

The maximum PR values listed are as suggested by the United States Department of Agriculture.
The values are average and may vary with respect to actual soil condition and condition of ground cover.





Method of Wire Sizing for Electrical Components of an Automatic Irrigation System

Data Needed

- Maximum current draw of the electrical unit (valve or controller) in amperes (I)
- Distance in feet (one way) to the electrical unit (F)
- The allowable voltage drop in the wire without affecting functions of the electrical unit (Vd)

Steps

1. Calculate the maximum allowable wire resistance per 1000 feet with the following formula:

$$R = \frac{500 \times Vd}{F \times I}$$

where R = allowable wire resistance per 1000 feet.

2. Select the wire size from Chart #2 which has a resistance less than that calculated in the above formula.

Example: A valve with a minimum operating voltage of 20 volts and inrush current of .30 amps is to be located 2680 ft. from a controller. The controller minimum output voltage is 24 V ac.

The allowable voltage drop

(Vd) = 24 – 20 = 4 volts

The distance to valve (F) = 2680 ft.

The current draw (I) = .3 amps

$$R = \frac{500 \times 4}{2680 \times .3} = 2.49 \text{ ohm/1000 ft.}$$

From Chart #2 we find that #14 AWG wire has slightly too much resistance. Therefore, choose #12 AWG copper wire. The accompanying charts are useful for quick and easy selection of wire sizes for valves with standard and optional solenoids. Chart #3 is set up to provide maximum wire runs given a standard 24 V ac valve with a minimum operating voltage of 20 volts and a controller output of 24 V ac Chart #4 is a multiplier factor for determining maximum wire runs for other controller output voltages and optional solenoids.

Example: Determine maximum wire run to a valve with model 24 V ac-D solenoid and controller output voltage of 26 volts and #14 control and ground wire.

From Chart #3 we find a length of 2590 ft. with #14 ground and control wire. From Chart #4 the multiplier factor at 26 V ac controller output with a model 24 V ac-D solenoid is 4.33. Therefore, the maximum wire distance to the valve is: 4.33 x 2590 feet = 11,215 feet.

* This assumes control wire and ground wire are the same size.

Minimum Operating Voltages at Various Static Pressures (standard 24 V ac solenoid)

Chart 1
Minimum Solenoid Operating Voltage Under Various Line Pressure

Line Pressure	Voltage (Internal Bleed Configurations)	Voltage (External Bleed Configurations)
200 psi (13,8 Bar)	21.1	
175 psi (12,1 Bar)	20.2	
150 psi (10,3 Bar)	19.1	20.0
125 psi (8,6 Bar)	18.2	19.1
100 psi (6,9 Bar)	17.1	18.2
75 psi (5,2 Bar)	16.1	17.3
50 psi (3,4 Bar)	16.0	16.4

Chart 2
Copper Wire Resistance of Various Sizes

Sizes AWG	Resistance at 20°C Ohms per 1000 ft.
4	.25
6	.40
8	.64
10	1.02
12	1.62
14	2.57
16	4.10
18	6.51

Chart 3

Maximum One-way Distance (ft.) Between Controller and Valve
(standard 24 VAC solenoid) †

Valve Wire Sizing							
Ground Wire	Control Wire						
	18	16	14	12	10	8	6
18	1020	1260	1470	1640	1770	1860	1930
16	1260	1630	2000	2330	2610	2810	2960
14	1470	2000	2590	3180	3710	4150	4480
12	1640	2330	3180	4120	5050	5900	6590
10	1770	2610	3710	5050	6540	8030	9380
8	1860	2810	4150	5900	8030	10400	12770
6	1930	2960	4480	6590	9380	12770	16540

† Solenoid Model: 24 V ac Pressure: 150 psi Voltage Drop: 4 V Min. Op. Voltage: 20 V Amperage (peak): 0.3A

Multiplier Factor for Various Controller Output Voltages and Optional Low-voltage Solenoids

Chart 4

Controller Output Voltage	24-Volt Solenoids		
	24 V ac	24 V ac-D	24 VDC
28	2.00	5.77	5.45
27	1.75	5.05	4.77
26	1.50	4.33	4.09
25	1.25	3.61	3.41
24	1.00	2.88	2.73
23	.75	2.16	2.05
22	.50	1.44	1.36

Chart 5

Controller Output Voltage	12-Volt Solenoids		
	12 V.a.c.	12 V ac-D	12 VDC
16	.58	2.50	1.96
15	.50	2.08	1.63
14	.41	1.67	1.30
13	.33	1.25	.98
12	.25	.83	.65
11	.17	.42	.33

The Toro Company and its affiliate, Toro Warranty Company, pursuant to an agreement between them, jointly warrants to the owner each new piece of irrigation product (featured in the current catalog at date of installation) against defects in material and workmanship for a period described herein, provided they are used for irrigation purposes under manufacturer's recommended specifications.

During the warranty period, we will repair or replace, at our option, any part found to be defective. Your remedy is limited solely to the replacement or repair of defective parts. This warranty does not apply (i) to Acts of God (e.g., lightning, flooding, etc.) unless specifically listed under the Extended Lightning Protection Warranty provided herein; or (ii) to products not manufactured by Toro when used in conjunction with Toro products; or (iii) where equipment is used or installation is performed in any manner contrary to Toro's specifications and instructions, or where equipment is altered or modified; or (iv) to natural infestations (e.g., insects, rodents, etc.).

Return the defective part to your irrigation contractor or installer, or your local distributor who may be listed in your telephone/web directory under "Irrigation Supplies" or "Sprinkler Systems", or contact The Toro Warranty Company, 5825 Jasmine Street, Riverside, California, 92504, phone (877) 345-8676, for the location of your nearest Toro distributor, or outside the U.S., call (951) 688-9221.

Neither Toro nor Toro Warranty Company is liable for indirect, incidental or consequential damages in connection with the use of equipment, including but not limited to vegetation loss, the cost of substitute equipment or services required during periods of malfunction or resulting non-use, property damage or personal injury resulting from installer's actions, whether negligent or otherwise. Some states do not allow the exclusion of incidental or consequential damages, so this exclusion may not apply to you.

All implied warranties, including those of merchantability and fitness for use, are limited to the duration of this express warranty. Some states do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you.

This warranty gives you specific legal rights and you may have other rights, which vary from state to state.

Standard Warranty

Toro Irrigation Division products are covered by this warranty for a period of two years from the date of installation, except as otherwise noted.

Extended Three-Year Warranty

The following products are covered by this warranty for three years from date of installation: DDC™ WP Controller.

Extended Five-Year Warranty

The following products are covered by this warranty for five years from date of installation: Fixed **Sprays**: 570Z PR and 570Z PRX Series ; **Rotors**: T5, T7, TS90 and 640 Series

Valves: EZ-Flo Plus, TPV, P-220 and 220 Brass Series ; **Controllers**: EVOLUTION®, TMC-424E, Custom Command and TDC Series **Sensors**: TWRS Wireless RainSensor™ Series (receiver and transmitter)

Sentinel® Series Product Warranty

All Sentinel Centrals, with the exception of centrals covered by the Toro National Support Network (NSN®), and Sentinel hand-held remotes are covered by this warranty for a period of two years from date of installation. All Sentinel Series satellites are covered by this warranty for a period of five years from date of installation.

Landscape Drip Warranty

Warranty period from date of delivery:

DL2000™ Series Dripline

- Emitters 2 years
- Hose 5 years (prorated)
- Rootguard 7 years

Drip In® Series Dripline

- Emitters 2 years
- Hose 5 years (prorated)

Blue Stripe® Hose

- All 7 years (prorated)

Fittings

- All 1 year

Emission Devices

- All (except NGE) 1 year
- NGE® Emitter and Drip Bubblers 2 years

Filters and Components

- All 1 year

Other Accessories

- All 1 year

Grounding

The Toro Warranty for Irrigation Controllers is void if controller is not properly grounded per instruction manual. A good ground source is a mandatory component of overall surge protection for Toro Irrigation Control Systems. Grounding electrode(s) should be placed at each automatic controller or controller group locations. The resistance to the grounding electrode should not exceed 10 Ohms when measured with a Megger Earth Resistance Testing instrument or equivalent. It is the responsibility of the installer to connect all electronic irrigation equipment for which he is responsible to earth ground in accordance with Article 250 of the National Electrical Code (NEC). Even with optimum grounding, neither Toro nor Toro Warranty Company are liable for product failures due to acts of God (i.e., lightning, flooding, etc.), and these failures are not covered by warranty.





**Toro is always there to help you care for your landscapes the way you want,
when you want, better than anyone else.**



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