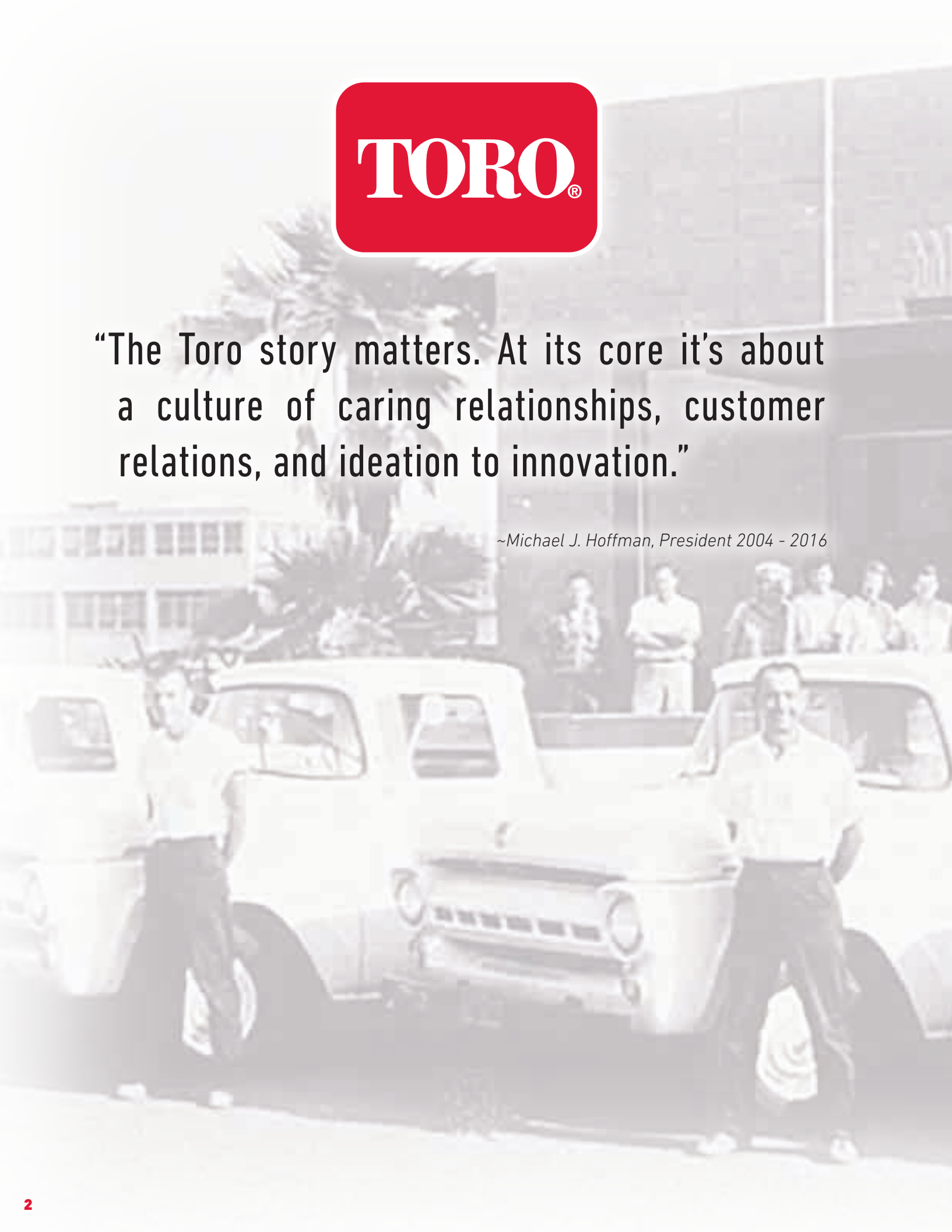
Residential & Commercial Irrigation

Specification Catalog 2018-2019

TORO®



"The Toro story matters. At its core it's about a culture of caring relationships, customer relations, and ideation to innovation."

~Michael J. Hoffman, President 2004 - 2016

CUSTOMER CARE YOU CAN COUNT ON

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 and product literature. Specialty sites for Specifiers (**www.specifier.toro.com**) and water management highlights (**www.watersmart.toro.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 water while maintaining healthy landscapes. Incorporate WaterSmart solutions throughout the whole system to ensure optimum water savings.

toro

WHAT'S NEW IN IRRIGATION PRODUCTS

SEE PAGE 64-67

TS170 Series Rotors

The piston-driven Toro TS170 Series long radius rotor is the irrigation solution of choice for the cooling and washing down of large synthetic turf fields. Capable of achieving a throw of 177 feet, the TS170 Series Rotor can be installed along the outer perimeter of the playing surface, which helps preserve player safety and maintain field aesthetics.

SEE PAGE 68-71

TS120 Series Impact Sprinklers

The TS120 Series Impact Sprinkler is capable of achieving long-range throws of up to 125 feet, making it well suited to meet the needs of both synthetic and natural turf sports fields. Available in Part Circle and Full Circle models, the TS120 can be configured with a factory-installed 4" TurfCup™ that helps to seamlessly blend the sprinkler into natural turf surfaces and preserve field aesthetics.

SEE PAGE 80-83

P2 Series Sprinklers

The lightweight and versatile P2 Series Sprinklers are capable of achieving radii of up to 226 feet, making them well suited for a wide range of applications, including dust suppression and control, cooling and washdown of synthetic turf, and the distribution of reclaimed water.

SEE PAGE 84-87

RollcarT™ Traveling Sprinkler

The Toro RollcarT™ offers a cost-effective, easy-to-setup solution for irrigating sports fields, golf course roughs, and other large, open turf areas where an underground irrigation system is not installed or impractical.

SEE PAGE 112-115

SMRT LOGIC™

The SMRT Logic gateway provides on-demand access to your irrigation controller and other landscape features from anywhere in the world, and gives you the power to manage your landscape through your smartphone, tablet, or computer.

Precision™ Series Rotating Nozzle Shrub & Slope Kit

The new Toro Precision™ Series Rotating Nozzle Shrub & Slope Kit is the ideal tool for delivering efficient irrigation in above-ground settings, such as slopes, shrub beds, and grow nurseries. Pre-assembled out of the box, the kit features a highly-efficient Precision™ Rotating Nozzle, 570ZSXF Shrub Riser, and 15' Precision™ Check Valve. The kit has a universal ½" NPT female inlet, making it a go-to solution for both new installs and retrofit projects.

SEE PAGE 28-31

Precision™ Check Valve

The Toro Precision™ Check Valve saves water and eliminates runoff by immediately sealing the spray head at its connection point at the end of the irrigation cycle, thereby preventing the draining of lateral lines through the lowest-lying heads.

SEE PAGE 38

Tri-Loc™ Fittings

Tri-Loc fittings offer exceptional retention strength and are great for both new and existing systems alike. This universal fit makes them particularly great for repairs and system expansions–contractors can work on an existing ½" drip tubing system without risking a mismatch between fitting and tubing size.

SEE PAGE 161

Insert Barb Fittings

The new i620 series insert fittings work with Toro's DL2000™, Drip In®, and 5/8" Blue Stripe® Hose, featuring a double-barb for stronger retention, and are made from rigid acetal for long-lasting durability under even the toughest conditions.

SEE PAGE 161

SPRAYS

Pages 10-43

570Z Series	12-15
Precision™ Series Spray Nozzles	16-23
Precision™ Series Rotating Nozzles	24-27
Precision™ Series Rotating Nozzles Shrub & Slope Kit	28-31
MPR Plus Nozzles	32-33
TVAN Variable Arc Nozzles	34-35
Pressure-Compensating Flood Bubblers	36
500 Series Bubblers	36
Stream Spray Nozzles	37
Stream Bubbler Nozzles	37
Precision™ Check Valve	38
Spray Tools & Accessories	39
Super Funny Pipe®	40-41
Super Funny Pipe Swing Joints	42
Super Funny Pipe Fittings	43

ROTORS

Pages 44-57

Mini 8 Series	46-49
300 Series Stream Rotor®	50-53
T5 RapidSet® Series	54-57

SF&G SPRINKLERS

Pages 58-89

TS170 Series Rotor	60-63
TS120 Series Impact Sprinklers	64-67
T7 Series	68-71
640 Series	72-75
TS90 Series	76-79
P2 Series Sprinklers	80-83
Toro RollcarT™ Traveling Sprinkler	84-87
Sentinel® Central Control	89
Turf Guard® Soil Monitoring System	89

VALVES

Pages 90-109

EZ-Flo® Plus Series	92-93
TPV Series	94-95
250/260 & 254/264 Series	96-97
252 Series	98-99
P-220 Series	100-101
P-220S Scrubber Series	102-103
220 Brass Series	104-105
Quick Coupler Series	106-107
Electric/Hydraulic Converter	108
Valve Accessories	109

CONTROLLERS

Pages 110-129

SMRT Logic™	112-115
EVOLUTION® Series	116-119
Scheduling Advisor™ Software	120-121
DDC™WP	122-123
TMC-424E Series	124-125
Custom Command™ Series	126-127
TDC Series Two-Wire System	128-129

SENSORS & REMOTES

Pages 130-149

Precision™ Soil Sensor	132-135
Turf Guard®	136-137
Pro Series™ Soil Sensor	138-139
Wireless ET Weather Sensor	140-143
Wireless RainSensor™	144
Wired RainSensor™	145
TFS Flow Sensors	146
TMR Maintenance Remote	147
EVOLUTION® Smart Connect® Remote	148
EICON Remote	149

LANDSCAPE DRIP

Pages 150-173

DL2000™ Series Subsurface Dripline	152-155
Drip In® Brown Dripline	156-159
DL2000 Series Microline with ROOTGUARD®	160
Soakerline™ Classic Dripline	160
Drip Fittings & Accessories	161
Blue Stripe® Poly Hose	162-163
NGE® Emitters	164-165
Turbo SC™ Plus Emitter	166
E-2™ Classic Emitter	167
Pressure Regulating Multi-Outlet Manifold	168
Drip Bubblers	169
Varis™ & Varistake™ Adjustable Emitters	170
Pressure Regulators	170
Plastic Y Filters	171
Drip Zone Valve Kits	172-173

CENTRAL CONTROL

Pages 174-185

Sentinel® Central Control	176-177
Sentinel® Controllers	178-179
Sentinel® Wireless Output Board	180
Sentinel® Compact Control Series	180
Sentinel® Two-Wire Controllers	181
Sentinel® Smart Irrigation	182
Sentinel® Soil Sensing	183
Sentinel® Flow Sensing	183
Sentinel® Handheld Remote	184
Sentinel® Retro Link	184
National Support Network (NSN®)	185

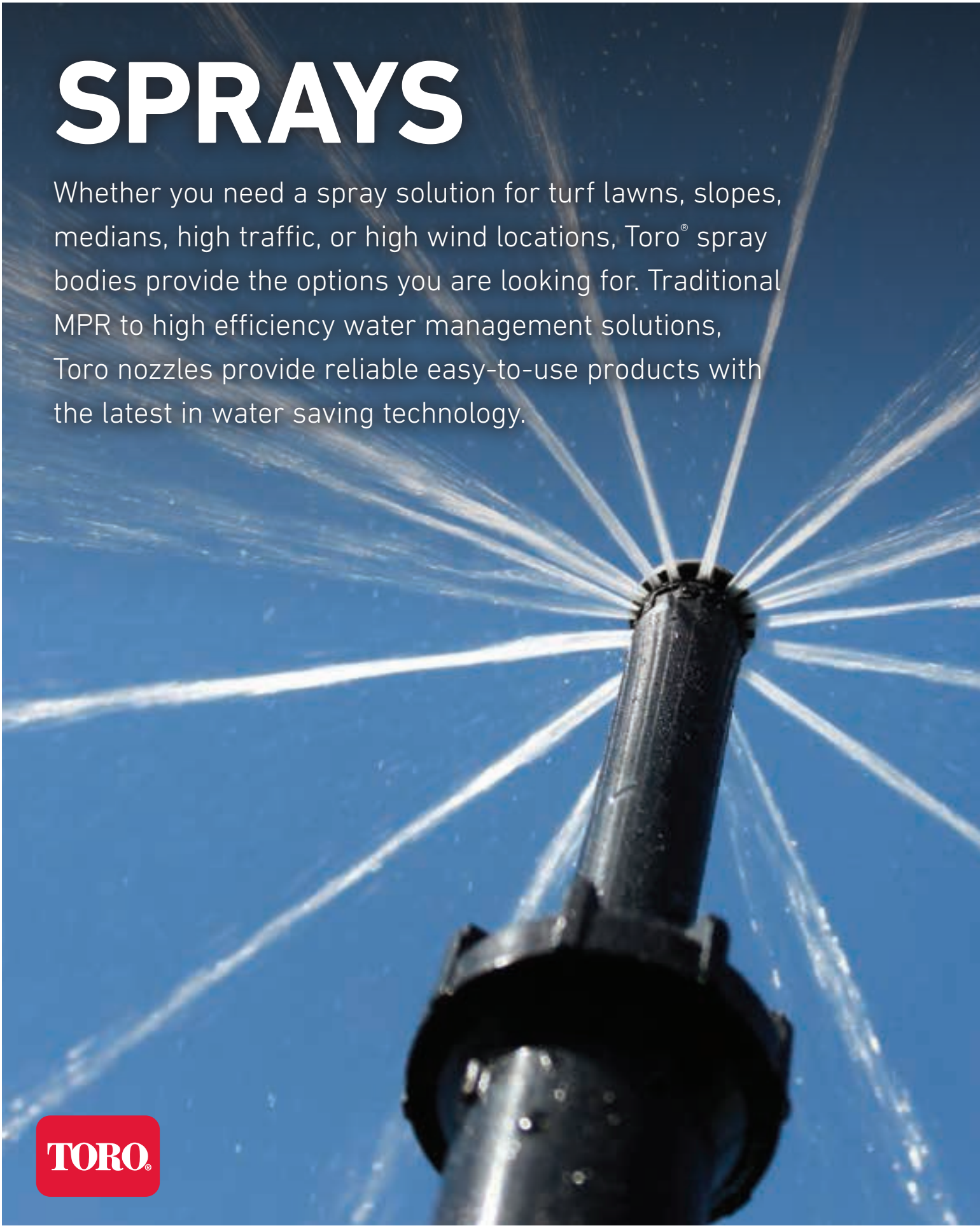
RESOURCES

Pages 186-214

Customer Support	189
Formulas & Conversion Factors	190
Drip Equations	191
Sprinkler Spacing & Winterization	192
Friction Loss Characteristics	192
Pressure Loss Through Water Meters	212
Wire Sizing	213
Toro Limited Warranty for Irrigation Products	214

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.



TORO®

SPRAYS

Pages 10-43

570Z Series	12-15
Precision™ Series Spray Nozzles	16-23
Precision™ Series Rotating Nozzles	24-27
Precision™ Series Rotating Nozzles Shrub & Slope Kit	28-31
MPR Plus Nozzles	32-33
TVAN Variable Arc Nozzles	34-35
Pressure-Compensating Flood Bubblers	36
500 Series Bubblers	36
Stream Spray Nozzles	37
Stream Bubbler Nozzles	37
Precision™ Check Valve	38
Spray Tools & Accessories	39
Super Funny Pipe®	40-41
Super Funny Pipe Swing Joints	42
Super Funny Pipe Fittings	43

RUGGED – FLEXIBLE – VERSATILE – RELIABLE: Toro® 570Z Series spray heads provide a durable solution 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.

570Z SERIES SPRAYS

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 (570CV)

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.

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)

Additional Features

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

Effluent Options Available

Check Valve Options Available

PRODUCT HIGHLIGHT

Enhanced Zero Flush Seal

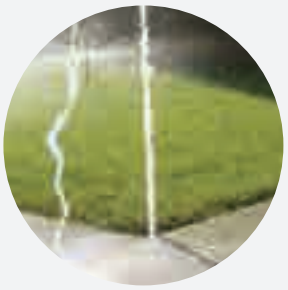
No Water Wasted at System Start

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.

Patented X-Flow® Shut-off Device

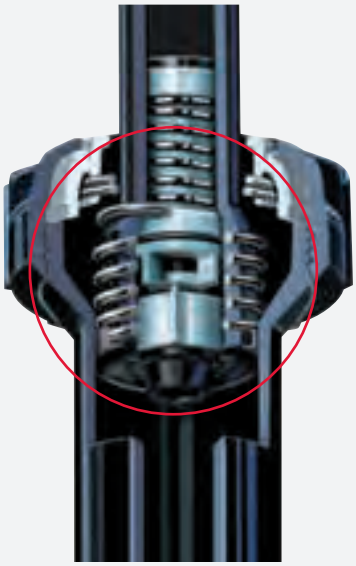
X-Flow® Technology Cuts Off Water Waste

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.



Without X-Flow

With X-Flow



Pressure Regulator

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.

Without Pressure Regulation

With Pressure Regulation

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 psi
- Flow rate: 0.5 – 4.5 gpm models

Dimensions

- Body diameters:
  – 1 3/8" on 2", 3", 4", 6" and 6"
- Side Inlet
  – 1 5/8" on 12"
  – 1 3/4" on 12" Side Inlet
- 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)

Warranty

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

570Z & 570ZLP

570S
Shrub Adapter

570Z-2P 2" Spray Head
570Z-2LP 2" Spray Head, Low Pressure

570Z-3P 3" Spray Head
570Z-3LP 3" Spray Head, Low Pressure

570Z-4P 4" Spray Head
570Z-4LP 4" Spray Head, Low Pressure

570Z-6P 6" Spray Head
570Z-6LP 6" Spray Head, Low Pressure

570Z-6SI 6" Spray Head, Side Inlet body
570Z-6LPSI 6" Spray Head, Low Pressure, Side Inlet body

570Z-12P 12" Spray Head
570Z-12LP 12" Spray Head, Low Pressure

570Z-12SI 12" Spray Head, Side Inlet body
570Z-12LPSI 12" Spray Head, Low Pressure, Side Inlet body

570Z-4P-COM 4" Spray Head with Check Valve

570Z-6P-COM 6" Spray Head with Check Valve

570Z-12P-COM 12" Spray Head with Check Valve

570ZXF

570S-XF
Shrub Adapter with X-Flow

570Z-4P-XF
4" XF Spray Head

570Z-6P-XF
6" XF Spray Head

570Z-6SI-XF
6" XF Spray Head, Side Inlet Body

570Z-12P-XF
12" XF Spray Head

570Z-12SI-XF
12" XF Spray Head, Side Inlet Body

570Z-4P-XFCOM
4" XF Spray Head with Check Valve

570Z-6P-XFCOM
6" XF Spray Head with Check Valve

570Z-12P-XFCOM
12" XF Spray Head with Check Valve

570ZPR

570S-PR
PR Shrub Adapter

570Z-4P-PR
4" PR Spray Head

570Z-6P-PR
6" PR Spray Head

570Z-12P-PR
12" PR Spray Head

570Z-4P-PRCOM
4" PR Spray Head with Check Valve

570Z-6P-PRCOM
6" PR Spray Head with Check Valve

570Z-12P-PRCOM
12" PR Spray Head with Check Valve

Certified by ICC-ES

570ZPRX

570S-PRX
PRX Shrub Adapter

570Z-4P-PRX
4" PRX Spray Head

570Z-6P-PRX
6" PRX Spray Head

570Z-6SI-PRX
6" PRX Spray Head, Side Inlet Body

570Z-12P-PRX
12" PRX Spray Head

570Z-12SI-PRX
12" PRX Spray Head, Side Inlet Body

570Z-4P-PRXCOM
4" PRX Spray Head with Check Valve

570Z-6P-PRXCOM
6" PRX Spray Head with Check Valve

570Z-12P-PRXCOM
12" PRX Spray Head with Check Valve

Certified by ICC-ES

Specifying Information—570Z Series

570X-XXXXX-XXXXXXX

Base Model	*Pop-Up Height*	*Spring and Inlet*	*Optional*	*Optional*	*Optional*
570X	**XX**	**XXX-**	**XXX**	**XXX**	**X**
S — Shrub Z — Lawn Pop-up	2 — 2" 3 — 3" 4 — 4" 6 — 6" 12 — 12"	P — Standard LP — Low Pressure SI — Std. Side Inlet LPSI — Low Pressure SI	XF — X-Flow® Technology PR — Pressure Regulator PRX — Pressure Regulator with XF	COM — Check Valve	E — Effluent

Example: A 570Z PRX Series Sprinkler with a 6" pop-up height, side inlet would be specified as: **570Z-6SI-PRX**

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

Toro® Precision™ Series Spray Nozzles are the most efficient spray nozzles available and feature proprietary H^2O 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).

WATER SMART

TORO®

*Laboratory and third party independent field testing show efficiency to be 15-20% higher than competitive nozzles at 15 feet or less.

PRECISION™ SERIES SPRAY NOZZLES

FEATURES & BENEFITS

Patented H^2O Chip Technology

Each nozzle contains one or more H^2O 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.

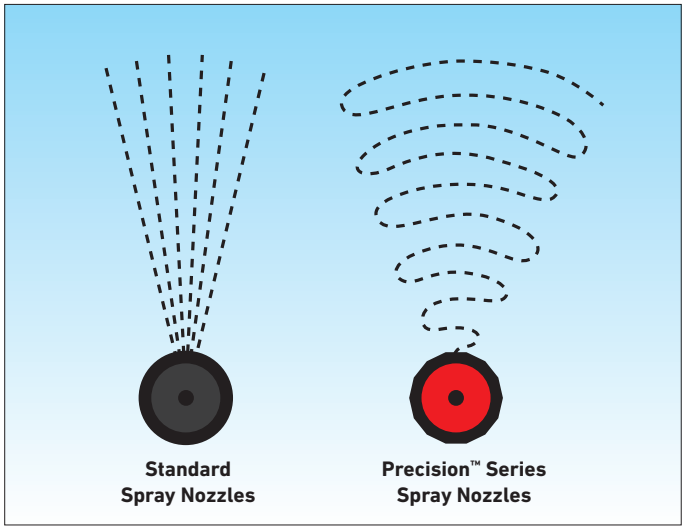
Design and Retrofit Effectiveness

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*



Patented H^2O Chip Technology Delivers Improved Uniformity
Water enters a specially designed chamber within the H^2O Chip where the water expands and collapses, creating an oscillating effect. Consistent-sized water droplets exit the Chip in the designed arc pattern and radius with clean edge definition, class-leading distribution uniformity, and reduced water usage.

Additional Features

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

Male-threaded Model

Female-threaded Model

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.

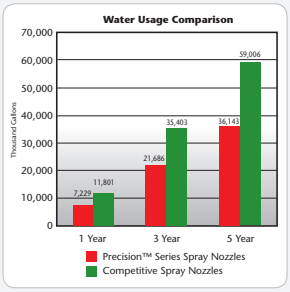
PRODUCT HIGHLIGHT

1" Per Hour Matched Precipitation & One-For-One Retrofit

Perfect when upgrading conventional, higher flow spray nozzles... Look for the "O" stamped on top of the nozzle.

" I was skeptical that putting 30% less water down would keep the turf in good condition. If I reduced my time by 30% with the old nozzles, I'd be growing straw. All I can say just by my observation is that it works. So far it looks great."

Bill Bobbit
Landscape Manager / La Quinta, CA



Higher Overall Irrigation Efficiency From 4-15 Feet

Precision™ Series Spray nozzles perform more like a small rotor. The H^20 Chip enables the nozzles to achieve distances of throw equivalent to those of conventional spray nozzles – but with one-third less flow and higher overall irrigation efficiency.

" I am absolutely thrilled by the installation of the Precision Spray Nozzles. I am getting water where the gardener said I never would. I asked him to completely do my back yard with these nozzles. I live in an area that we can only water three days a week. But every inch of my backyard now gets watered. And even though it's been hotter than blue blazes, my lawn is greening up."

Barbara Brown
Homeowner / San Diego, CA

Water Use Reduction While Minimizing Run-Off & Water Waste

Precision™ Series Spray Nozzles have proven to save water in the field while reducing unnecessary overspray, wasteful run-off and evaporation.

" I've been doing this 27 years and I can tell there is a savings of at least 20-25% of water. The droplets are good, I'm real impressed, so impressed, we want to retrofit other heads with all Toro Precision Spray Nozzles. We're always looking for anything that saves water. I'm sold on these."

Louie Raygoza
Sr. Crew Leader/Maintenance / Specialist (Irrigation), City of Santa Maria

---

Nozzle Selection Second To None

Available in male and female threaded models with a radius between 5' and 15' and the nozzle tops are color-coded to indicate the specific radius. Available in models with 9 different arcs between 60° and 360°, and specialty arcs such as right and left corners and center strips. All Precision™ nozzles can be used with operating pressures of between 20 and 50 psi.

" The Precision Series Spray Nozzle is sort of like the Compact Fluorescent Light (CFL) bulb of water savings. You just remove the old style nozzle, screw on a Precision Spray Nozzle, and save 25-30% more water instantly."

Bryan McDonald
Vice-President / Whitmore Landscape Management / Plano, TX

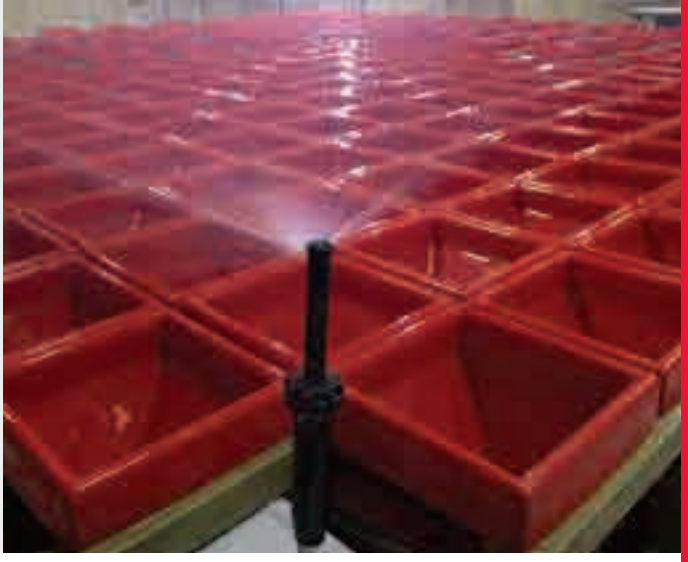
SPECIFICATIONS

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



Laboratory and third party independent field testing show efficiency to be 15-20% higher than competitive nozzles at 15 feet or less.

PRECISION™ SERIES SPRAY NOZZLE MODEL LIST

5' NOZZLE (RED)			8' NOZZLE (GREEN)		
Male	Female	Pattern	Male	Female	Pattern
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	Male	Female	
O-T-15-Q	O-15-Q	90° Arc	O-T-4X9-RCS	O-4X9-RCS	Right Corner
O-T-15-T	O-15-T	120° Arc	O-T-4X9-LCS	O-4X9-LCS	Left Corner
O-T-15-150	O-15-150	150° Arc	O-T-4X18-SST	O-4X18-SST	Side Strip
O-T-15-H	O-15-H	180° Arc	O-T-4X15-RCS	O-4X15-RCS	Right Corner
O-T-15-210	O-15-210	210° Arc	O-T-4X15-LCS	O-4X15-LCS	Left Corner
O-T-15-TT	O-15-TT	240° Arc	O-T-4X30-SST	O-4X30-SST	Side Strip
O-T-15-TQ	O-15-TQ	270° Arc			
O-T-15-F	O-15-F	360° Arc			

PRESSURE-COMPENSATING PRECISION™ SERIES SPRAY NOZZLE MODEL LIST

5' NOZZLE (RED)			8' NOZZLE (GREEN)		
Male	Female	Pattern	Male	Female	Pattern
O-T-5-60P	O-5-60P	60° Arc	O-T-8-60P	O-8-60P	60° Arc
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-5-150P	O-5-150P	150° Arc	O-T-8-150P	O-8-150P	150° Arc
O-T-5-HP	O-5-HP	18° Arc	O-T-8-HP	O-8-HP	18° Arc
O-T-5-210P	O-5-210P	210° Arc	O-T-8-210P	O-8-210P	210° 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-10-60P	O-10-60P	60° Arc	O-T-12-60P	O-12-60P	60° Arc
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-10-150P	O-10-150P	150° Arc	O-T-12-150P	O-12-150P	150° Arc
O-T-10-HP	O-10-HP	18° Arc	O-T-12-HP	O-12-HP	18° Arc
O-T-10-210P	O-10-210P	210° Arc	O-T-12-210P	O-12-210P	210° 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-TQP	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-15-60P	O-15-60P	60° Arc	Male	Female	
O-T-15-QP	O-15-QP	90° Arc	O-T-4X9-RCSP	O-4X9-RCSP	Right Corner
O-T-15-TP	O-15-TP	120° Arc	O-T-4X9-LCSP	O-4X9-LCSP	Left Corner
O-T-15-150P	O-15-150P	150° Arc	O-T-4X18-SSTP	O-4X18-SSTP	Side Strip
O-T-15-HP	O-15-HP	18° Arc	O-T-4X15-RCSP	O-4X15-RCSP	Right Corner
O-T-15-210P	O-15-210P	210° Arc	O-T-4X15-LCSP	O-4X15-LCSP	Left Corner
O-T-15-TTP	O-15-TTP	240° Arc	O-T-4X30-SSTP	O-4X30-SSTP	Side Strip
O-T-15-TQP	O-15-TQP	270° Arc			
O-T-15-FP	O-15-FP	360° Arc			

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 spcified as O-T-10-HP

**Not available with Pressure Compensation.*

PRECISION™ SERIES SPRAY NOZZLES

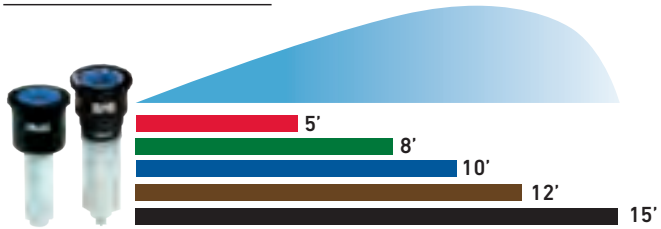
PERFORMANCE DATA PRESSURE COMPENSATING – PRECISION™ SERIES SPRAY NOZZLES

Arc	model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
60°	5-60P	40	0.07	6.0	1.2	1.4
		50	0.07	5.5	1.3	1.5
		60	0.07	6.0	1.0	1.2
		70	0.08	6.5	1.0	1.2
90°	5-QP	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
120°	5-TP	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
150°	5-150P	40	0.14	6.0	0.9	1.0
		50	0.14	6.0	0.9	1.0
		60	0.14	6.0	0.9	1.0
		70	0.14	6.0	0.9	1.0
180°	5-HP	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
210°	5-210P	40	0.16	5.0	1.1	1.2
		50	0.18	5.5	1.0	1.1
		60	0.20	6.0	0.9	1.1
		70	0.21	6.0	1.0	1.1
240°	5-TTP	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
270°	5-TQP	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
360°	5-FP	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

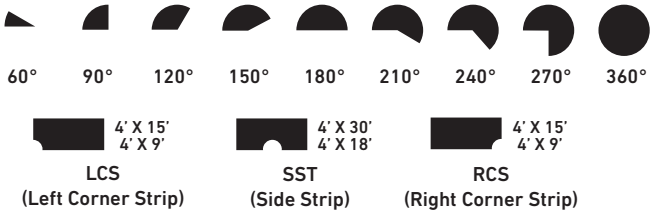
model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
8-60P	40	0.11	7.5	1.1	1.3
	50	0.11	7.5	1.2	1.3
	60	0.12	7.5	1.3	1.4
	70	0.14	8.0	1.2	1.4
8-QP	40	0.14	7.0	1.1	1.3
	50	0.17	7.7	1.2	1.3
	60	0.20	8.4	1.2	1.4
	70	0.23	9.1	1.3	1.4
8-TP	40	0.20	7.6	1.0	1.2
	50	0.24	8.0	1.1	1.3
	60	0.27	8.5	1.2	1.4
	70	0.31	8.9	1.3	1.5
8-150P	40	0.32	8.0	1.1	1.3
	50	0.32	8.5	1.0	1.2
	60	0.32	8.0	1.1	1.3
	70	0.32	8.0	1.1	1.3
8-HP	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	1.5
8-210P	40	0.34	8.0	0.9	1.0
	50	0.38	8.0	1.0	1.1
	60	0.42	8.0	1.1	1.3
	70	0.45	8.0	1.2	1.3
8-TTP	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
8-TQP	40	0.41	7.2	1.0	1.1
	50	0.48	7.9	1.1	1.2
	60	0.55	8.6	1.2	1.4
	70	0.62	9.3	1.3	1.5
8-FP	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

model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
10-60P	40	0.16	9.5	1.0	1.2
	50	0.18	10.5	1.0	1.1
	60	0.20	11.0	1.0	1.1
	70	0.22	11.0	1.1	1.2
10-QP	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
10-TP	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
10-150P	40	0.47	9.5	1.2	1.4
	50	0.49	10.0	1.1	1.3
	60	0.51	10.0	1.2	1.4
	70	0.53	10.5	1.1	1.3
10-HP	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
10-210P	40	0.57	9.5	1.1	1.2
	50	0.64	10.0	1.1	1.2
	60	0.70	10.0	1.2	1.3
	70	0.75	10.0	1.2	1.4
10-TTP	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
10-TQP	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
10-FP	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



PERFORMANCE DATA PRESSURE COMPENSATING – PRECISION™ SERIES SPRAY NOZZLES

Arc	model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
60°	12-60P	40	0.30	13.0	1.0	1.2
		50	0.30	13.0	1.0	1.2
		60	0.30	13.0	1.0	1.2
		70	0.30	13.0	1.0	1.2
90°	12-QP	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
120°	12-TP	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
150°	12-150P	40	0.59	12.0	1.0	1.1
		50	0.66	11.5	1.2	1.3
		60	0.72	12.0	1.2	1.3
		70	0.78	12.0	1.3	1.5
180°	12-HP	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
210°	12-210P	40	0.86	11.0	1.2	1.4
		50	0.96	11.5	1.2	1.4
		60	1.05	12.0	1.2	1.4
		70	1.13	12.0	1.3	1.5
240°	12-TTP	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
270°	12-TQP	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
360°	12-FP	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

model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
15-60P	40	0.36	14.0	1.1	1.2
	50	0.41	15.0	1.0	1.2
	60	0.45	15.0	1.1	1.3
	70	0.48	15.0	1.2	1.4
15-QP	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
15-TP	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
15-150P	40	0.93	14.0	1.1	1.3
	50	1.04	14.5	1.2	1.3
	60	1.14	14.5	1.3	1.5
	70	1.23	14.5	1.4	1.6
15-HP	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
15-210P	40	1.23	14.0	1.0	1.2
	50	1.44	14.0	1.2	1.4
	60	1.56	14.0	1.3	1.5
	70	1.70	15.0	1.2	1.4
15-TTP	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
15-TQP	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
15-FP	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.)
4X30 SSTP	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
4X15 LCSP	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
4X15 RCSP	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
4X18 SSTP	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
4X9 LCSP	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
4X9 RCSP	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

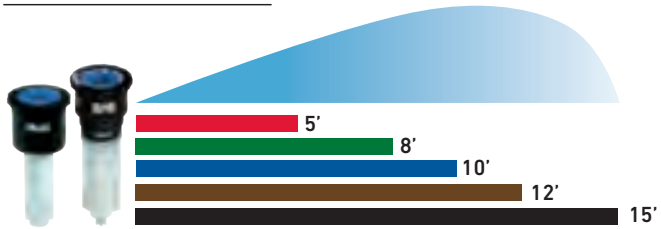
PERFORMANCE DATA – PRECISION™ SERIES SPRAY NOZZLES

Arc	model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
60°	5-60	20	0.04	4.7	1.0	1.2
		30	0.04	5.0	1.0	1.2
		40	0.04	5.0	1.0	1.2
		50	0.05	5.3	1.0	1.1
90°	5-Q	20	0.06	4.6	1.0	1.2
		30	0.06	5.0	1.0	1.1
		40	0.07	5.0	1.0	1.2
		50	0.07	5.0	1.0	1.2
120°	5-T	20	0.07	4.4	1.0	1.2
		30	0.09	5.0	1.0	1.2
		40	0.09	5.2	1.0	1.2
		50	0.10	5.4	1.0	1.1
150°	5-150	20	0.07	4.0	1.0	1.2
		30	0.11	5.0	1.0	1.2
		40	0.12	5.2	1.0	1.2
		50	0.13	5.4	1.0	1.2
180°	5-H	20	0.10	4.4	1.0	1.2
		30	0.13	5.0	1.0	1.2
		40	0.14	5.1	1.0	1.2
		50	0.14	5.2	1.0	1.1
210°	5-210	20	0.10	4.4	1.0	1.2
		30	0.15	5.2	1.1	1.2
		40	0.16	5.3	1.1	1.3
		50	0.17	5.5	1.1	1.3
240°	5-TT	20	0.14	4.3	1.1	1.3
		30	0.17	5.0	1.0	1.1
		40	0.19	5.0	1.1	1.2
		50	0.19	5.0	1.1	1.3
270°	5-TQ	20	0.15	4.3	1.0	1.2
		30	0.20	5.0	1.0	1.2
		40	0.21	5.0	1.1	1.2
		50	0.22	5.0	1.1	1.3
360°	5-F	20	0.17	4.0	1.0	1.2
		30	0.26	5.0	1.0	1.2
		40	0.26	5.0	1.0	1.2
		50	0.26	5.0	1.0	1.2

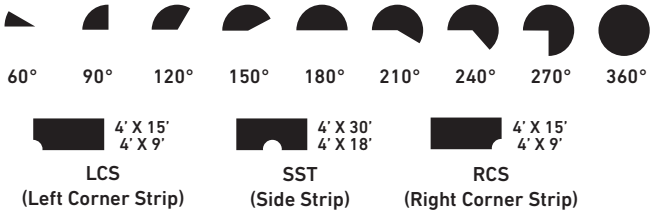
model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
8-60	20	0.10	7.6	1.0	1.2
	30	0.11	8.0	1.0	1.1
	40	0.12	8.1	1.1	1.2
	50	0.13	8.3	1.1	1.3
8-Q	20	0.14	7.0	1.1	1.3
	30	0.17	8.0	1.0	1.1
	40	0.18	8.2	1.0	1.2
	50	0.18	8.4	1.0	1.1
8-T	20	0.20	7.6	1.0	1.2
	30	0.22	8.0	1.0	1.1
	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
8-H	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
8-TT	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
8-TQ	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
8-F	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

model # (0-XX-XX)	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
10-Q	20	0.26	9.5	1.0	1.1
	30	0.23	10.0	1.0	1.2
	40	0.28	1.2	1.0	1.2
	50	0.28	1.3	1.0	1.2
10-T	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
10-H	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
10-TT	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
10-TQ	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
10-F	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

Five Radii Available in Toro (Male) & Female Threads



Nine Arcs, Plus Side and Center Strips Available



PERFORMANCE DATA – PRECISION™ SERIES SPRAY NOZZLES

Arc	model # (0-XX-XX)	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
60°	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
90°	12-Q	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
120°	12-T	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
150°	12-150	20	0.60	11.6	1.0	1.2
		30	0.62	12.0	1.0	1.1
		40	0.63	12.2	1.0	1.1
		50	0.64	12.3	1.0	1.1
180°	12-H	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
210°	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
240°	12-TT	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
270°	12-TQ	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
360°	12-F	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

model # (0-XX-XX)	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
15-Q	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
15-T	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
15-H	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
15-TT	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
15-TQ	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
15-F	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	1.2
	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	1.2
	30	0.19	4x9	1.0	1.2
	40	0.2	4x9	1.1	1.2
	50	0.2	4x9	1.1	1.1
4X9 RCS	20	0.18	4x9	1.0	1.2
	30	0.19	4x9	1.0	1.2
	40	0.2	4x9	1.1	1.2
	50	0.2	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.

PRECISION™ SERIES ROTATING NOZZLES

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.

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.

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

Female-threaded
PRN-A

Male-threaded
PRN-TA

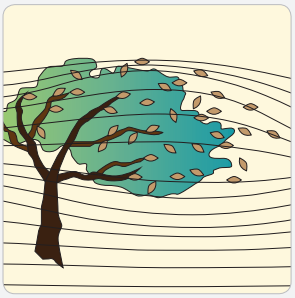
ADJUSTABLE

Female-threaded
PRN-F

Male-threaded
PRN-TF

FULL CIRCLE

PRODUCT HIGHLIGHT



Stronger, Low Trajectory Streams for Superior Performance in Wind

Precision™ Series Rotating Nozzle's streams have trajectories under 20°, making them more resistant to wind and drift than those of competing rotating nozzles. Lower trajectory streams provide great wind resistance, especially on 12" and 6" pop-ups resulting in significantly less overspray and misting.

Only Two Models Needed:

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

Shorter Watering Times (Up to 40%) with PRN

Precision™ Spray Nozzles average 0.6 inches per hour precipitation rate (square spacing) allowing shorter watering times. With the PSN's exceptional uniformity, close-in watering characteristics and phenomenal edge control it is the ideal nozzle for any water efficient application challenge.

Step-Up™ Technology

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.

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.

SPECIFICATIONS

Operational

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

Warranty

- Two years

PRECISION™ SERIES ROTATING NOZZLES PERFORMANCE DATA

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
	75	0.92	25.0	0.57	0.65
120°	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
	60	1.07	23.5	0.56	0.65
	75	1.18	25.0	0.55	0.63
180°	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
	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
240°	20	1.12	15.0	0.72	0.83
	30	1.27	17.0	0.63	0.73
	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
270°	20	1.08	14.0	0.71	0.81
	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
360°	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	
PRN-A	14-26 feet, Adjustable from 45°-270°
PRN-F	14-26 feet, Full circle
Shrub & Slope Kit - See page 28	
PRNTA-S-PCV	Adjustable PRN Shrub & Slope Kit, 45°-270°
PRNTF-S-PCV	Full Circle PRN Shrub & Slope Kit, 360°
PRNTA-SE-PCV	Adjustable PRN Shrub & Slope Kit, Effluent, 45°-270°
PRNTF-SE-PCV	Full Circle PRN Shrub & Slope Kit, Effluent, 360°

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.*

The new Toro® Precision™ Series Rotating Nozzle Shrub & Slope Kit is the ideal tool for delivering efficient irrigation in above-ground settings, such as slopes, shrub beds, and grow nurseries. Pre-assembled out of the box, the kit features a highly-efficient Precision™ Rotating Nozzle, 570ZSXF Shrub Riser, and 15' Precision™ Check Valve. The kit has a universal ½" NPT female inlet, making it a go-to solution for both new installs and retrofit projects.
WATER SMART
TORO®

PRECISION™ SERIES ROTATING NOZZLES SHRUB & SLOPE KIT

FEATURES & BENEFITS

Efficient and Effective

The fully-assembled PRN Shrub & Slope Kit features a Precision™ Series Rotating Nozzle, which delivers a matched precipitation rate of 0.6" per hour; a 570ZSXF Shrub Riser with integrated water-saving X-Flow® Technology; and a Precision™ Check Valve that provides up to 15 feet of check height.

Water-Saving Features

The patented X-Flow® Technology built into the Shrub Riser prevents water waste by virtually eliminating the flow of water through the riser in the event the nozzle is removed. The spring-actuated Precision™ Check Valve provides an immediate check at system shut-off and eliminates low head drainage – a critical need in slope settings.

Flexibility of Design

Available with an Adjustable Arc nozzle that allows arc adjustments from 45° to 270°, or a 360° Full Circle nozzle, the PRN Shrub & Slope Kit is capable of meeting the details of any layout.

Additional Features

- Maximum stream trajectory of 20° to help fight wind and minimize drift
- Radius reduction of up to 25% by turning set screw at top of nozzle
- Integrated X-Flow® Technology
- Pre-assembled for ease of installation
- Effluent option available

Effluent Options Available

Toro Precision™ Series Rotating Nozzle (Full or Adjustable Arc)

Toro 570SXF Shrub Riser (Patented X-Flow Technology)

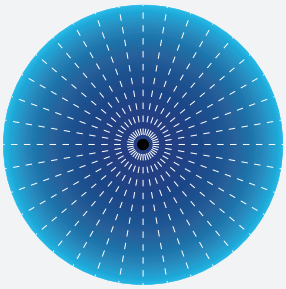
Toro Precision™ Check Valve (Eliminates Low Head Drainage)

PRODUCT HIGHLIGHT

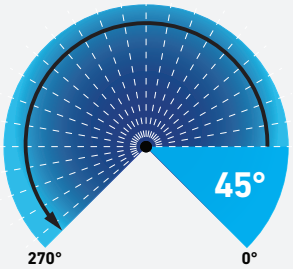
Toro Precision™ Series Rotating Nozzle

Full or Adjustable Arc

Pre-installed adjustable or full circle Precision™ Series Rotating Nozzle delivers multiple wind-resistant, low trajectory streams at a matched precipitation rate of 0.6 inches per hour.



Full-Circle



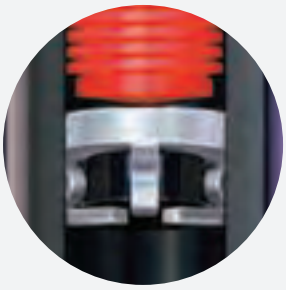
Adjustable Arc

Wind-resistant

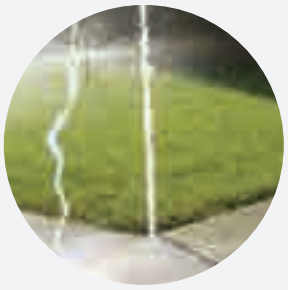
Toro 570SXF Shrub Riser

Patented X-Flow Technology

Shrub riser with patented X-Flow® Technology prevents water waste by eliminating 99.9% of the flow through the riser in the event the nozzle is removed. Ideal protection against vandalism and theft, or for maintenance convenience. (Flush laterial line before installing)



X-Flow® Technology



Without X-Flow

With X-Flow

Toro Precision™ Check Valve

Eliminates Low Head Drainage

With a hold-back strength of up to fifteen (15) feet, the Precision™ Check Valve is spring-activated and provides an immediate check at system shut-off, making it ideally suited for slope settings. ½" FxM NPT Thread.

SPECIFICATIONS

Operational

- Radius: 14-26 feet (max radius at 75 psi operating pressure)
- Operating pressure range: 40-75 psi (Use of the Precision™ Check Valve is not recommended on systems with an operating pressure of less than 40 psi.)
- Recommended operating pressure: 45 psi
- ½" NPT Female inlet
- Check height: up to 15 feet

Warranty

- Two years

PRN SHRUB & SLOPE KIT MODEL LIST

Model	Description
PRNTA-S-PCV	Adjustable Arc kit with X-Flow® and 15' Check Valve
PRNTF-S-PCV	Full Circle kit with X-Flow® and 15' Check Valve
PRNTA-SE-PCV	Adjustable PRN Shrub & Slope Kit, Effluent, 45°-270°
PRNTF-SE-PCV	Full Circle PRN Shrub & Slope Kit, Effluent, 360°

(Designate 'SE' in model number for effluent option)

PRECISION™ SERIES ROTATING NOZZLES PERFORMANCE DATA (ADJUSTABLE) 45° - 270°

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
90°	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
180°	40	1.22	20.5	0.56	0.65
	50	1.46	22.5	0.56	0.64
	60	1.61	24.0	0.54	0.62
270°	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

PRECISION™ SERIES ROTATING NOZZLES PERFORMANCE DATA (FULL)

Arc	psi	gpm	Radius	Precip. Rate ■ (in./hr.)	Precip. Rate ▲ (in./hr.)
360°	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

Nozzle data subject to change.

Specifying Information—PRN Shrub & Slope Kit

PRNTX-SX-PCV				
Model	*Arc*	*Riser*	*Type*	*PCV*
PRN	**X**	**S**	**X**	**PCV**
PRNT - Precision™ Rotating Nozzle (Toro male thread)	A - Adjustable F - Full Circle"	S - 570ZSXF Shrub Riser	Blank - Standard E - Effluent (lavender body)	PCV - 15' Precision™ Check Valve
Example: A Shrub & Slope Kit with an adjustable arc pattern and lavender-colored Riser would be specified as: **PRNA-SE-PCV**				

MPR PLUS SPRAY NOZZLES

5' MPR Plus Nozzle

8' MPR Plus Nozzle

8' Flat Spray

10' MPR Plus Nozzle

12' MPR Plus Nozzle

Special Patterns

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.

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

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'		
4SSST	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	Radius	Prec. Rate ▲	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
		40-75	0.10	5	1.79	1.55
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
		40-75	0.13	5	1.79	1.55
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
		40-75	0.20	5	1.79	1.55
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
		40-75	0.27	5	1.81	1.57
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
		40-75	0.29	5	1.73	1.50
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	Radius	Prec. Rate ▲	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
		40-75	0.25	8	1.75	1.51
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
		40-75	0.35	8	1.84	1.59
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
		40-75	0.50	8	1.75	1.51
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
		40-75	0.70	8	1.84	1.59
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
		40-75	0.70	8	1.63	1.41
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	Radius	Prec. Rate ▲	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
		40-75	0.37	10	1.66	1.43
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
		40-75	0.50	10	1.68	1.45
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
		40-75	0.75	10	1.68	1.45
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
		40-75	1.00	10	1.68	1.45
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
		40-75	1.09	10	1.63	1.41
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	Radius	Prec. Rate ▲	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
		40-75	0.53	12	1.65	1.43
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
		40-75	0.70	12	1.63	1.41
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
		40-75	1.05	12	1.63	1.41
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
		40-75	1.40	12	1.63	1.41
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
		40-75	1.60	12	1.66	1.44
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 ▲	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
		40-75	0.81	15	1.61	1.40
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
		40-75	1.10	15	1.64	1.42
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
		40-75	1.65	15	1.64	1.42
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
		40-75	2.20	15	1.64	1.42
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
		40-75	2.50	15	1.66	1.44
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 Patterns Width		Special 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
		40-75	0.50	4'	x	15'	1.61
	4-CST	20	0.75	3'	x	24'	2.01
		30	0.90	4'	x	30'	1.44
		40	1.04	4'	x	30'	1.67
		50	1.16	4'	x	31'	1.80
	4-CST-PC	30-40	0.86	4'	x	30'	1.38
		40-75	1.00	4'	x	30'	1.61
	9-SST	20	1.00	9'	x	18'	1.19
		30	1.20	9'	x	18'	1.43
		40	1.38	9'	x	20'	1.48
		50	1.55	10'	x	22'	1.36
	9-SST-PC	30-40	1.10	9'	x	18'	1.31
		40-75	1.20	9'	x	18'	1.43
	4-SST	20	0.65	4'	x	24'	1.30
		30	0.90	4'	x	30'	1.44
		40	1.04	4'	x	32'	1.56
		50	1.16	5'	x	33'	1.35
	4-SST-PC	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'	1.54
		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
		40-75	0.10	2'	x	6'	1.61
	4S-SST	20	0.46	4'	x	17'	1.30
		30	0.55	4'	x	18'	1.47
		40	0.63	4'	x	19'	1.60
		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

TVAN VARIABLE ARC NOZZLES

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

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

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.

8' Variable Arc Nozzle

10' Variable Arc Nozzle

12' Variable Arc Nozzle

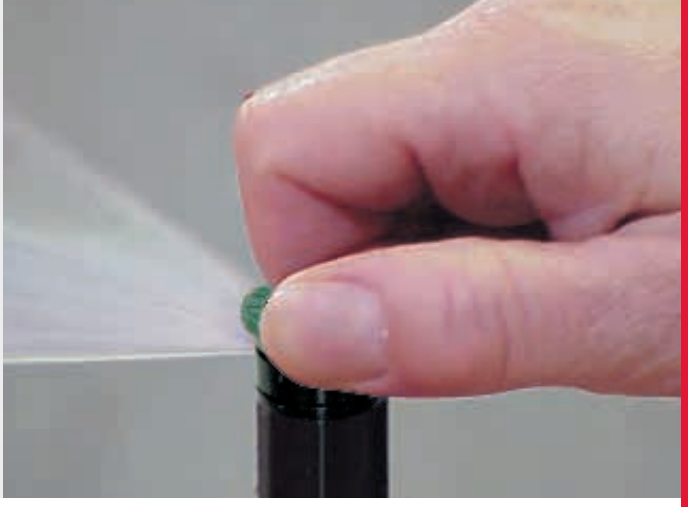
15' Variable Arc Nozzle

17' Variable Arc Nozzle

SPECIFICATIONS

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

Warranty
- Two years



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

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

TVAN VARIABLE ARC NOZZLE PERFORMANCE DATA

Pattern	psi	8' Series (Green)				10' Series (Blue)				12' Series (Brown)				15' Series (Black)				17' Series (Gray)			
		gpm	Radi	Precip. Rate ▲	Precip. Rate ■	gpm	Radi	Precip. Rate ▲	Precip. Rate ■	gpm	Radi	Precip. Rate ▲	Precip. Rate ■	gpm	Radi	Precip. Rate ▲	Precip. Rate ■	gpm	Radi	Precip. Rate ▲	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°.

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**

PRESSURE-COMPENSATING FLOOD BUBBLERS

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	0.25 gpm
FB-50-PC	0.50 gpm
FB-100-PC	1.00 gpm
FB-200-ADJ-PC2.00	Adjustable gpm

500 SERIES BUBBLERS

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

STREAM SPRAY NOZZLES

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* ▲	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
	10-SSQ-PC	40-50	0.70	13	1.84	1.60
		60-70	0.70	15	1.38	1.20
180°	10-SSH	20	1.00	14	1.13	.98
		30	1.20	16	1.04	.90
		40	1.38	17	1.06	.92
		50	1.55	18	1.06	.92
	10-SSH-PC	40-50	1.40	13	1.84	1.60
		60-70	1.40	15	1.38	1.20
360°	10-SSF	20	1.80	14	1.02	.88
		30	2.10	16	.91	.79
		40	2.42	17	.93	.81
		50	2.70	18	.93	.80
	10-SSF-PC	40-50	1.80	13	1.18	1.03
		60-70	2.00	15	.99	.86

PERFORMANCE DATA 35° STREAM SPRAY

Pattern	Desc.	psi	gpm	Radius	Prec. Rate* ▲	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
	35-SSQ-PC	40-50	0.70	17	1.08	.93
		60-70	0.70	18	.96	.83
180°	35-SSH	20	1.00	18	.69	.59
		30	1.20	20	.67	.58
		40	1.38	21	.70	.60
		50	1.55	22	.71	.62
	35-SSH-PC	40-50	1.40	17	1.08	.93
		60-70	1.40	18	.96	.83
360°	35-SSF	20	1.80	18	.62	.54
		30	2.10	20	.58	.51
		40	2.42	21	.61	.53
		50	2.70	22	.62	.54
	35-SSF-PC	40-50	1.80	17	.69	.60
		60-70	2.00	18	.69	.59

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

STREAM BUBBLER NOZZLES

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 gpm	10 psi Rad	20 psi gpm	20 psi Rad	30 psi gpm	30 psi Rad	40 psi gpm	40 psi Rad	50 psi gpm	50 psi Rad	60 psi gpm	60 psi 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,

PRECISION™ CHECK VALVE

Low head drainage can be seen in an elevation change of fewer than six inches. The resulting runoff and water waste can lead to landscape erosion, unsafe conditions on hardscapes and sidewalks, and pooling around spray heads. The Toro Precision™ Check Valve saves water and eliminates runoff by immediately sealing the spray head at its connection point at the end of the irrigation cycle, thereby preventing the draining of lateral lines through the lowest-lying heads.

FEATURES & BENEFITS

Hold Back Strength of Up to 15 Feet

Capable of compensating for elevation changes in a zone of up to 15 feet, the Precision™ Check Valve (PCV) eliminates issues with low head drainage and the resulting water waste.

Spring-Actuated Design

Spring actuation ensures an immediate check when the irrigation cycle ends.

Low Profile

With an overall profile of just under 1 1/4" cubic inches, the PCV-500 adds less than 3/8" of height to retrofitted spray heads and can be retrofit to side inlet spray heads with minimal digging. The low profile design makes the PCV-500 ideal for turf or slope applications.

A Universal Fit

Featuring 1/2" NPT threads, the PCV fits all major manufacturers' spray bodies and fittings.

PRECISION™ CHECK VALVE MODEL LIST

Model	Description
PCV-500	15' Check Valve, 1/2" NPT

PCV-500 PRESSURE LOSS DATA

Flow Rate (gpm)	1	2	3	4	5
Pressure Loss (psi)	5.1	6.0	6.5	7.0	10.2

Note: *Use of the PCV-500 is not recommended for irrigation systems with dynamic operating pressure of less than 35 psi.*

Specifying Information—Precision™ Check Valve

PCV-XXX	
Model	*Thread Size*
PCV	**XXX**
PCV—Precision™ Check Valve	500—1/2" NPT, MxF

SPRAY TOOLS & ACCESSORIES

EFFLUENT WATER INDICATORS

570S
(Nozzle not included)
- 570 Series shrub adapter
- Installs onto a 1/2" NPT riser

570S-E
(Nozzle not included)
- Lavender molded 570S Series shrub adapter
- Installs onto a 1/2" NPT riser

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

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
- 10' hold back

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
- ½" 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

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

PNOZZTOOL
- Riser pull up tool
- Fits all 570Z Sprays

PIPING

This unique piping acts like an extension cord, allowing you to put sprinklers exactly where you want them. Even deep-seated high-pops are easy to install in difficult, hard-to-trench locations.

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.

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

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 Flow							
gpm	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

SUPER FUNNY PIPE® SWING JOINTS

SPFA-5125

SPFA-585

SPFA-51275

SPFA-5875

SPECIFICATIONS

Warranty

- Two years

SUPER FUNNY PIPE SWING JOINTS MODEL LIST

Model	Description
SPFA-585	8" x ½"
SPFA-5875	8" x ¾"
SPFA-5125	12" x ½"
SPFA-51275	12" x ¾"

SUPER FUNNY PIPE® FITTINGS

850-20

850-34

850-31

850-35

850-32

850-36

850-33

850-37

SUPER FUNNY PIPE FITTINGS FRICTION LOSS DATA

Model No.	Description	gpm Flow						
		1	2	3	4	5	6	7
850-36	¾" Male Adapter	0.04	0.10	0.23	0.43	0.80	1.37	1.86
850-35	½" Male Adapter	0.03	0.06	0.18	0.31	0.60	1.00	1.41
850-31	½" Male Elbow	0.05	0.15	0.36	0.62	1.13	1.62	2.37
850-34	½" Female Elbow	0.05	0.15	0.36	0.62	1.13	1.62	2.37
850-32	¾" 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, ½"
850-32	Male Elbow, ¾"
850-33	Female Adapter, ½" – ¾"
850-34	Female Elbow, ½"
850-35	Male Adapter, ½"
850-36	Male Coupling, ¾"
850-37	Tee, Barbed Inserts
850-60	Saddle Tee, ¾"
850-61	Saddle Tee, 1"

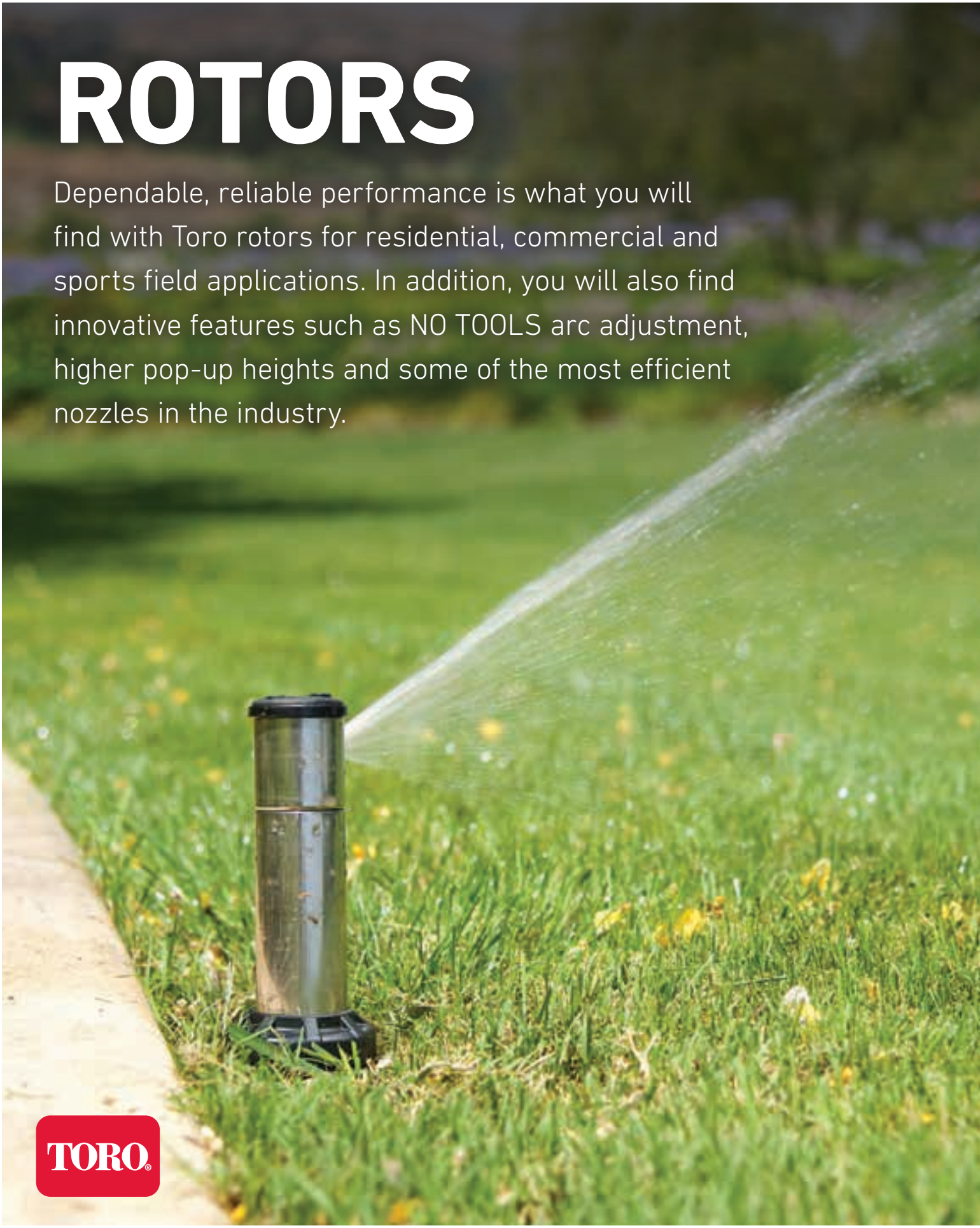
SPECIFICATIONS

Warranty

- Two years

ROTORS

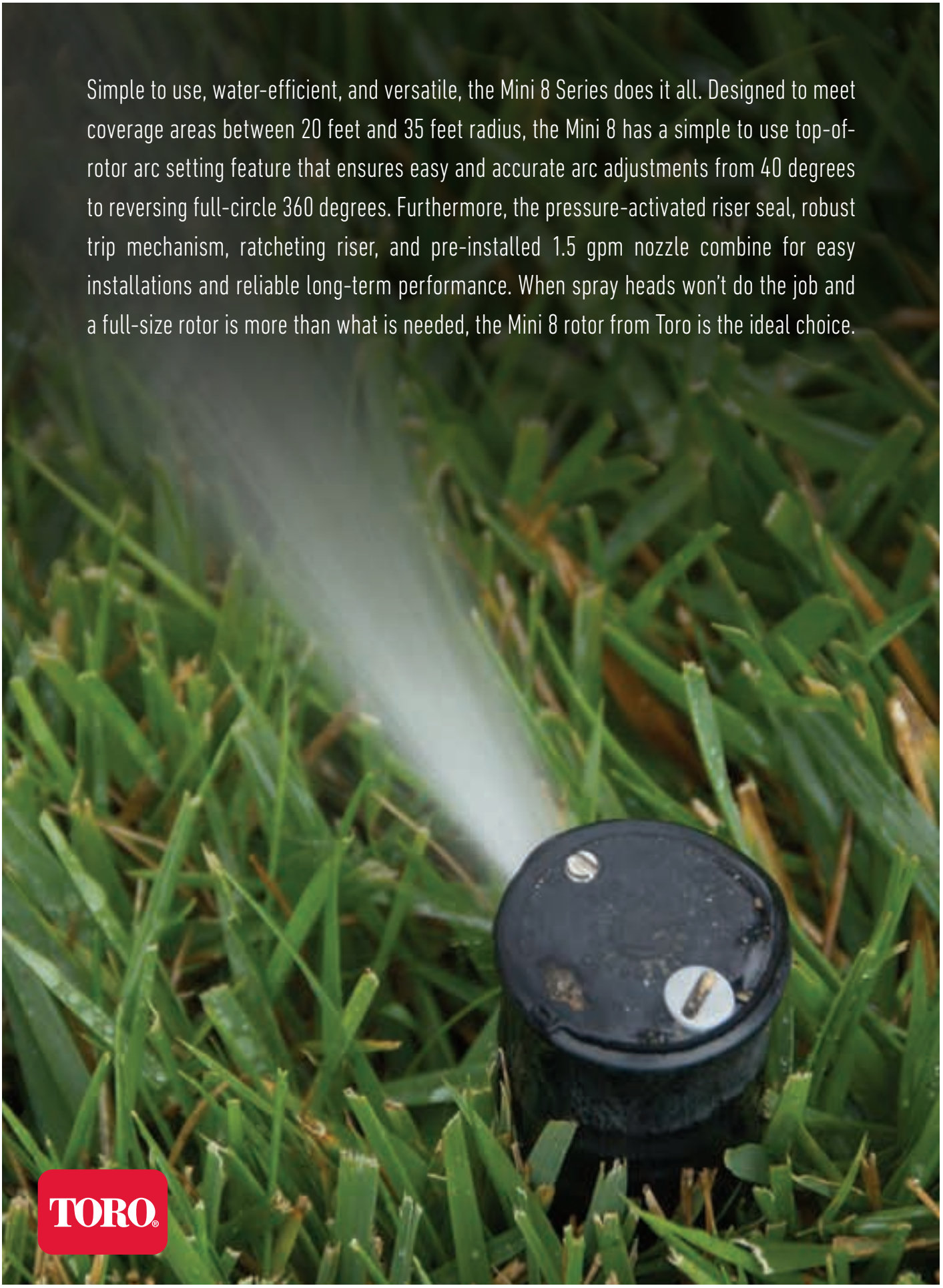
Dependable, reliable performance is what you will find with Toro rotors for residential, commercial and sports field applications. In addition, you will also find innovative features such as NO TOOLS arc adjustment, higher pop-up heights and some of the most efficient nozzles in the industry.



ROTORS

Pages 44-57

Mini 8 Series	46-49
300 Series Stream Rotor®	50-53
T5 RapidSet® Series	54-57



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 radius, the Mini 8 has a simple to use top-of-rotor arc setting feature that ensures easy and accurate arc adjustments from 40 degrees to reversing 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.

MINI 8 SERIES ROTORS

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 (40° to 360°).

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.

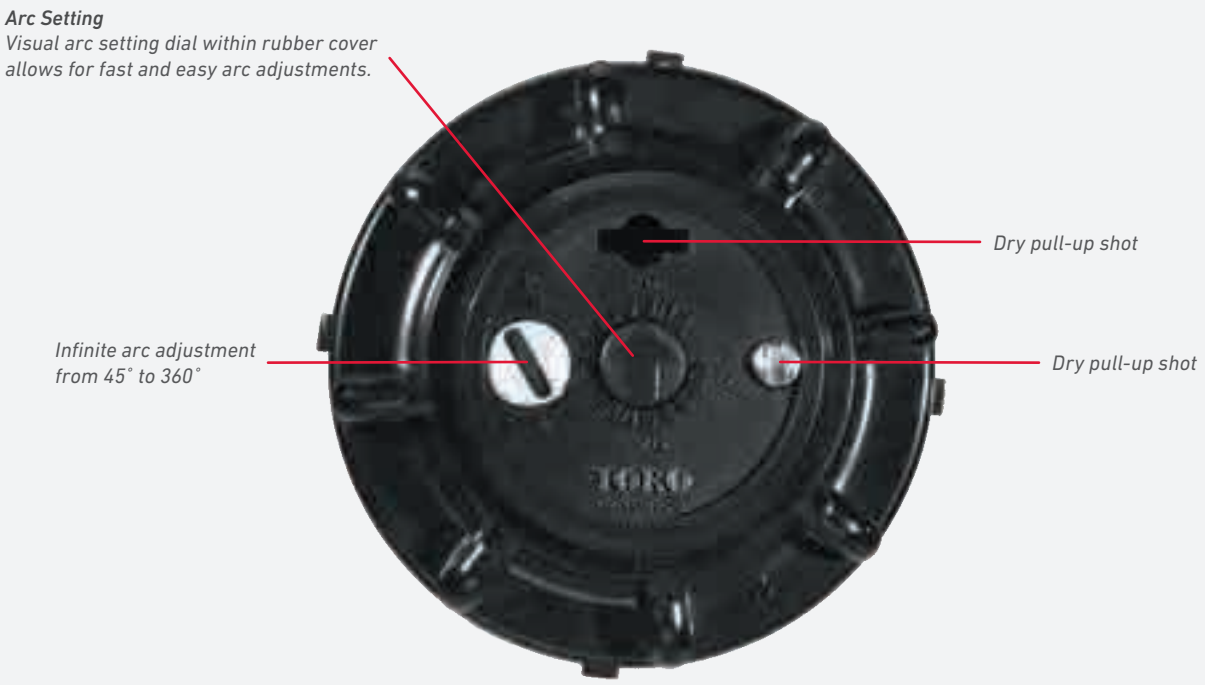
Nozzle Tree
Five interchangeable nozzles – comes pre-installed with a 1.5 nozzle

Check Valve
Optional for field installations

Effluent Options Available

Check Valve Options Available

PRODUCT HIGHLIGHT



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.

SPECIFICATIONS

Operational
- Radius: 20'–35'
- Arc Adjustment – 40° to 360°
- Operating pressure range: 30-60 psi
- Flow Rate: 0.80 – 3.40 gpm
- Trajectory: 25°

Dimensions
- Body height: 6"
- Pop-up to nozzle height: 3¾"
- Exposed diameter: 1¾"
- Cap diameter: 2¼"
- Inlet: ½" female-thread

Options Available
- 102-2024 – Adjustment Tool
- MINI8-CV – Check Valve

Warranty
- Two years

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

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 Rotors

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!

300 SERIES MULTI-STREAM ROTOR®

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

PRODUCT 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.

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: 2¾"
  - High Pop: 11¾"
- Inlet (Female-threaded):
  - Lawn Pop-up and High pop: ¾"
  - Shrub: Combined ½" to ¾"
- Large basket filter screen

Dimensions

- Body Diameter: 2⅜"
- Cap Diameter: 3"
- Height:
  - Lawn Pop-up: 6⅛"
  - High Pop: 16"
- Shrub Base Diameter: 1¾"

Options Available

Recycled Water Indicators:

- Lavender Cover, High-Pop (89-7854 - fits 300-25 Omni only)
- Lavender Cover, Lawn & Shrub (89-7853 - fits 300-15 Omni only)
- Lavender Cap, Standard Nozzles (89-7889 - fits 01, 02, 03, 63, 93)
- COM Check Seal (89-7561) (Fits Shrub model only)

Warranty

- Two years

300 SERIES: 300-15 (LAWN) AND 300-25 (HIGH POP) OMNI PERFORMANCE CHART

psi	Radius	Precipitation Rate*		90°	112°	135°	157.7°	180°	202.5°	225°	270°	360°
		▲	■	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 SHRUB WITH COM (360° ARC DISC)

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	27°
	Max. Ht. of Spray
01	4' 10"
02	5' 1"
03	5' 11"
63	7' 0"
93	6' 3"

300 SERIES: FIXED RADIUS NOZZLE PERFORMANCE CHART

Nozzle	psi	Radius	Precipitation Rate*		90°	112°	135°	157.7°	180°	202.5°	225°	270°	360°
			▲	■	gpm								
01/21	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
02/22	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
03/23	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 gallonage. Radius shown in feet. Data based on 360°.*

300 SERIES MULTI-STREAM ROTOR MODEL LIST

Model	Description
300-00-00	Lawn Pop-up without Nozzle
300-10-00	Shrub without Nozzle
300-12-00	12" High Pop without Nozzle

Specifying Information—300 Series Multi-Stream Rotor

3XX-XX-XX-COM-E				
Arc	*Body*	*Nozzle*	*Optional*	*Optional*
3XX	XX	XX	COM	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	01/21—Small Radius, 12 Ports 02/22—Medium Radius, 12 Ports 03/23—Large Radius, 12 Ports 15—Adjustable Shrub & Lawn Pop-up 25—Adjustable, High 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.*

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 ¾" rotor needed to get the job done.

TORO®

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

T5 RAPIDSET® SERIES ROTORS

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, 12" High Pop and Stainless Steel models.

Stainless Steel Model Features

- ✔ 304 Stainless Steel riser and nozzle base protection
- ✔ Ideal for settings with heavy foot traffic or sandy soil conditions
- ✔ Heavy-duty construction protects the rotor from damage caused by vandalism

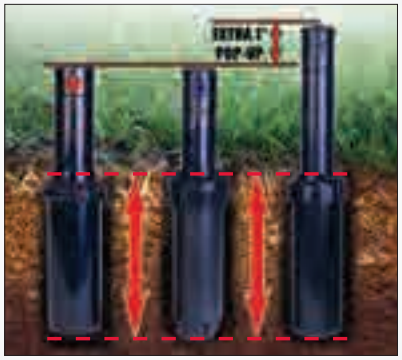
Effluent Options Available

Check Valve Options Available

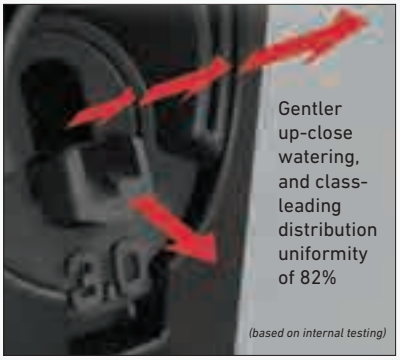
PRODUCT HIGHLIGHT

NO TOOLS Arc Adjustment

5" Pop-Up In A 4" Body

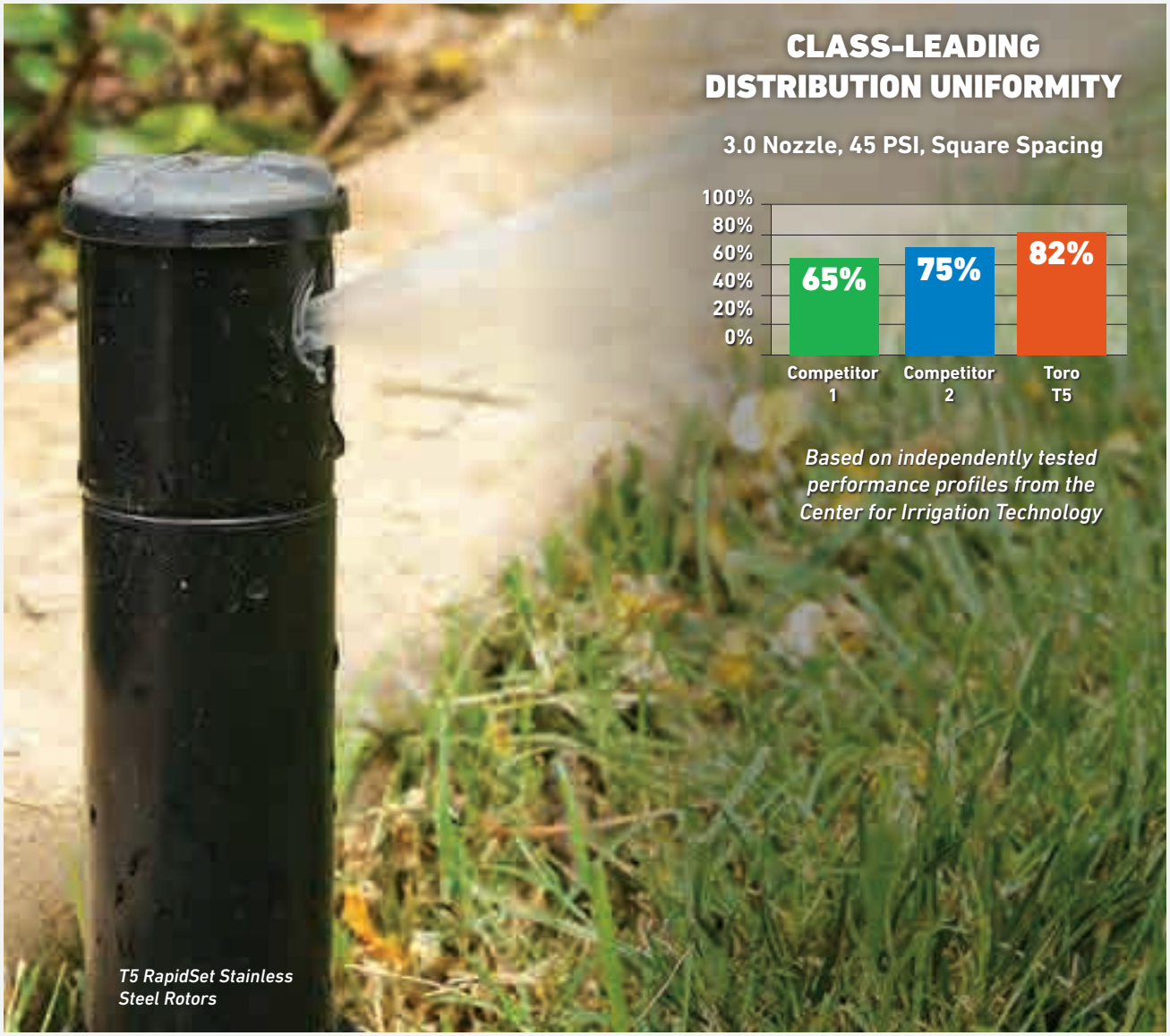


Exclusive Airfoil™ Technology Nozzles



Gentler up-close watering, and class-leading distribution uniformity of 82%

(based on internal testing)



T5 RapidSet Stainless Steel Rotors

SPECIFICATIONS

Operational

- Radius: 25 - 50 feet
- Flow rate: 0.74 - 9.70 gpm
- Arc: 40° to 360°, adjustable
- Inlet: ¾" 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® ROTOR MODEL LIST

Model	Description
T5P-RS	5" RapidSet Lawn pop-up
T5PE-RS	5" RapidSet Lawn pop-up, Effluent
T5PCK-RS	5" RapidSet Lawn pop-up with Check Valve
T5PCK1.5-RS	5" RapidSet Lawn pop-up with Check Valve, 1.5 gpm nozzle
T5PCK2.0-RS	5" RapidSet Lawn pop-up with Check Valve, 2.0 gpm nozzle
T5PCK2.5-RS	5" RapidSet Lawn pop-up with Check Valve, 2.5 gpm nozzle
T5HP-RS	12" RapidSet High Pop
T5HPE-RS	12" RapidSet High Pop, Effluent
T5S-RS	RapidSet Shrub
T5SE-RS	RapidSet Shrub, Effluent
T5PSS-RS	5" RapidSet Stainless Steel Lawn pop-up
T5PSSE-RS	5" RapidSet Stainless Steel Lawn pop-up, Effluent
T5PCKSS-RS	5" RapidSet Stainless Steel Lawn pop-up with Check Valve

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°.*

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 Rotors

T5XX XX XX X.X E-RS

Base Model	*Body*	*Optional*	*Optional*	*Custom Nozzles*	*Optional*	
T5	**XX**	**XX**	**XX**	**X.X**	**E**	**-RS**
T5— T5 RapidSet Series Rotor	P - Lawn S - Shrub HP - High Pop	CK — Check Valve	SS — Stainless Steel Riser	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 gpm nozzle and Check Valve would be specified as: **T5PCK2.5-RS**

SPORTS FIELDS & GROUNDS SOLUTIONS

Whether natural turf or synthetic, a professional sports field or municipal park, or spacing of 60 feet or 170 feet, Toro offers a wide range of rotor products to meet the unique needs and challenges presented by large turf areas.

TORO®

SF&G SPRINKLERS

Pages 58-89

TS170 Series Rotor	60-63
TS120 Series Impact Sprinklers	64-67
T7 Series	68-71
640 Series	72-75
TS90 Series	76-79
P2 Series Sprinklers	80-83
Toro RollcarT™ Traveling Sprinkler	84-87
Sentinel® Central Control	89
Turf Guard® Soil Monitoring System	89

The piston-driven Toro® TS170 Series long radius rotor is the irrigation solution of choice for the cooling and washing down of large synthetic turf fields. Capable of achieving a throw of 177 feet, the TS170 Series Rotor can be installed along the outer perimeter of the playing surface, which helps preserve player safety and maintain field aesthetics.

TS170 SERIES ROTORS

FEATURES & BENEFITS

Innovative Nozzle Technology

The unique nozzle design minimizes water turbulence, which helps to maintain stream exit speed at the nozzle outlet, resulting in higher radii at reduced flows. Nozzles are available in 16, 20, and 24 mm sizes.

Low Maintenance Piston Drive

A fully enclosed piston drive system presents smooth, continuous rotation.

Integrated Valve-in-Head

Electric valve in head models feature ON/OFF/Auto control at the rotor, and provide individual management of each rotor to help ensure they perform at their highest level of efficiency.

Reduced Watering Time

High flow capability of up to 303 gallons per minute, in combination with adjustable rotation speed allows a synthetic turf field featuring a system of TS170 Series Rotors to be wet down in under ten minutes.

Additional Features

- Available in Block Style models
- Available with factory-installed Synthetic TurfCup™
- High-density body construction with stainless steel and brass components.

PRODUCT HIGHLIGHT

TS170 Series Rotors

Designed for the washing down and cooling of Synthetic Turf fields, and capable of radii that allow it to be installed along the perimeter of the field – not within the playing surface. The TS170 Series Rotor is available with a factory-installed synthetic TurfCup™.

SPECIFICATIONS

Operational

- Radius Capability: 111-177 feet
- Arc Adjustment: Part circle (30°-330°) / Full circle (360°)
- Output Flow: 113-303 gallons per minute
- Recommended Operating Pressure: 100 psi
- Maximum Operating Pressure: 145 psi
- Minimum Operating Pressure: 60 psi
- Nozzle Options: 16, 20 and 24 mm
- Nozzle Trajectory: 25°
- Speed of Rotation (180° arc): 50-120 seconds, adjustable (pressure dependent)
- Valve Type: Electric Valve-in-Head (VIH) 24V ac actuated solenoid

Dimensions

- Inlet Size: 2" NPT Female
- Overall Dimensions: 20.8" H x 13.75" W (Block Style model), 26.8" H x 13.75" W (VIH model)
- Cover Diameter: 10.1"
- Pop-up Height: 4.7"
- Overall Weight: 23 pounds (Block Style model), 26 pounds (VIH model)

Warranty

- Five years

TS170 SERIES MODEL LIST

Model	Description
TS170-02-16	TS170 Rotor, 16 MM, NPT
TS170-02-20	TS170 Rotor, 20 MM, NPT
TS170-02-24	TS170 Rotor, 24 MM, NPT
TS170V-02-16	TS170 Rotor with VIH, 16 MM, NPT
TS170V-02-20	TS170 Rotor with VIH, 20 MM, NPT
TS170V-02-24	TS170 Rotor with VIH, 24 MM, NPT
TS171-02-16	TS170 Rotor with Synthetic TurfCup, 16 MM, NPT
TS171-02-20	TS170 Rotor with Synthetic TurfCup, 20 MM, NPT
TS171-02-24	TS170 Rotor with Synthetic TurfCup, 24 MM, NPT
TS171V-02-16	TS170 Rotor with Synthetic TurfCup and VIH, 16 MM, NPT
TS171V-02-20	TS170 Rotor with Synthetic TurfCup and VIH, 20 MM, NPT
TS171V-02-24	TS170 Rotor with Synthetic TurfCup and VIH, 24 MM, NPT

TS170 PERFORMANCE DATA*

Pressure (psi)	16 mm Nozzle		20 mm Nozzle		24 mm Nozzle	
	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
60	111	114	131	159	137	214
70	121	127	137	178	144	239
90	131	139	147	195	160	262
100	137	151	157	211	170	283
115	144	161	163	225	177	303

**Radius measurements taken at minimum rotation speed.*

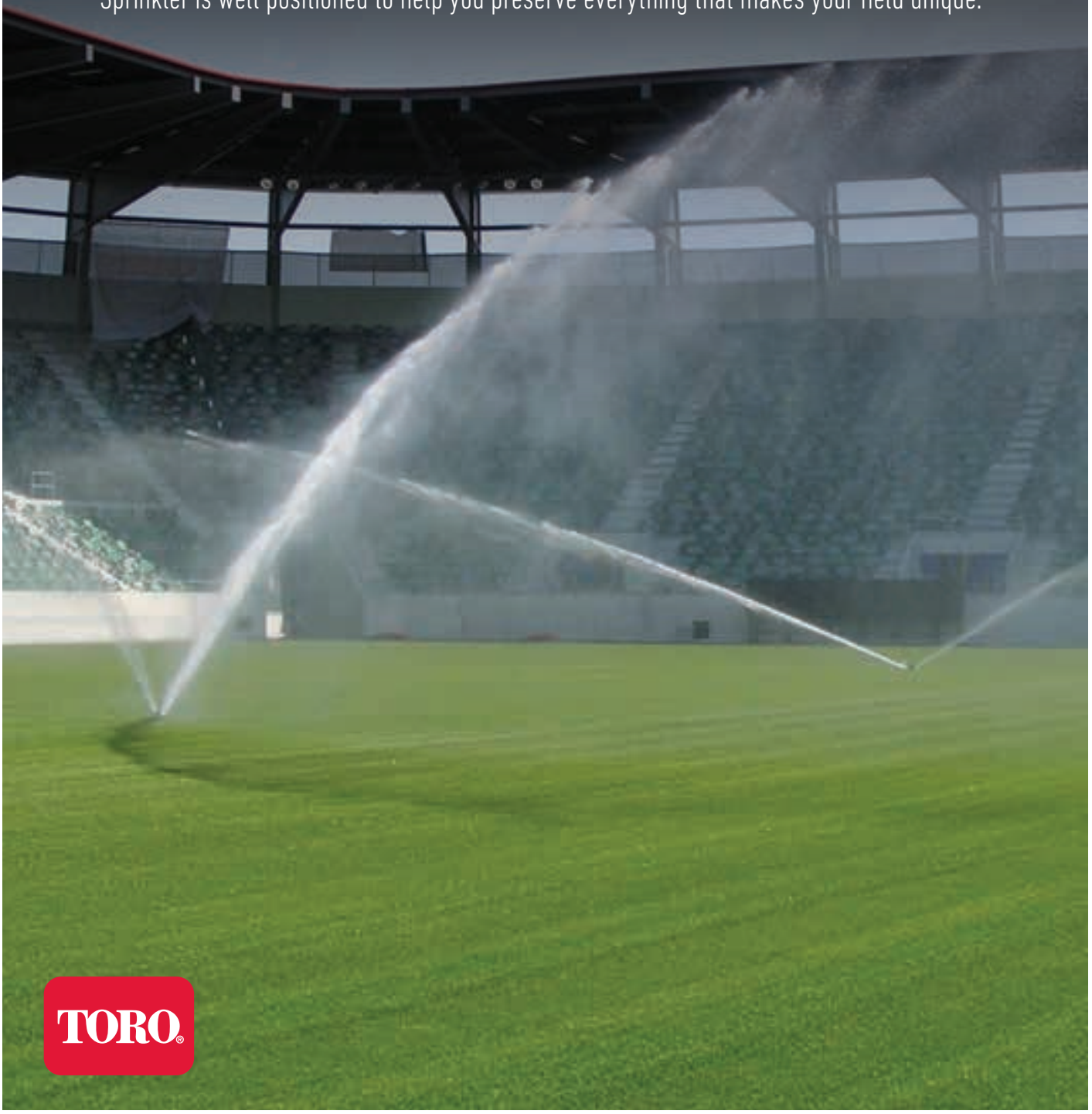
TS170 SERIES NOZZLES

Model	Description
RB25412	16 mm Nozzle
RB25413	20 mm Nozzle
RB25414	24 mm Nozzle

Specifying Information—TS170 Series Rotors

TS170-XX-XX		
Configuration	*Inlet Thread*	*Nozzle*
TS170	**XX**	**XX**
TS170 - TS170 long-range rotor TS170V - TS170 long-range rotor with VIH TS171 - TS170 long-range rotor with Synthetic TurfCup TS171V - TS170 long-range rotor with Synthetic TurfCup and VIH	02 - 2" NPT	16 - 16 mm 20 - 20 mm 24 - 24 mm
Example: A TS170 Rotor with 16 mm nozzle would be specified as: **TS170-02-16**		

The Toro® TS120 Series Impact Sprinkler is capable of achieving long-range throws of up to 125 feet, making it well suited to meet the needs of both synthetic and natural turf sports fields. Available in Part Circle and Full Circle models, the TS120 can be configured with a factory-installed 4" TurfCup™ that helps to seamlessly blend the sprinkler into natural turf surfaces and preserve field aesthetics. Combining a wide assortment of Nozzle options with low maintenance requirements and heavy-duty construction, the TS120 Series Impact Sprinkler is well positioned to help you preserve everything that makes your field unique.



TORO®

TS120 SERIES IMPACT SPRINKLERS

FEATURES & BENEFITS

Synthetic or Natural Turf applications

The TS120 Series nozzles offer excellent water distribution and radius capability, giving the TS120 sprinkler the ability to meet the needs and expectations of groundskeepers of both synthetic and natural turf fields.

Flexibility and Ease of Use

A Full Circle rotation speed of 60 seconds and easy tool-free arc adjustments allow flexibility in field design and irrigation schedules to best meet the needs of the site. All sprinkler parts can be dismantled and serviced from the top, limiting the need for digging or sub-surface access.

Top Serviceable Valve-in-Head*

Electric Valve-In-Head (VIH) models feature ON/OFF/Auto control at the top of the sprinkler and provide individual control of each sprinkler to help ensure optimal performance and ease of maintenance.

Durable and Versatile

With the ability to operate on reclaimed and grey water systems, the robust and heavy-duty design makes the TS120 insensitive to many environmental conditions, such as frost and sand.

Additional Features

- High level of wind resistance due to high velocity streams
- Full Circle models include a back nozzle for optimal coverage
- High-strength stainless steel riser helps prevent sprinkler damage due to unintended impact or vandalism
- Tool-free mounting and removal of lid

TS120

TS121V

PRODUCT HIGHLIGHT

TS120 Series Impact Sprinklers

Capable of meeting the requirements of both synthetic and natural turf fields with low maintenance requirements and VIH control.

TS120 SERIES MODEL LIST

Model	Description
TS120P-02	TS120 Impact Sprinkler, Part Circle
TS120F-02	TS120 Impact Sprinkler, Full Circle
TS120VP-02	TS120 Impact Sprinkler with VIH, Part Circle
TS120VF-02	TS120 Impact Sprinkler with VIH, Full Circle
TS121VP-02	TS120 Impact Sprinkler with VIH and TurfCup™, Part Circle
TS121VF-02	TS120 Impact Sprinkler with VIH and TurfCup™, Full Circle
TS122VP-02	TS120 Impact Sprinkler with VIH and Synthetic Turf Cover, Part Circle
TS122VF-02	TS120 Impact Sprinkler with VIH and Synthetic Turf Cover, Full Circle

TS120 SERIES NOZZLES

Model	Description
RT17463	7 mm Nozzle
RT17464	8 mm Nozzle
RT17465	9 mm Nozzle
RT17466	10 mm Nozzle
RT17467	11 mm Nozzle
RT17468	12 mm Nozzle
RT17469	13 mm Nozzle
RT17470	14 mm Nozzle
RT17471	15 mm Nozzle
RT17472	16 mm Nozzle
RT17473	17.5 mm Nozzle

SPECIFICATIONS

Operational

- Radius Capability: 62-125 feet
- Arc Adjustment: Part Circle (30°-330°) / Full Circle (360°)
- Output Flow: 20-121 gallons per minute
- Recommended Operating Pressure range: 45-120psi
- Maximum Operating Pressure: 145 psi
- Minimum Operating Pressure: 45 psi
- Nozzle Options: 7,8,9,10,11,12,13,14,15 and 17.5 mm
- Nozzle Trajectory: 22°
- Speed of Rotation (360°): 60 seconds
- Valve Type: Electric Valve-in-Head (VIH) 24 Vac actuated solenoid
- Standard Nozzles: 17.5 mm

Dimensions

- Inlet Size: 1½" NPT female
- Overall Dimensions:
  - 14.8" H x 10.1" W (Block Style model)
  - 17.9" H x 10.1" W (VIH model)
  - 26.0" H x 10.1" W (VIH with TurfCup models)
- Pop-up Height (measured from grade to top of lid):
  - 4" (Standard)
  - 8.1" (with TurfCup)

Warranty

- Five years

TS120 SERIES NOZZLE PERFORMANCE DATA – PART CIRCLE MODELS

psi	7 mm Nozzle		8 mm Nozzle		9 mm Nozzle		10 mm Nozzle		11 mm Nozzle		12 mm Nozzle		13 mm Nozzle		14 mm Nozzle		15 mm Nozzle		17.5 mm Nozzle*	
	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)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
60	64	22.9	67	28.6	69	34.4	72	39.6	75	44.9	79	50.7	82	56.8	85	64.3	88	71.8	92	86.3
70	68	25.6	71	31.7	73	39.3	76	44.1	81	49.8	87	56.4	90	63.4	95	71.8	98	79.7	102	96.0
90	70	28.2	74	34.8	77	41.9	81	48.5	87	54.6	92	61.7	95	69.2	100	78.4	105	87.2	111	104.4
100	72	30.0	76	37.4	81	44.9	86	52.0	91	58.6	96	66.5	100	74.4	105	84.6	110	94.3	120	113.7
115	73	32.2	79	40.1	84	48.0	90	55.5	95	62.6	101	70.9	105	83.3	110	90.3	115	100.9	125	121.1

**Standard nozzle*

TS120 SERIES NOZZLE PERFORMANCE DATA – FULL CIRCLE MODELS WITH BACK NOZZLE

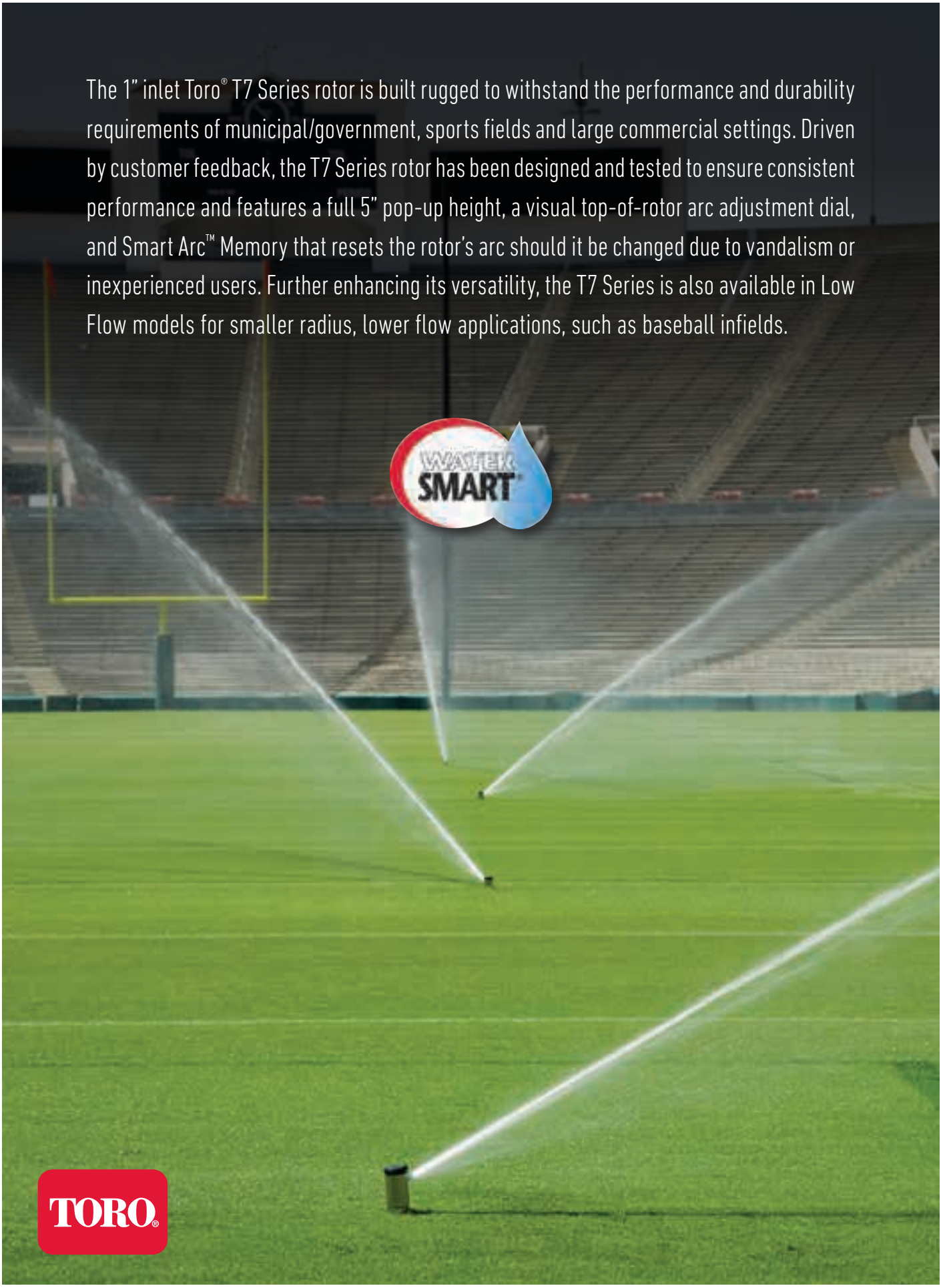
psi	7 mm Nozzle		8 mm Nozzle		9 mm Nozzle		10 mm Nozzle		11 mm Nozzle		12 mm Nozzle		13 mm Nozzle		14 mm Nozzle		15 mm Nozzle		17.5 mm Nozzle*	
	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
60	64	27.8	67	33.5	69	39.2	72	44.5	75	49.8	79	55.5	82	61.7	85	69.2	88	76.7	92	91.2
70	67	31.3	70	37.4	73	44.1	76	49.8	81	55.5	87	62.1	90	69.2	95	77.5	98	85.5	102	101.8
90	70	34.8	74	41.4	77	48.5	81	55.1	87	61.2	92	68.3	95	75.8	100	85.0	105	93.8	111	111.9
100	72	36.6	76	44.5	81	52.0	86	59.0	91	65.6	96	73.6	100	81.5	105	91.6	110	101.3	120	120.7
115	73	39.6	79	47.6	84	56.0	90	63.0	95	70.5	101	78.4	105	87.2	110	97.8	115	108.4	125	126.0

**Standard nozzle*

Specifying Information – TS120 Series Impact Sprinklers

TS12XXX-02-XX				
Configuration	*Style*	*Arc*	*Threads*	*Nozzle*
TS12X	X	X	02	XX
TS120 – TS120 long-range impact sprinkler TS121 – TS120 long-range impact sprinkler with TurfCup TS122 – TS120 long-range impact sprinkler with Synthetic Turf cover	Blank – Block Style V – Valve-In-Head	P – Part Circle F – Full Circle	02 – 1.5" NPT	07 – 7 mm 08 – 8 mm 09 – 9 mm 10 – 10 mm 11 – 11 mm 12 – 12 mm 13 – 13 mm 14 – 14 mm 15 – 15 mm 16 – 16 mm 17 – 17.5 mm
Example: A full circle TS120 Series Impact Sprinkler with VIH, TurfCup, and 16mm nozzle would be specified as: **TS121VF-02-16**				

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.



T7 SERIES ROTORS

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 stream.

Vandal and Abuse Resistance

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

Design Solutions and Safety

Standard Check-O-Matic Seal prevents low head drainage, and a minimal 2.2" exposed rubber cover diameter reduces the potential for injuries on play areas.

Durability

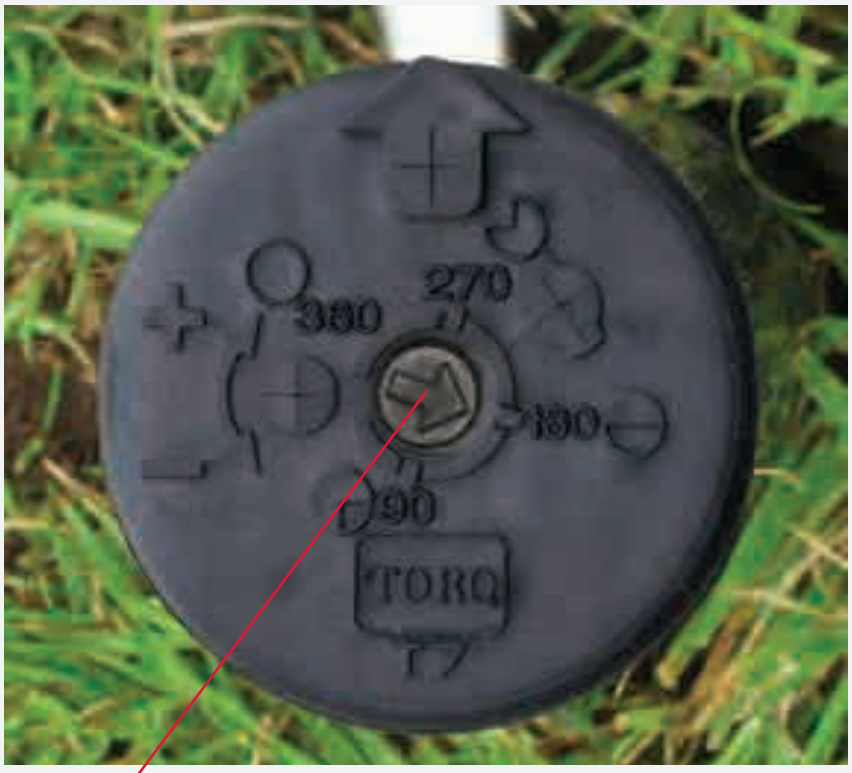
Heavy-duty retract spring and wiper seal reduce the occurrence of stick-ups and seal leakage, while a water-lubricated gear drive contributes to long-term consistent performance.

Effluent Options Available

SST Riser Options Available

Additional Features

- Standard reversible Check-O-Matic seal
- 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



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

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

STANDARD NOZZLES PERFORMANCE DATA

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

LOW FLOW NOZZLES PERFORMANCE DATA

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°.*

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

Specifying Information—T7 Series Rotors

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**			

With over 30 years of history, the heavy-duty Toro® 640 Series rotor is a proven commercial-grade sprinkler for athletic fields, parks, campuses, and commercial sites.

The 640 installs below grade for increased player safety.

TORO®

640 SERIES ROTORS

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
- Basket filter screen

Effluent Options Available

Check Valve Options Available

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
	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
41	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
	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
42	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
	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
43	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
	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
44	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
	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
	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
41	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
	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
42	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
	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
43	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
	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
44	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
	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	2.76	3.68	3.68	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.*

SPECIFICATIONS

Operational

- Radius: 47' – 67'
- Flow Rate: 6 – 25 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' in elevation change
- Selection of five nozzles and 12 arcs
- Adjustment screw allows up to 25% radius reduction

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"

Options Available

- Valve-In-Head Snap Ring Pliers (995-100)
- Valve Removal Tool (995-08)
- #41 Fast Rotating Stator (35-0579)

Warranty

- Five years

640 SERIES MODEL LIST

Model	Description
ASSEMBLED ROTORS	
641-02-40	90°Arc with #40 Nozzle
641-02-41	90°Arc with #41 Nozzle
641-02-42	90°Arc with #42 Nozzle
641-02-43	90°Arc with #43 Nozzle
641-02-44	90°Arc with #44 Nozzle
642-02-40	180°Arc with #40 Nozzle
642-02-41	180°Arc with #41 Nozzle
642-02-42	180°Arc with #42 Nozzle
642-02-43	180°Arc with #43 Nozzle
642-02-44	180°Arc with #44 Nozzle
644-02-40	360°Arc with #40 Nozzle
644-02-41	360°Arc with #41 Nozzle
644-02-42	360°Arc with #42 Nozzle
644-02-43	360°Arc with #43 Nozzle
644-02-44	360°Arc with #44 Nozzle
BODY PACKAGE	
640-10	640 Body Package, VIH Check-O-Matic
640-20	641 Body Package,

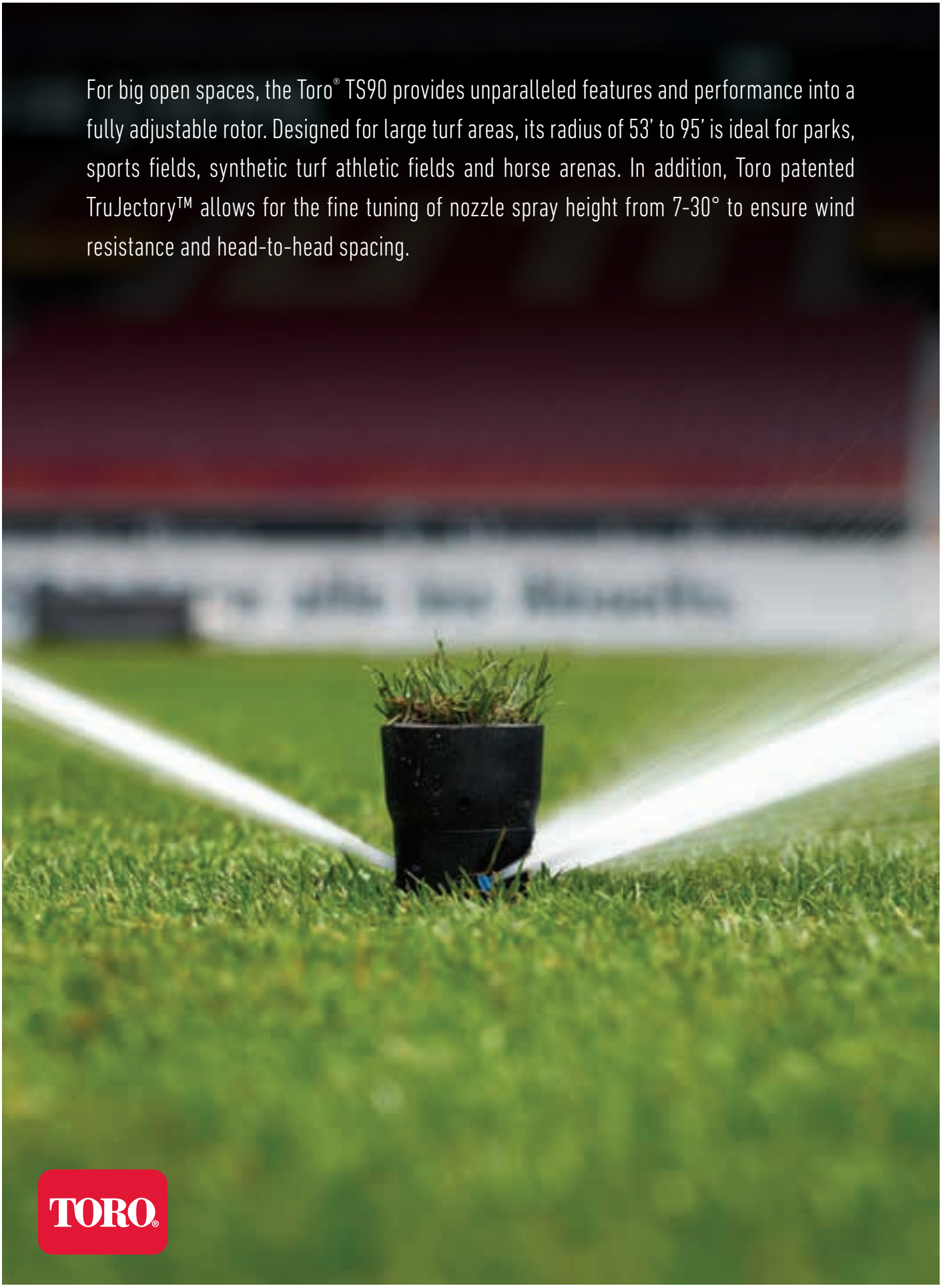
Model	Description
DRIVE ASSEMBLY	
640-0045	640 Drive Assembly, 45 degrees
640-0060	640 Drive Assembly, 60 degrees
640-0090	640 Drive Assembly, 90 degrees
640-0108	640 Drive Assembly, 108 degrees
640-0127	640 Drive Assembly, 127 degrees
640-0148	640 Drive Assembly, 148 degrees
640-0173	640 Drive Assembly, 173 degrees
640-0180	640 Drive Assembly, 180 degrees
640-0192	640 Drive Assembly, 192 degrees
640-0238	640 Drive Assembly, 238 degrees
640-0270	640 Drive Assembly, 270 degrees
640-0360	640 Drive Assembly, 360 degrees
NOZZLE/STATOR SET	
641-40	#40 Nozzle and Stator
641-41	#41 Nozzle and Stator
641-42	#42 Nozzle and Stator
641-43	#43 Nozzle and Stator
641-44	#44 Nozzle and Stator

Specifying Information—640 Series Rotors (Assembled Rotors)

64X-XX-XX				
Arc	*Thread*	*Valve Type*	*Nozzle*	*Optional*
64X	X	X	XX	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	41 - #41 Nozzle 42 - #42 Nozzle 43 - #43 Nozzle 44 - #44 Nozzle	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.



TS90 SERIES ROTORS

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

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

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 rotation
  - Part-circle: 40°-330°
- Rotation Speed: 3 minutes ± 30 seconds (360°)
- Inlet: 1" female-threaded (NPT)
- 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

- Nozzle, #9 Main (102-4259)
- Effleunt Cap Marker (118-0063)
- Main Nozzle Tool (995-99)
- Intermediate nozzle and TruJectory™ tool (995-105)

Warranty

- Five years

TS90 SERIES MODEL LIST

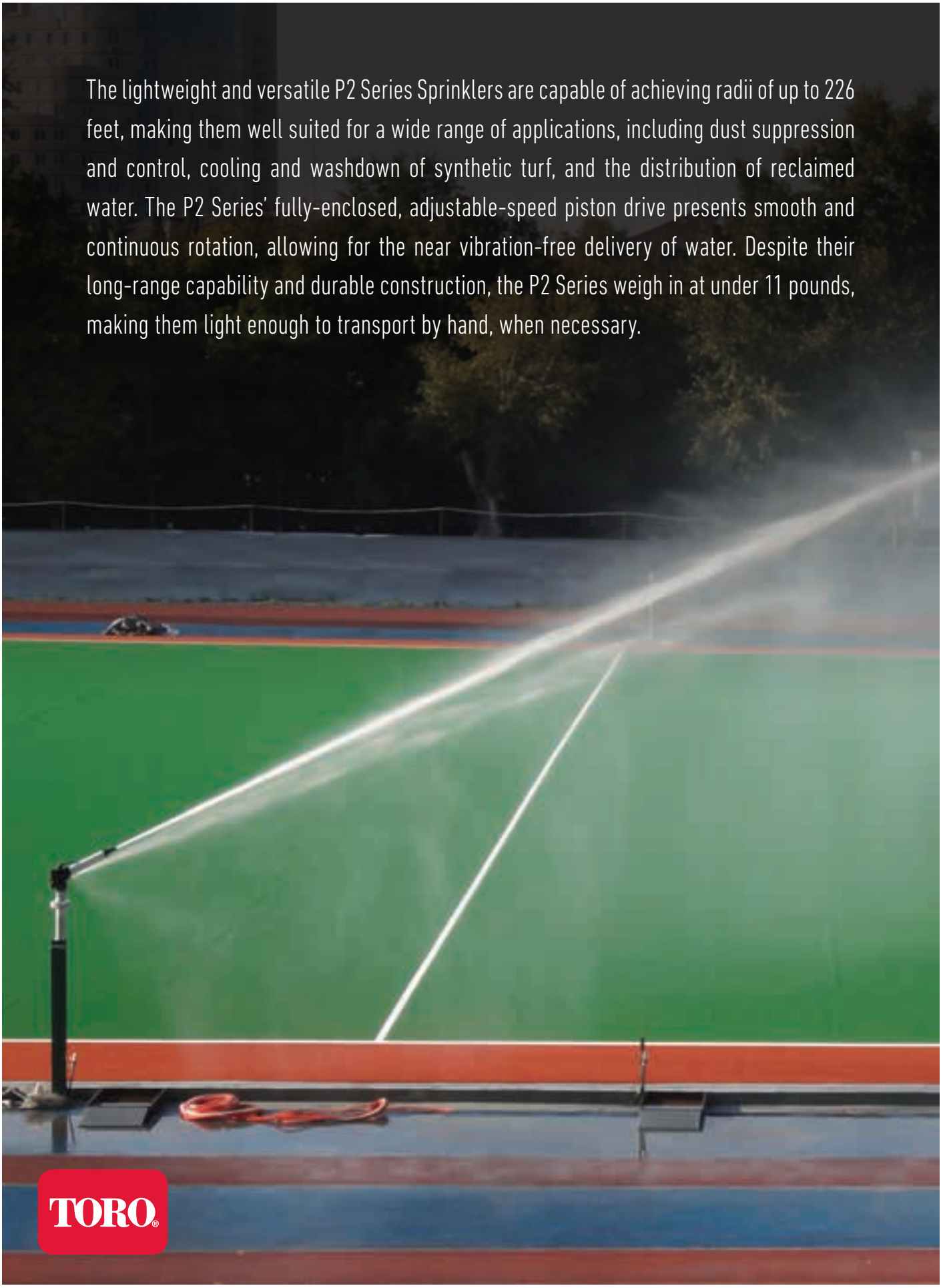
Model	Description
TS90TP-02-14	#3 Main Nozzle and Yellow Stator pre-installed (includes #1, #2, and #4 Main nozzles)
TS90TP-02-58	#6 Main Nozzle and White Stator pre-installed (includes #5, #7, and #8 Main nozzles)
TS90TP-02TC	#8 Main Nozzle, White Stator, and TurfCup pre-installed (includes #5, #6, and #7 Main nozzles)

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—TS90 Series

TS90TP-02-XX			
Arc	*Threads*	*Configuration*	*TurfCup™*
TS90TP	**02**	**X**	**TC**
TS90TP— TS90TP 1" Rotor with TruJectory™	02—NPT	14–Yellow Stator 58–White Stator	TC—TurfCup option
Example: A TS90 Series sprinkler with TruJectory, NPT threads, and with an 82' radius would be specified as: **TS90TP-02-58**			



The lightweight and versatile P2 Series Sprinklers are capable of achieving radii of up to 226 feet, making them well suited for a wide range of applications, including dust suppression and control, cooling and washdown of synthetic turf, and the distribution of reclaimed water. The P2 Series' fully-enclosed, adjustable-speed piston drive presents smooth and continuous rotation, allowing for the near vibration-free delivery of water. Despite their long-range capability and durable construction, the P2 Series weigh in at under 11 pounds, making them light enough to transport by hand, when necessary.

P2 SERIES SPRINKLERS

FEATURES & BENEFITS

Adjustable Rotation Speed

Easy-to-adjust rotation speed allows a complete rotation to be accomplished between two and seven minutes.

Low Maintenance Piston Drive

A fully enclosed piston drive system presents smooth, near vibration-free rotation, which helps to maintain the even distribution of water.

Wide Range of Nozzles

Nozzle choices from 14 mm to 34 mm provide a wide range of irrigation options and the flexibility to tailor the P2 Series to the specific needs of the site.

Part- and Full-Circle in One

Infinitely adjustable between 30° and 330°, or capable of uni-directional 360°.

Additional Features

- Integrated ergonomic carrying handle for ease of portability.
- Adjustable nozzle trajectory between 15° and 47° (P2M-VAR configuration).

P2M

PRODUCT HIGHLIGHT

P2 Series Sprinklers

Weighing under 11 pounds, the P2 Series sprinkler is light enough to transport by hand from one end of the field to the other.

P2S SERIES MODEL LIST

Model	Description
T-P2S	P2S High Volume Gun with 14 mm Nozzle
RT25150	14 mm Nozzle, P2S
RT25151	16 mm Nozzle, P2S
RT25152	18 mm Nozzle, P2S
RT25153	20 mm Nozzle, P2S
RT25154	22 mm Nozzle, P2S
RT25155	24 mm Nozzle, P2S

P2M SERIES MODEL LIST

Model	Description
T-P2M	P2M High Volume Gun with 26 mm Nozzle
T-P2M-VAR	P2M High Volume Gun with Adjustable Trajectory and 26 mm Nozzle
RT24961	18 mm Nozzle, P2M
RT24962	20 mm Nozzle, P2M
RT24963	22 mm Nozzle, P2M
RT24964	24 mm Nozzle, P2M
RT24965	26 mm Nozzle, P2M
RT24966	28 mm Nozzle, P2M
RT24967	30 mm Nozzle, P2M
RT24968	32 mm Nozzle, P2M
RT24969	34 mm Nozzle, P2M

SPECIFICATIONS

Operational

- Radius Capability
  - P2S: 105-180 feet
  - P2M/VAR: 138-226 feet
- Output Flow
  - P2S: 70-267 gallons per minute
  - P2M/VAR: 131-535 gallons per minute
- Recommended Operating Pressure range:
  - P2S: 60-115 psi
  - P2M/VAR: 70-115 psi
- Maximum Operating Pressure:
  - 120 psi
- Minimum Operating Pressure:
  - 60 psi
- Nozzle Options:
  - P2S: 14, 16, 18 , 20 , 22, 24 mm
  - P2M/VAR: 18, 20, 22, 24, 26, 28, 30, 32, and 34 mm
- Nozzle Trajectory:
  - 25°
- Speed of Rotation:
  - Adjustable between 2-7 minutes
- Arc Adjustment:
  - Part circle (30°-330°) / Full circle (360°)

Dimensions

- Inlet Size
  - P2S: 2 ½" NPT female
  - P2M/VAR: 3" NPT female
- Overall Dimensions:
  - P2S: 15.2" H x 21.3" L
  - P2M/VAR: 17.4" H x 26.3" L
- Overall Weight:
  - P2S: 9.5 pounds
  - P2M/VAR: 10.8 pounds

Warranty

- Five years

P2S NOZZLE PERFORMANCE DATA

Pressure (psi)	14 mm Nozzle		16 mm Nozzle		18 mm Nozzle		20 mm Nozzle		22 mm Nozzle		24 mm Nozzle	
	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
60	105	69.9	114	88.7	131	109.6	136	133.8	140	160.2	147	189.0
70	111	78.1	124	99.2	141	123.0	147	149.6	150	179.1	157	211.3
90	118	85.6	134	108.6	150	134.8	157	163.9	164	196.2	170	231.5
100	124	92.5	141	117.4	154	145.6	164	177.1	169	211.9	175	250.0
115	131	98.9	144	125.5	160	155.6	167	189.3	173	226.5	180	267.3

P2M NOZZLE PERFORMANCE DATA

Pressure (psi)	18 mm Nozzle		20 mm Nozzle		22 mm Nozzle		24 mm Nozzle		26 mm Nozzle		28 mm Nozzle		30 mm Nozzle		32 mm Nozzle		34 mm Nozzle	
	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)	Flow (gpm)	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
70	138	130.8	144	157.2	151	186.8	157	218.9	164	254.2	174	292.1	180	332.6	187	376.2	190	422.5
90	148	143.2	154	172.2	161	204.8	167	240.1	174	278.4	184	319.8	190	364.3	197	411.9	200	463.0
100	157	154.6	164	186.3	170	221.1	177	259.0	187	300.4	197	345.4	207	393.4	213	444.9	216	499.6
115	164	165.2	170	199.1	177	236.1	184	277.1	193	321.1	203	369.2	213	420.7	220	475.8	226	534.6

Specifying Information – P2 Series Sprinkler

T-P2X-XXX-XX		
Configuration	*Trajectory*	*Nozzle*
T-P2X	**X**	**XX**
T-P2S – P2 Series High Volume gun-style sprinkler (2.5" NPT) T-P2M – P2 Series High Volume gun-style sprinkler (3" NPT) T-P2M-VAR – P2 Series High Volume gun-style sprinkler with adjustable trajectory	Blank – 25° VAR – Adjustable (15° to 47°)**	14 – 14 mm 16 – 16 mm 18 – 18 mm 20 – 20 mm 22 – 22mm 24 – 24 mm 26 – 26 mm* 28 – 28 mm* 30 – 30 mm* 32 – 32 mm* 34 – 34 mm*
Example: A P2S Sprinkler with an 18 mm nozzle would be specified as: **T-P2S-18**		

** Nozzle sizes are only available for P2M models. ** Variable TraJectory only available for P2M model.*

The Toro RollcarT™ offers a cost-effective, easy-to-setup solution for irrigating sports fields, golf course roughs, and other large, open turf areas where an underground irrigation system is not practical. The RollcarT is hydraulically powered and travels the length of the field while applying consistent irrigation through the top-mount long radius impact sprinkler. The RollcarT travels along its integrated high-strength guide cable, and automatically shuts off the flow of water once it has reached the end of the line.

ROLLCART™ TRAVELING SPRINKLER

FEATURES & BENEFITS

Variable Speed

Adjustable travel speed allows the RollcarT to be dialed in to meet the specific needs of the turf.

Auto Shutoff

To eliminate water waste and over-watering, the RollcarT will stop irrigation and traveling once the guide cable has been fully retracted and the pass/cycle is complete.

Ease of Maintenance

Encased in a sealed gearbox, the drive gears have a very low friction factor and are practically maintenance free.

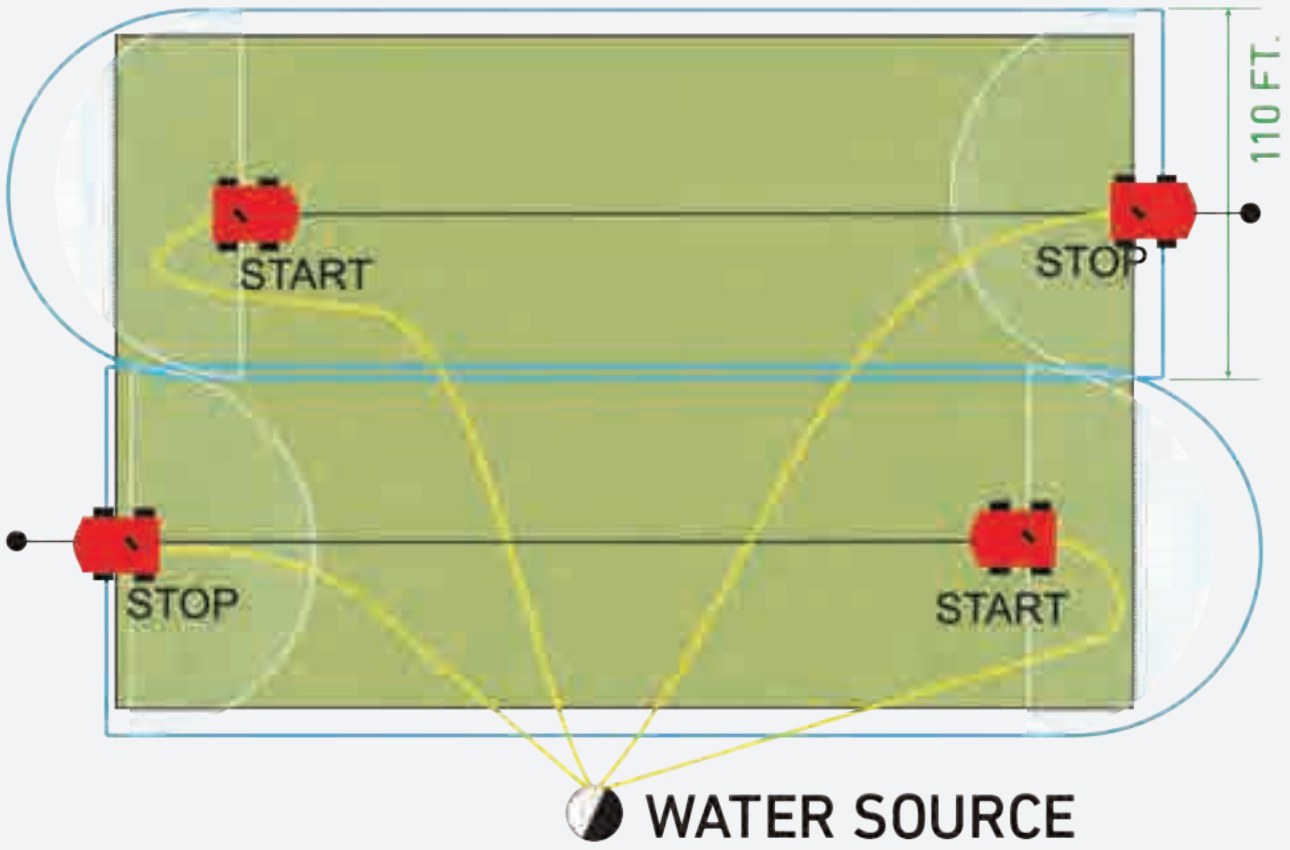
Flexible

A guide cable length of over 350 feet presents a wide range of applicable settings.

Additional Features

- 1" hose inlet
- High-density body construction with stainless steel and brass components
- Galvanized anchor stake

PRODUCT HIGHLIGHT



RollcarT™ Traveling Sprinkler

The autonomous RollcarT™ can operate in part-or full-circle mode and starts travelling along its integrated guide cable as soon as the water supply is turned on. The RollcarT will automatically stop and shut off the irrigation at the end of its run.

SPECIFICATIONS

Operational

- Radius capability: 52-64 feet
- Arc Adjustment: Part circle (30°-330°) / Full circle (360°)
- Output Flow: 11-20 gallons per minute
- Travel Speed: 20-70 feet per hour, adjustable
- Travel Distance: up to 390 feet
- Recommended Operating Pressure: 65 psi
- Maximum Operating Pressure: 100 psi
- Minimum Operating Pressure: 50 psi
- Nozzle Options: 6 and 7 mm

Dimensions

- Inlet Size: 1"
- Overall Dimensions: 30" long x 18" wide x 16" tall
- Overall Weight: 60 pounds

Warranty

- Two Years

ROLLCART PERFORMANCE DATA

psi	6 mm Nozzle		7 mm Nozzle	
	Radius (ft)	Flow (gpm)	Radius (ft)	Flow (gpm)
60	52	11.3	56	15.4
70	55	12.6	59	18.0
90	58	13.8	61	19.6
100	60	14.9	64	20.3

Specifying Information – RollcarT™

Rollcart Traveling Sprinkler	
Model	*Description*
T-ROLLCART	Rollcart Traveling Sprinkler

SPORTS FIELD MANAGEMENT SOLUTIONS

Sentinel® Central Control

(Page: 176-177)

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

Turf Guard® Soil Monitoring System

(Page: 137)

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

ROTOR ACCESSORIES

EFFLUENT WATER INDICATORS FOR 300 SERIES

89-7854
- Lavender cover for 300 Series Omni nozzle high-pop models
- Use with part no. 300-25 (Omni Nozzle)

89-7853
- Lavender cover for 300 Series Omni nozzle lawn and shrub models
- Use with part no. 300-15 (Omni Nozzle)

89-7889
- Lavender cap for 300 Series standard lawn and shrub models
- Use with nozzle assy (01, 02, 03, 63, 93)

NOZZLES

Standard T7 Nozzle Tree
102-2633

Low Flow T7 Nozzle Tree
102-1877

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, T7 and TS90 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

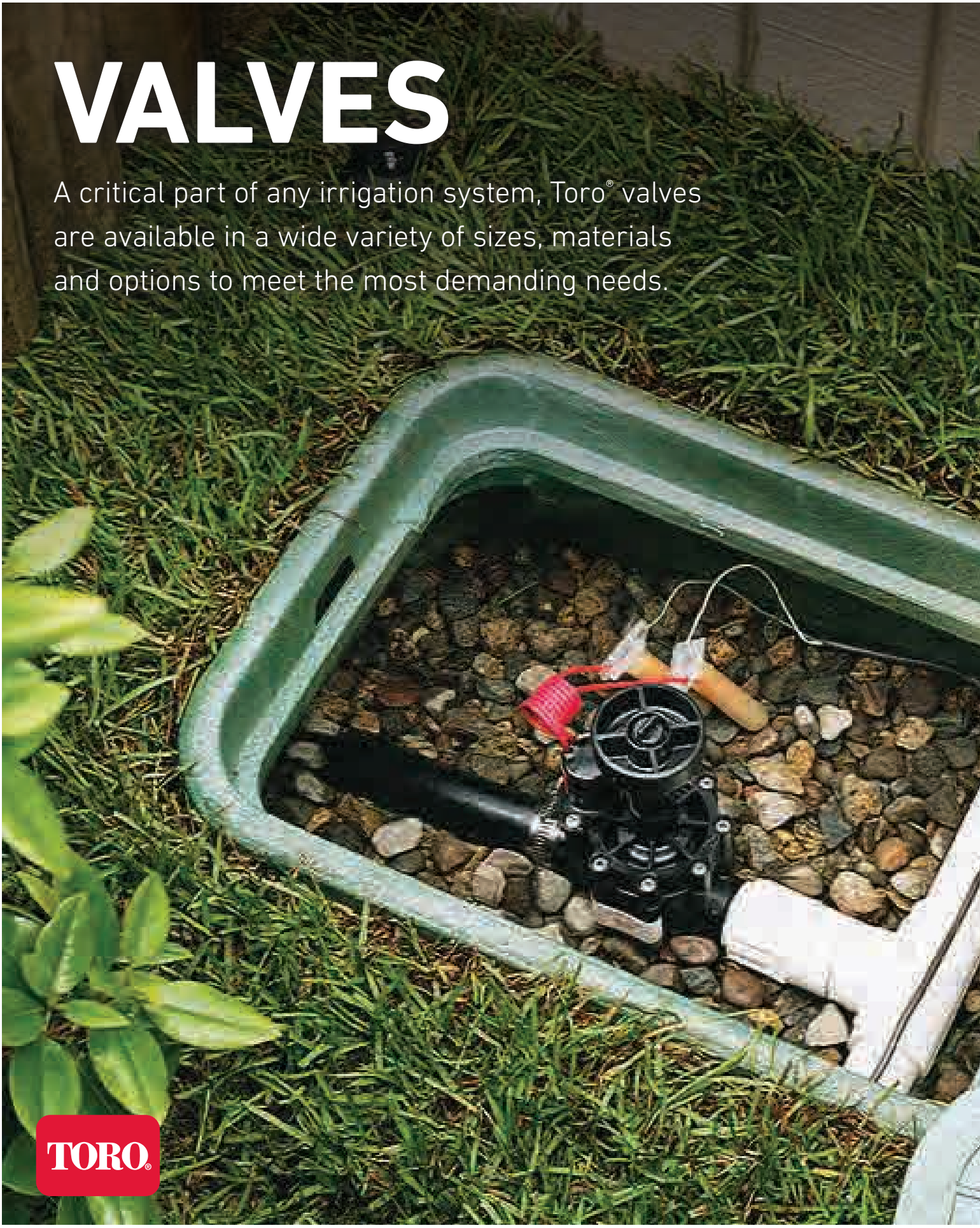
INSTALLATION/ADJUSTMENT TOOLS FOR 640 SERIES

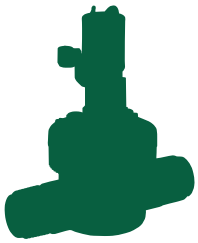
995-08
- Valve removal tool
- Designed for quick removal of valve assembly from body

995-33
- 1/16" Allen screwdriver

VALVES

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





VALVES

Pages 90-109

EZ-Flo® Plus Series	92-93
TPV Series	94-95
250/260 & 254/264 Series	96-97
252 Series	98-99
P-220 Series	100-101
P-220S Scrubber Series	102-103
220 Brass Series	104-105
Quick Coupler Series	106-107
Electric/Hydraulic Converter	108
Valve Accessories	109

EZ-FLO® PLUS SERIES VALVES

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 polypropylene, all EZ-Flo Series valves feature double-beaded chloramine- and ozone-resistant 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 Polypropylene and Stainless Steel Construction

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

Double-beaded, Chloramine- and Ozone-Resistant 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.

Effluent Options Available

DC Latching Solenoid Option

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 (118-5982):
  - Inrush current, 0.4 amps
  - Holding current, 0.2 amps

Dimensions

- Female Globe: 5 1/8" H x 3" W x 4" L
- Male Globe: 5 1/8" H x 3" W x 5 1/2" L
- Anti-Siphon: 6" H x 3" W x 6 7/8" L

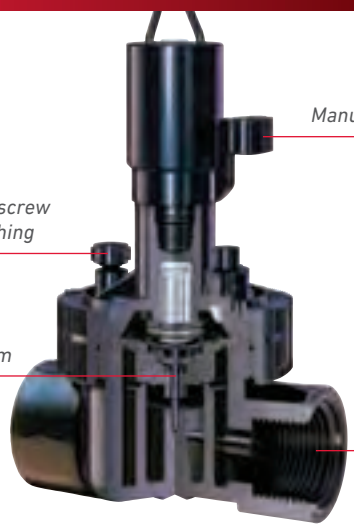
Available Parts & Accessories

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

Warranty

- Five years

PRODUCT HIGHLIGHT



Flow Control
The precise flow control with ergonomic handle allows fine tuning of the downstream pressure to prevent high pressure situations that can lead to misting, poor nozzle performance, or system damage and premature wear.

PRESSURE 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	—

EZ-FLO® PLUS JAR-TOP SERIES MODEL LIST

Model	Description
AC SOLENOID ASSEMBLY	
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 SOLENOID ASSEMBLY	
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**			

TPV SERIES VALVES

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 0.25 to 40 GPM, making them ideal for everything from drip to high-flow residential and light-commercial applications.

Additional Features

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

FEATURES & BENEFITS

Double-Beaded, Chloramine- and Ozone-Resistant 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.

Flow Control

Fine tune the valve's downstream pressure to ensure optimal performance throughout the zone.

Robust Solenoid Design

Ensures reliable opening and closing.

Effluent Options Available

DC Latching Solenoid Option

SPECIFICATIONS

Operational
- Flow Range: 0.25 to 40 gpm
- Operating Pressure: 10 to 175 psi
- Burst pressure safety rating: 525 psi
- Solenoid: 24 Vac (60 Hz) Standard (P/N 118-5982)
  - Inrush: 0.4 amps
  - Holding: 0.2 amps

Dimensions
- 5⅛" H x 2¾" 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

PRODUCT HIGHLIGHT

Flow Control
The precise flow control with ergonomic handle allows fine tuning of the downstream pressure to prevent high pressure situations that can lead to misting, poor nozzle performance, or system damage and premature wear.

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.

TPV PRESSURE LOSS DATA

Flow Rate (gpm)	0.25	1	5	10	15	20	30	40
Pressure Loss (psi)	2.0	2.9	4.0	5.0	5.5	6.0	8.0	14.9

TPV SERIES VALVES MODEL LIST

Model	Description
AC SOLENOID ASSEMBLY	
TPV100	1" Female x Female Threads, In-Line, without Flow Control
TPVF100	1" Female x Female Threads, In-Line, with Flow Control
TPV100MM	1" Male x Male Threads, In-Line, without Flow Control
TPVF100MM	1" Male x Male Threads, 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 SOLENOID ASSEMBLY	
TPV100DC	1" Female x Female Threads, In-Line, without Flow Control, DCLS-P
TPVF100DC	1" Female x Female Threads, In-Line, with Flow Control, DCLS-P
TPV100MMDC	1" Male x Male Threads, In-Line, without Flow Control, DCLS-P
TPVF100MMDC	1" Male x Male Threads, 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

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**				

250/260 & 254/264 SERIES VALVES

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 bonnet and ABS body construction allow 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.

Additional Features

- Self-cleaning, stainless steel metering pin
- External manual bleed
- 18" lead wires (electric)
- Low in-rush solenoid

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 Nylon Bonnet and ABS Body
Durable construction that provides years of reliable operation.

Effluent Options Available

SPECIFICATIONS

Operational

- 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

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

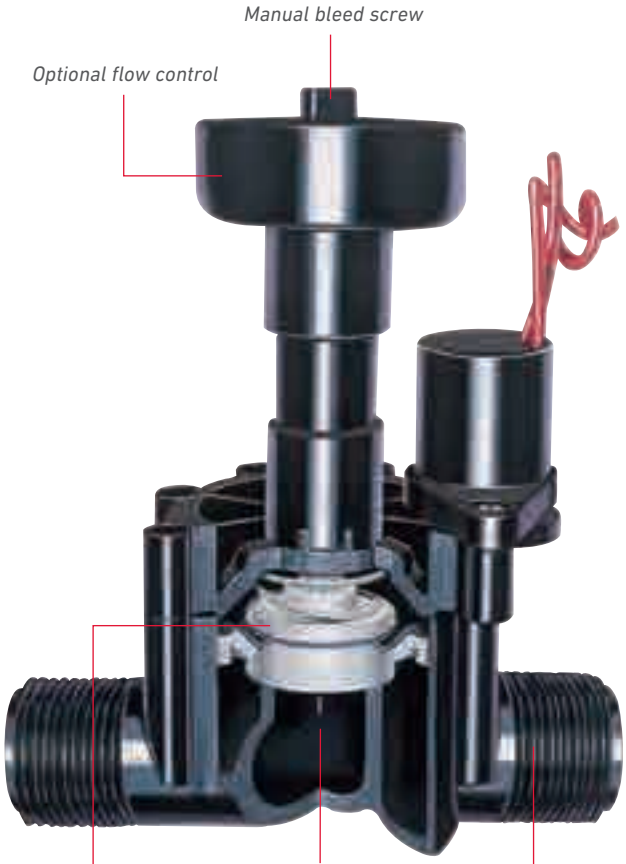
Options Available

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

Warranty

- Two years

PRODUCT HIGHLIGHT



254/264 SERIES PRESSURE LOSS DATA

Size	Model	gpm Flow											
		0.5	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 Pressure Loss to ensure sufficient downstream pressure. Flow rates are recommended not to exceed 5 psi loss. Values are listed in psi.*

250/260 SERIES PRESSURE 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

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 (Female)

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 (Male)

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.*

252 SERIES VALVES

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 ABS 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 a cost effective option for commercial applications.

Additional Features

- 24" lead solenoid wires on 1 1/2" and 2" models, 18" lead wires 1" models
- Self-cleaning, stainless steel metering pin (electric)
- Tough, glass-filled bonnet
- Single-piece diaphragm

FEATURES & BENEFITS

Heavy-Duty Toro Solenoid

Provides dependable operation and long life.

Fabric-Reinforced Rubber Diaphragm

Provides long-term resistance to tears and stretching.

Flow Control Handle

Adjusts the flow of each zone on a system.

Robust ABS Body Material and Durable Glass-Filled Cap

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

Effluent Options Available

SPECIFICATIONS

Operational

- Recommended Flow Range:
  - 1": 5.0 to 40 gpm
  - 1 1/2": 25 to 120 gpm
  - 2": 60 to 180 gpm
- Operating Pressure: 20 to 150 psi
- Solenoid: 24 Vac, 50/60 Hz
  - Inrush: 0.30 amps, 7.20 Vac
  - Holding: 0.20 amps, 4.80 Vac
- Burst pressure safety rating: 380 psi

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

Options Available

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

Warranty

- Two years

PRODUCT 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.

Combination Globe and Angle Valve
The all-in-one globe and angle configuration allows flexibility in design and installation. Angle installations allow for less pressure loss across the piping system, while globe configurations are standard in many irrigation systems.

252 SERIES PRESSURE 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 Pressure 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

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

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.*

P-220 SERIES VALVES

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.

Additional Features

- 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®
- EPDM diaphragm and seat seal

FEATURES & BENEFITS

Durable Glass-Filled Nylon Construction

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.

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

SPECIFICATIONS

Operational

- Flow Range:
  - 1": 5 to 50 gpm
  - 1 1/2": 30 to 110 gpm
  - 2": 80 to 150 gpm
  - 3": 130 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 flow requirement of 5 gpm
- Minimum Pressure Differential (between inlet and outlet) for Pressure Regulation: 10 psi
- Body Styles:
  - Globe/Angle – 1", 1 1/2", 2" & 3" female threads
- Solenoid: 24 Vac (50/60 Hz) Standard (118-5982)
  - -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, 24 Vac, 60 Hz; and Warning Tag (EFF-KIT-60HZ)
- Potted DC Latching Solenoid Assembly (DCLS-P)
- Spike Guard™ Solenoid, 24 Vac, 50/60 Hz (SGS-12) *not compatible with 2-wire systems*

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

PRODUCT 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.

P-220 SERIES MODEL LIST

Model	Description	
		WITH PRE-INSTALLED LATCHING SOLENOIDS
P220-26-04	1" NPT, Globe/Angle	P220-26-94
P220-26-06	1½" NPT, Globe/Angle	P220-26-96
P220-26-08	2" NPT, Globe/Angle	P220-26-98
P220-26-00	3" NPT, Globe/Angle	P220-26-90
PRESSURE-REGULATED WITH EZ REG®		**WITH PRE-INSTALLED LATCHING SOLENOIDS**
P220-27-04	1" NPT, Globe/Angle	P220-27-94
P220-27-06	1½" NPT, Globe/Angle	P220-27-96
P220-27-08	2" NPT, Globe/Angle	P220-27-98
P220-27-00	3" NPT, Globe/Angle	P220-27-90

P-220 SERIES PRESSURE 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	4.00	4.20	3.20	4.10	7.20																	
	Angle	4.00	4.20	3.10	2.70	4.80																	
1 1/2"	Globe				1.60	2.30	3.60	5.20	7.00	9.20	11.20	13.60	16.40										
	Angle				1.30	1.60	2.80	4.00	5.50	7.10	8.90	10.90	13.50										
2"	Globe									2.10	2.70	3.30	4.00	4.80	5.60	6.50	7.50	8.70					
	Angle									1.20	1.60	2.00	2.40	2.80	3.30	3.90	4.40	5.20					
3"	Globe																2.50	3.00	4.10	5.30	6.70	8.30	10.10
	Angle																1.90	2.40	3.30	4.30	5.50	6.90	8.50

***Note:** For optimum performance when designing a system, be sure to calculate total Pressure 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-XX			
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—1½" 8—2" 0—3"
Example: A 1" P-220 Series plastic electric, pressure-regulating valve would be specified as: **P220-27-04**			

P-220S SCRUBBER SERIES VALVES

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 ACT™ (Active Cleansing Technology), which helps prevent the build-up of sand, algae, and other organic materials that may inhibit water from metering properly through the valve.

Additional Features

- Internal and external bleeds
- 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

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.

ACT™ (Active Cleansing Technology)

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 Seal

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

SPECIFICATIONS

Operational

- Flow Range:
  - 1": 5 to 50 gpm
  - 1 1/2": 30 to 110 gpm
  - 2": 80 to 150 gpm
  - 3": 130 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 flow requirement of 5 gpm
- Minimum Pressure Differential (between inlet and outlet) for Pressure Regulation: 10 psi
- Body Styles:
  - Globe/Angle with female threads
- Solenoid: 24 Vac (50/60 Hz) Standard (118-5982)
  - 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, 24 Vac, 60 Hz; and Warning Tag (EFF-KIT-60HZ)
- Potted DC Latching Solenoid (DCLS-P)

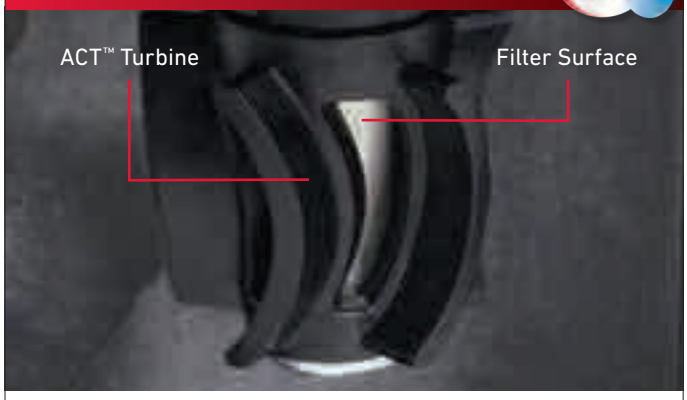
Dimensions

- 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

PRODUCT HIGHLIGHT



The P-220S Scrubber Series Valves Feature Toro's Patented ACT™ (Active Cleansing Technology) 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-220S SCRUBBER SERIES MODEL LIST

Model	Description
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-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-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

TORO P-220S 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 Pressure 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-XX			
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**			

220 BRASS SERIES VALVES

Heavy-duty brass construction for superior performance under the harshest conditions. Toro® 220 Brass Series valves are rugged and reliable, and offer dependable performance in the toughest situations and settings.

FEATURES & BENEFITS

Leading Lighting Protection (Spike Guard™)

A lightning rating that exceeds 20,000 volts – nearly three times the protection of competing products.

Dirty Water Ready

A stainless steel 120-mesh filter enables dependable valve operation in dirty and reclaimed water applications.

Spike Guard™ Solenoid

Reduces wire size requirements and allows twice as many valves to run simultaneously on a transformer, all while lowering power consumption and related costs.

EZReg® Pressure Regulator compatible

Available in two fully-adjustable models, Toro EZReg Pressure Regulators allow the consistent regulation of pressure within a zone, ensuring optimal operation of all downstream sprinklers. EZReg Pressure Regulators thread directly to the valve bonnet – no special adaptor required and no need to remove the solenoid. The desired pressure can be set fast and with a high level of accuracy thanks to an easy-to-read turn dial design.

Additional Features

- Commercial-grade 316 Stainless Steel stem for maximum corrosion resistance
- Manual Flow Control; adjustable to full shut-off
- Robust, double-beaded, fabric-reinforced rubber diaphragm
- Built-in Schrader-type valve is standard on all models for fast downstream pressure verification
- EZReg® Pressure Regulator can be installed as a service kit without having to drain the main line
- Pressure regulates in electric or manual modes, and is serviceable under pressure

Effluent Options Available

Pressure Regulation

DC Latching Solenoid Option

Spike Guard™ Standard

Notes: *All come with Effluent Sticker and Label. Compatible with DC Latching Solenoid and 24 Vac.*

SPECIFICATIONS

Operational

- Flow Range:
  - 1" model: 5 to 40 gpm
  - 1 1/4" model: 20 to 100 gpm
  - 1 1/2" model: 20 to 120 gpm
  - 2" model: 30 to 170 gpm
  - 2 1/2" model: 60 to 250 gpm
  - 3" model: 80 to 350 gpm
- Operating Pressure: 10 to 220 psi
- Pressure Regulating:
  - Outlet (EZR-30): 5 to 30 psi ± 3
  - Outlet (EZR-100): 5 to 100 psi ± 3
  - Minimum flow requirement of 5 gpm
- Minimum Pressure Differential (between inlet and outlet) for Pressure Regulation:
  - 1", 1 1/4", and 1 1/2" models: 10 psi
  - 2", 2 1/2", and 3" models: 20 psi
- Burst Pressure Safety Rating: 750 psi
- Body Styles:
  - Globe orientation – 1", 1 1/4", 1 1/2", and 2" models, female threads
  - Angle orientation – 2 1/2" and 3" models, female threads

Options Available

- EZReg®, 5-30 psi adjustable Pressure Regulator (EZR-30)
- EZReg®, 5-100 psi adjustable Pressure Regulator (EZR-100)
- Effluent Water Solenoid and warning tag; lavender color, 24V AC / 60 Hz (EFF-KIT-60HZ)
- 24 Vac Solenoid; 60 Hz, 18-inch leads, and captive plunger (118-5982)
- Potted DC Latching Solenoid (DCLS-P)

Dimensions

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

Warranty

- Five years

PRODUCT HIGHLIGHT

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.

220 BRASS SERIES VALVES MODEL LIST

Model	Description
220-26-04	1" Inlet/Outlet; Globe
220-26-05	1 1/4" Inlet/Outlet; Globe
220-26-06	1 1/2" Inlet/Outlet; Globe
220-26-08	2" Inlet/Outlet; Globe
220-26-09	2 1/2" Inlet/Outlet; Angle
220-26-00	3" Inlet/Outlet; Angle
PRESSURE REGULATED WITH EZREG®	
220-27-04	1" Inlet/Outlet; Globe
220-27-05	1 1/4" Inlet/Outlet; Globe
220-27-06	1 1/2" Inlet/Outlet; Globe
220-27-08	2" Inlet/Outlet; Globe
220-27-09	2 1/2" Inlet/Outlet; Angle
220-27-00	3" Inlet/Outlet; Angle
WITH 24 VAC SOLENOID	
220-26-74	1" Inlet/Outlet; Globe
220-26-75	1 1/4" Inlet/Outlet; Globe
220-26-76	1 1/2" Inlet/Outlet; Globe
220-26-78	2" Inlet/Outlet; Globe

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

220 BRASS SERIES VALVES PRESSURE LOSS DATA

Model	Type	Gallons Per Minute																		
		5	10	15	20	30	40	50	60	70	80	100	120	150	170	180	200	250	300	350
1"	Electric	1.8	2.0	2.2	3.1	5.1	7.8													
1 1/4"	Electric				1.9	2.5	2.7	3.5	4.1	5.6										
1 1/2"	Electric				2.2	2.5	2.8	3.1	3.8	5.0	6.6									
2"	Electric					3.1	3.2	2.9	3.0	3.3	3.4	4.5	6.6	10.1	13.5	14.9				
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 optimal performance when designing a system, it is recommended that total Pressure Loss be calculated to ensure sufficient downstream pressure. For optimum pressure regulation performance, size regulating valves towards the higher flow ranges. Flow rates are recommeded not to exceed 5 psi loss.*

Specifying Information – 220 Brass Series Valves

220-2X-X-X			
Model	***Type***	***Solenoid***	***Thread Size***
220	**2X**	**X**	**X**
220-220 Series Brass Valve	6 - NPT, Electric 7 - NPT, Pressure-regulated (5-100 psi)	0 - Spike Guard Solenoid 6 - Less Solenoid 7 - 24 Vac Solenoid 9 - DC Latching Solenoid	4—1" 8—2" 5—1 1/4" 9—2 1/2" 6—1 1/2" 0—3"
Example: A 1" NPT, pressure-regualted 220 Series Brass Valve with Spike Guard Solenoid, would be specificed as: **220-27-04**			

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

QUICK COUPLER SERIES

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

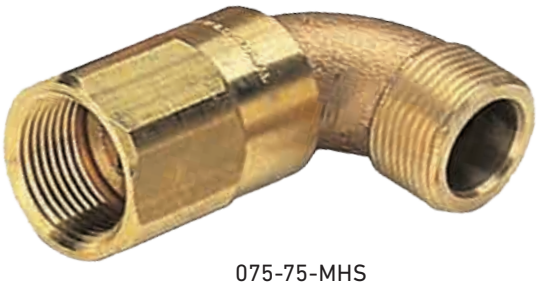
There are a variety of one-piece and two-piece models in 3/4" and 1" sizes, including ACME thread key connections.

Eliminate Tangled Hoses

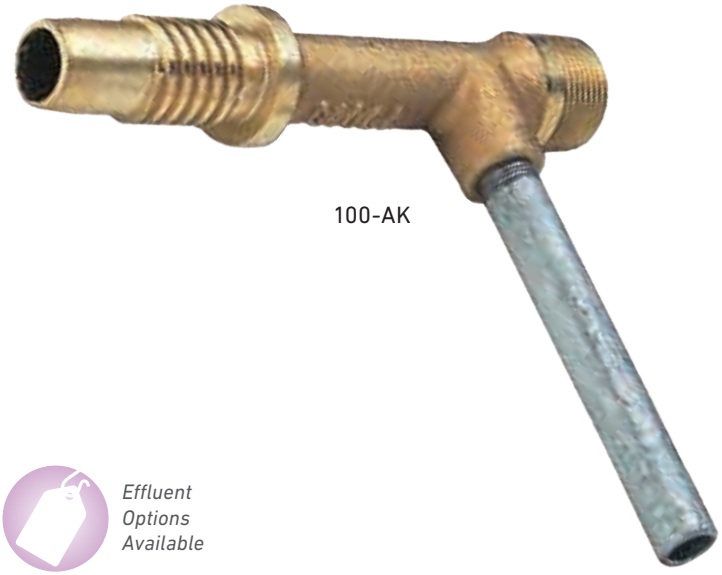
The 360-degree hose swivel provides movement without hose tangling.

100-SLSC

100-ATLVC



075-75-MHS



100-AK

Effluent Options Available

QUICK COUPLER SERIES PRESSURE 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 Pressure Loss to ensure sufficient downstream pressure. Values listed in psi. Flow rates are recommended not to exceed 5 psi loss.*

QUICK COUPLER KEYS AND ACCESSORIES MODEL LIST

Model	Description
075-SLK	¾" Single Lug Key with ¾" Male and ½" Female NPT 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

Specifying Information—Quick Couplers

XXX-XXX-XXX		
Size	***Configuration***	***Cover***
XXX	**XXX**	**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 with a vinyl locking cover, would be specified as: **100-SLVLC**		

ELECTRIC-HYDRAULIC CONVERTERS

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.

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

Operational

- Pressure: 40-150 psi
- Wiring: 18 AWG x 4' wire leads
  - Maximum distance from converter to valve:
    3/16" – 500'
    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 3/4" W x 4 1/2" H x 2 1/2" D
- 12-Station:
  – 8 3/4" W x 12 1/2" H x 2 1/2" D
- 16-Station:
  – 8 3/4" W x 16 1/2" H x 2 1/2" D

Warranty

- Two years

VALVE ACCESSORIES

SOLENOIDS

DCLS-P
- Potted DC Latching Solenoid for Toro valves
- Compatible with EZ-Flo Plus, TPV, P-200, P-220S Scrubber and 220 Brass Series valves.

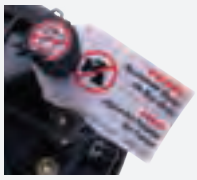
118-5982
- 24 Vac Solenoid assembly for EZ-Flo Plus, TPV, P-220, P-220S Scrubber, and 220 Brass Series valves.
- Captive hex plunger
- 18" leads

SGS-12
- 24 Vac Spike Guard Solenoid assembly for EZ-Flo Plus, TPV, P-220, P-220S Scrubber, and 220 Brass Series valves.
- 20,000 volts lightning rating
- Inrush 0.2 amps/ Holding 0.1 amps

LWS
- 19 Vac Low Wattage Solenoid assembly for EZ-Flo Plus, TPV, P-220, P-220S Scrubber, and 220 Brass Series valves.
- Inrush 0.2 amps/ Holding 0.1 amps

EFFLUENT WATER INDICATORS

EFF-KIT-60HZ
- Lavender-colored 118-5982 Solenoid assembly for EZ-Flo Plus, TPV, P-220, P-220S Scrubber, and 220 Brass Series valves.
- Lavender-colored Effluent warning tag



RWSG-Kit
- Effluent tag and Solenoid sticker

EZREG® PRESSURE/INSTALLATION REGULATOR & EHC ACCESSORIES

EZR-30 and EZR-100
- Pressure regulator module for use with P-220, P-220S Scrubber and 220 Brass 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

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.

TORO®

CONTROLLERS

Pages 110-129

SMRT Logic™	112-115
EVOLUTION® Series	116-119
Scheduling Advisor™ Software	120-121
DDC™WP	122-123
TMC-424E Series	124-125
Custom Command™ Series	126-127
TDC Series Two-Wire System	128-129

SMRT Logic™ provides secure, on-demand access from anywhere of your Toro® irrigation controller, outdoor landscape lighting, and other landscape features through a smartphone, tablet, or PC.

Google and Google Home are trademarks of Google, Inc. and Amazon Echo are trademarks of Amazon.com, Inc.

TORO®

SMRT LOGIC™

FEATURES & BENEFITS

Simple
Simple Plug & Play installation allows the SMRT Logic Gateway to connect to the internet on its own with no need for network permissions or passwords.

Connected
Powered by a proprietary 900MHz radio signal, SMRT Logic communicates to your landscape systems with a level of consistency, distance, and security not seen across competing Wi-Fi and Bluetooth platforms.

Secure
Industry standard encryption coupled with Toro's proprietary radio technology provide secure access and communication between your landscape systems and SMRT Logic.

Compatible
SMRT Logic is backward compatible with Toro® EVOLUTION® Series, TMC Series, and Custom Command controllers.

SMRT Logic Gateway

SMRTscape™ EVO Mobile App
Available through iTunes App Store/Google Play.

SMRT Logic Website & Mobile App

SMRT Logic Gateway

EVOLUTION®

Unique Lighting Systems®

TMC-424

TMC-212

Custom Command™

Wireless Auxiliary Relay

SPECIFICATIONS

Operational
- Input: 5Vdc, 1 amp
- FCC

Dimensions
- 4.5" W x 5.5" H x 4.5" D (antenna installed in typical orientation)
- Weight: 0.6 lbs.

Warranty
- Five Years

Additional Features

- Add users (representatives) to an account for greater flexibility and ease to system management
- Control and manage up to 10 irrigation controllers through a single SMRT Logic gateway
- Control and program any 120V-powered indoor or outdoor device with a Wireless Auxiliary Relay (e.g., pond lights, fountains, awnings, Holiday lights, or indoor lamps)
- Custom name stations and programs, and add images through the SMRTscape™ mobile app and website.
- Compatible with existing TMC-424, TMC-212, and Custom Command™ Controllers equipped with Irritrol® Mini-Receiver (CL-MR)**

**Android™ and the Android™ logo are trademarks or registered trademarks of Google Inc. iOS® is a trademark or registered trademark of Cisco in the U.S. and other countries.*

Easy to Setup, Easy to Use

1. Connect the SMRT Logic Internet Gateway (Ethernet connection to router)
2. Register and create an account at www.SMRTscape.com
3. Configure Location(s), irrigation controllers, lighting scenes, and AUX relays.

works with the Google Assistant

amazon alexa

Specifying Information- SMRT Logic™

Model	Description
SMRT-T	SMRT Logic Internet Gateway

The Toro® EVOLUTION® series controller has changed the way we think about irrigation control. It combines a modern and intuitive design with wide-ranging functionality, making it perfect for everyday residential use, yet able to meet the needs of more complex landscapes.

TORO®

EVOLUTION® SERIES CONTROLLER

FEATURES & BENEFITS

Ease of Use

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.

Water-Saving Wireless Accessories

The unique Smart Connect® receiver plugs into the back of the front panel, 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.

Control from Anywhere

Manage your client's new or existing EVOLUTION through the internet using the Toro SMRT Logic™ gateway and SMRTscape™ mobile app or website.

Powerful Features

The EVOLUTION controller comes standard with features ready to meet the wide-ranging needs of your clients, such as three independent watering schedules, and a stand-alone Auxiliary schedule, modular expansion from 4 to 16 zones, and the capability to power up to four standard solenoids.

Additional Features

- Up to six schedules:
  - 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

Certified by ICC-ES

When equipped with a Wireless ET Weather Sensor (EVO-WS)

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.

SMRT Logic™ Internet Gateway

Monitor and manage the EVOLUTION controller from anywhere using your smartphone, tablet, or computer. SMRT Logic uses a secure 900 MHz radio frequency and has a communication range nearly three times that of competing Wi-Fi controllers.

Wireless ET Weather Sensor

Combines real-time temperature and solar measurements with historical ET data for your location to automatically calculate and adjust the irrigation schedule.

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 relay switches can be used to power and control a wide range of 120V ac devices, such as outdoor lighting, pumps, fountains, or outdoor entertainment systems.

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

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
EVO-WS	Wireless ET Weather Sensor
EVO-HH	Wireless Handheld Maintenance Remote
EVO-AR	Wireless Auxiliary Relay
SMRT-T	SMRT Logic™ Internet Gateway

Certified by ICC-ES

When equipped with a Wireless ET Weather Sensor (EVO-WS)

Additional Features *(continued)*

- 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

Hardware Features

- Backlit dispay
- 4-station base; expandable to 16-stations with 4- and 12-station hot-swappable modules
- Powerful transformer can run up to 4 standard solenoids at once
- Battery on the timing mechanism for Armchair Programmable
- 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	**XX**	**XX**	**SC**
EVO – 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 Smart Connect would be specified as: **EVO-ID-16-SC**			

SCHEDULING ADVISOR™ SOFTWARE

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.

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

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.

Download FREE software from
www.toro.com/evolution

**Smart Connect device not required for software programming capability.*

***Windows® is a registered trademark of Microsoft*

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

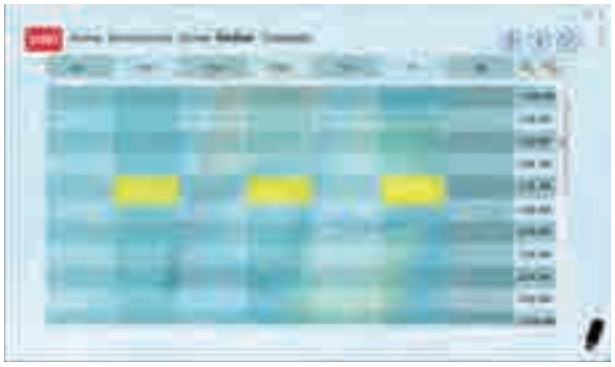
The software also allows you to enter custom names for schedules and zones (such as "Shrubs" or "Front Yard" instead of "Zone 1"), as well as contact information that the homeowner can access in the "local contact" screen any time they press the "Help" button on the controller. The information can be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



DDC™ WP SERIES CONTROLLER

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 potted DC latching solenoids.

FEATURES & BENEFITS

Fully Waterproof and Submersible

Submersible up to 6½ feet per IP-68 standards, the controller can be direct-mounted 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.

PRODUCT 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.

Wired Rain Sensor Compatible

SPECIFICATIONS

Operational

- Operating temperature: 0° - 60°F
- Operates using two 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

- 5 3/4" W x 5" H x 1 15/16" D
- Weight: 23.3 oz. without 9V battery

Warranty

- Three years

PRODUCT HIGHLIGHTS

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 6½ feet per IP-68.

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

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

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

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**		

TMC-424E SERIES

The Toro® 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.

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

Rain Sensor Compatible

PSS-KIT Compatible

Flow Sensor Compatible

TMR-1 Compatible

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

- 10 3/4" W x 10 1/4" H x 4 5/8" 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/TWRFS – Wireless RainSensor or Wireless Rain/Freeze Sensor
- TMR-1-KIT - Toro Maintenance Remote
- TFS-Flow Sensor

Warranty

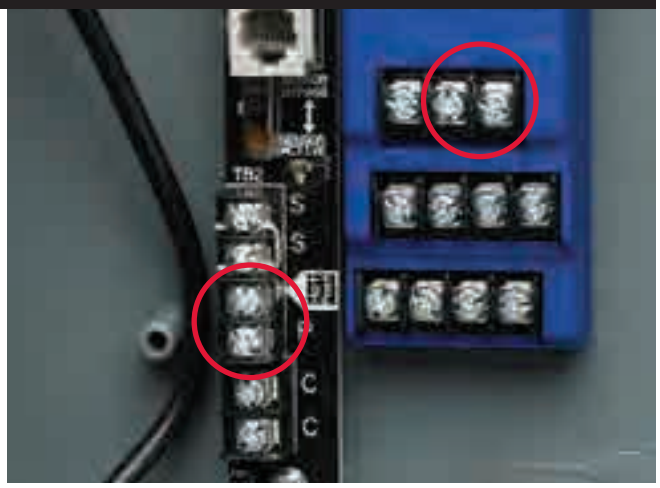
- Five years

Certified by ICC-ES

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

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

Specifying Information—TMC-424

TMC-424E-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.*

CUSTOM COMMAND™ SERIES

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.

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.

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

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

Rain Sensor Compatible

PSS-KIT Compatible

TMR-1 Compatible

Certified by ICC-ES

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

SPECIFICATIONS

Electrical
- Input Power
  - 120 Vac ± 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-KIT – Toro Maintenance Remote

Warranty
- Five years

PRODUCT 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 *(continued)*

- ✔ 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

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-XXX-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**			

TDC SERIES TWO-WIRE SYSTEM

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

Integrated Surge 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.

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

TMR-1 Compatible

Rain Sensor Compatible

PSS-KIT Compatible

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

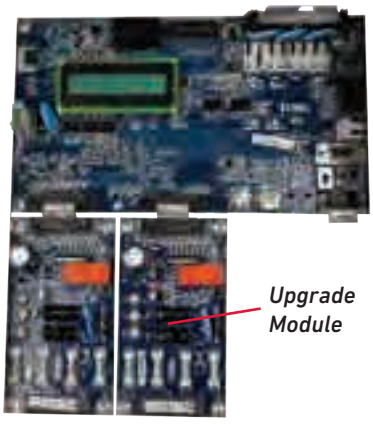
- Five years

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
TDC units may also be ordered preinstalled in a stainless steel pedestal.

*Please specify **CDEC-PED-100** or **CDEC-PED-200**.*

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.



Additional Features *(continued)*

- ✔ 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

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
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)

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*

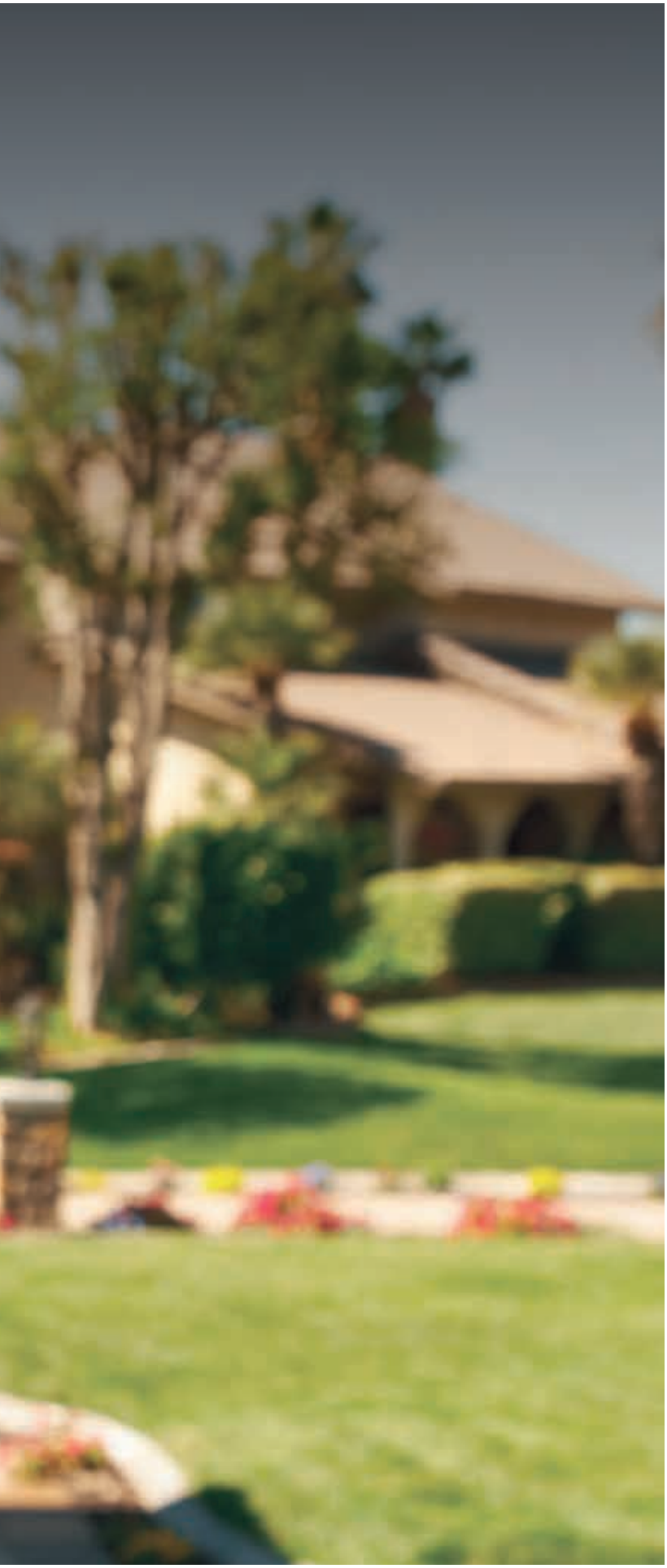
Specifying Information-TDC

CDEC-XXX-XXX		
Model	**Cabinet**	**Description**
CDEC	**XXX**	**XXX**
CDEC—Two-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.

TORO®



SENSORS & REMOTES

Pages 130-149

Precision™ Soil Sensor	132-135
Turf Guard®	136-137
Pro Series™ Soil Sensor	138-139
Wireless ET Weather Sensor	140-143
Wireless RainSensor™	144
Wired RainSensor™	145
TFS Flow Sensors	146
TMR Maintenance Remote	147
EVOLUTION® Smart Connect® Remote	148
EICON Remote	149

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.

PRECISION™ SOIL SENSOR

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.

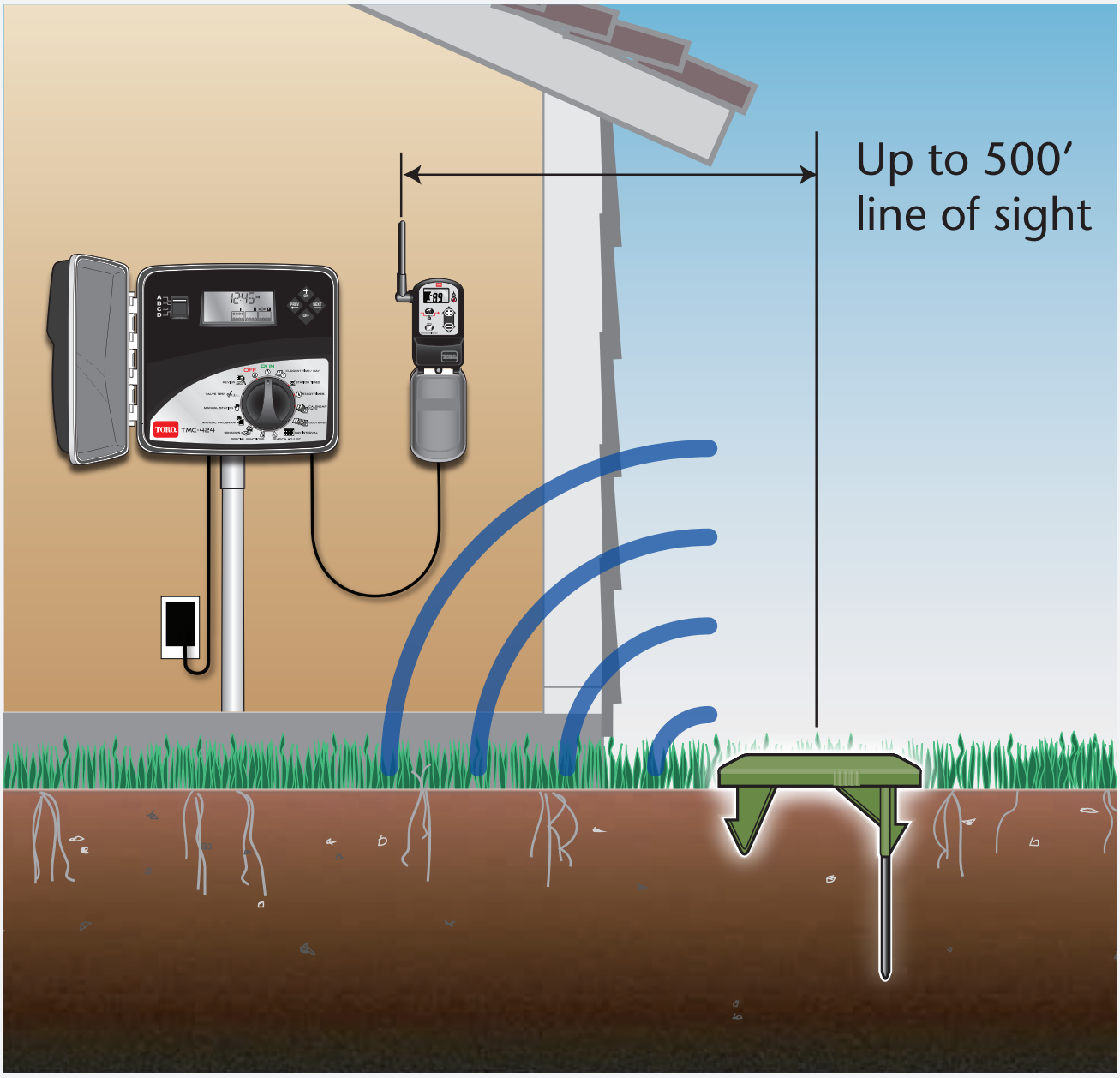
Freeze Detection

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

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
- 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

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).

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

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

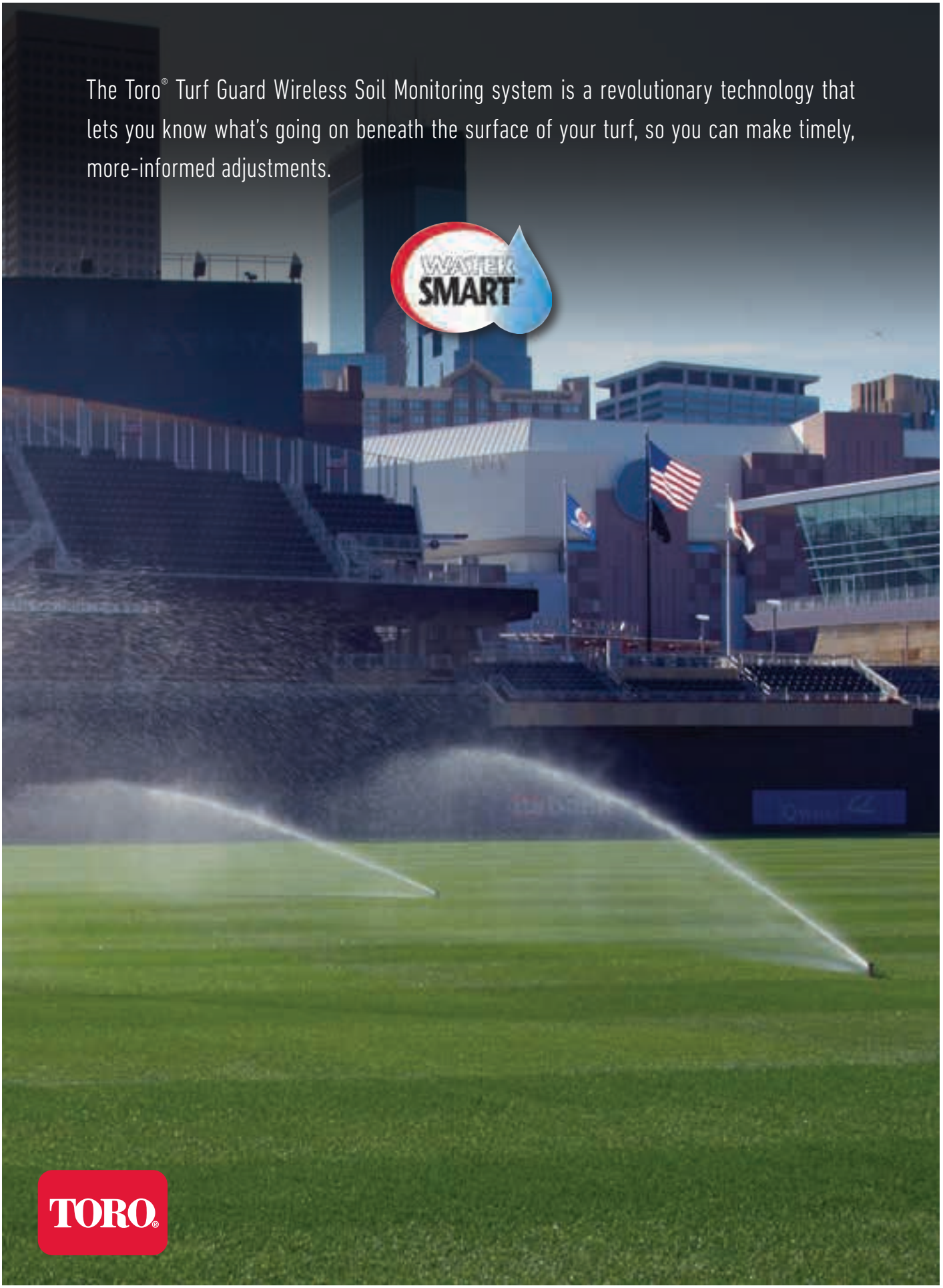
Additional Features *(continued)*

- 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 integrated 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®)


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.
WATER SMART
TORO®

TURF GUARD® SOIL MONITORING SYSTEM

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

SPECIFICATIONS

Electrical

- Input Power:
  - Repeater: <0.02 amps @ 6 Vdc
  - Base Station: <0.1 amps @ 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

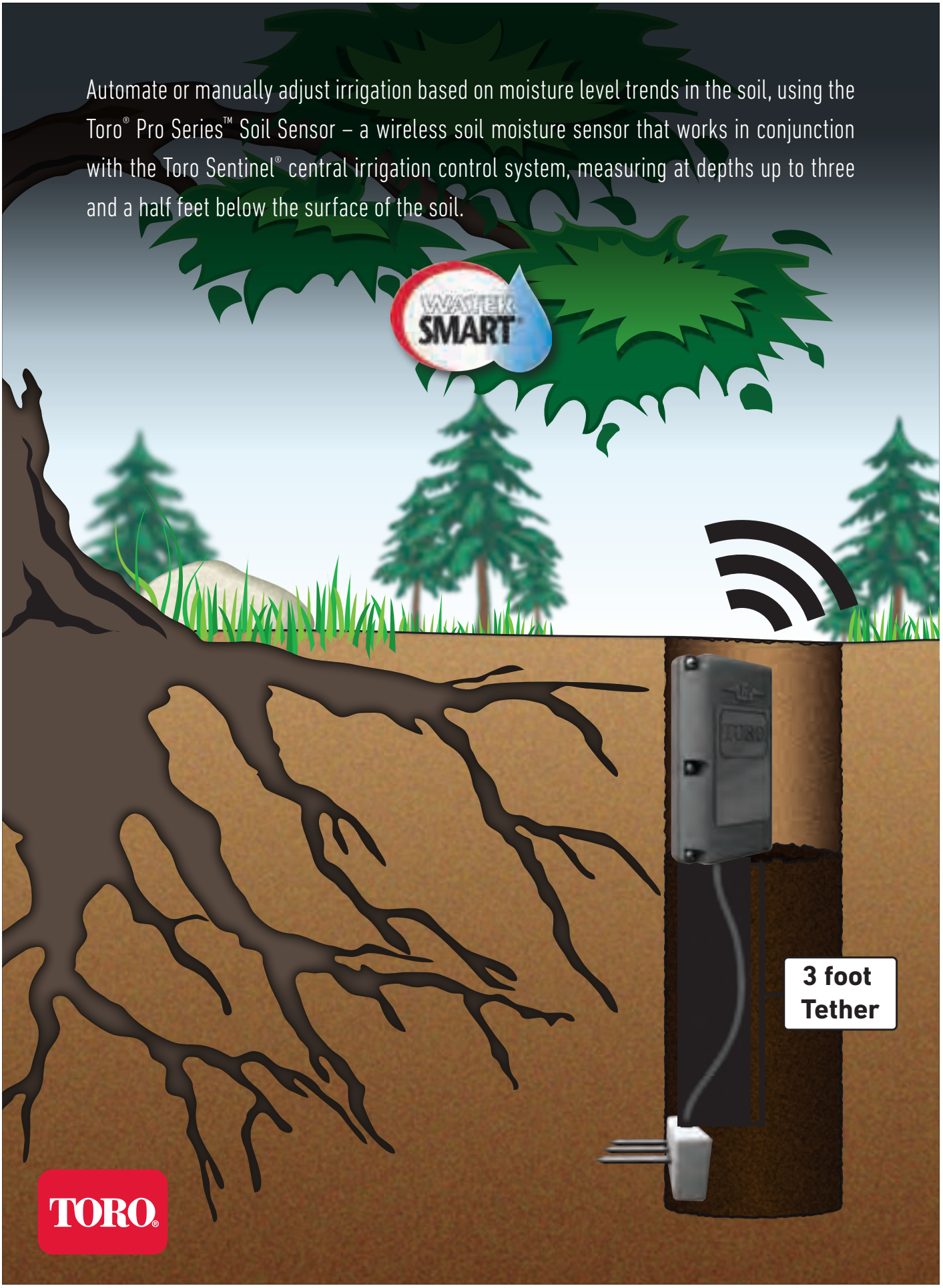
Warranty

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

Specifying Information—Turf Guard

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

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.



PRO SERIES™ SOIL SENSOR

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 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: <0.02 amps @ 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 (TG-B)

Warranty

- Two years

Specifying Information—Pro Series™ Soil Sensor

Model	Description
TPS-SS	Toro Pro Series Soil Sensor
TS-TGB	Toro Pro Series Receiver

The Toro® Wireless ET Weather Sensor makes saving water easy through the automatic management of the irrigation schedule. Combining real-time temperature and sunlight measurements with location-based ET (evapotranspiration) data, the Wireless ET Weather Sensor wirelessly communicates seasonal adjustments to the EVOLUTION® Series controller. The EVOLUTION controller uses the information to automatically adjust the scheduled runtimes, helping to ensure the landscape receives just the right amount of water.

TORO®

WIRELESS ET WEATHER SENSOR

FEATURES & BENEFITS

On-site Weather in Real-time

Continuously monitors temperature and sunlight to generate schedule adjustments based on what's happening at the site.

Built in Rain/Freeze Sensor

Adjustable freeze sensor and rain gauge automatically suspends irrigation in the event of precipitation and near-freezing temperatures.

Completely Wireless

Installed in minutes and powered by a single 9V battery, the sensor presents ultimate flexibility with a communication range of 1,000 feet.*

Historical Weather Information

The sensor includes a decades' worth of historical weather data for North America that is used by the controller to generate schedule adjustments in the event of communication issues due to a depleted battery.

No Fees

The sensor is self-sufficient and does not require any external data, or associated subscription fees, to operate.

**Line of sight*

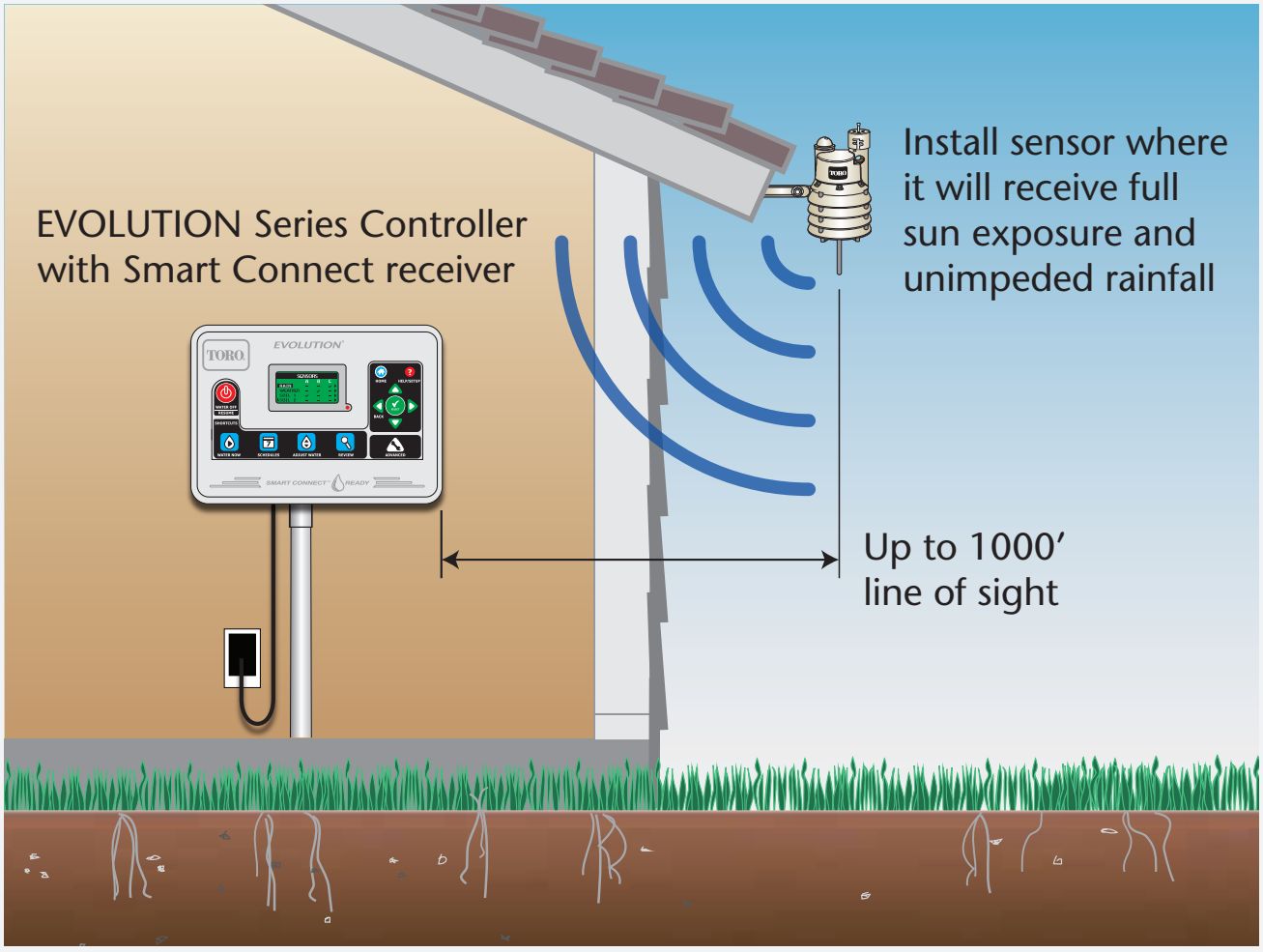
Certified by ICC-ES

EPA WaterSense approved when equipped with an EVOLUTION® Series controller

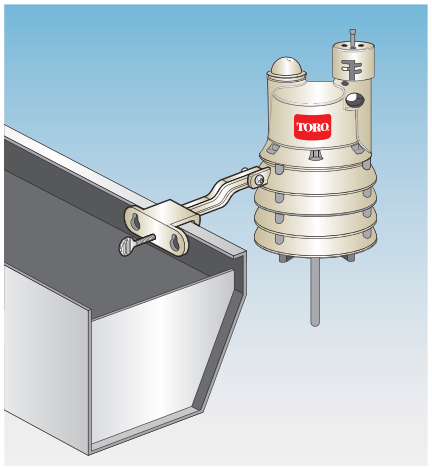
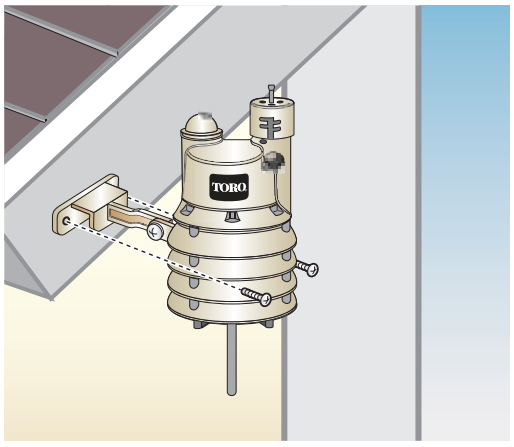
Additional Features

- EPA WaterSense certified when used in combination with the Toro EVOLUTION Series controller
- Sensor data and schedule adjustments viewable on-demand through EVOLUTION Review screens
- QuickClip™ mounting arm
- Automatic freeze shutoff feature prevents watering when temperatures approach freezing
- Low battery indicator and alert in the EVOLUTION controller
- Dryout days are adjustable between 0-14 days after a rain event
- One sensor can support multiple controllers within range

HOW IT WORKS



TWO MOUNTING OPTIONS:

QuickClip™ Gutter Bracket	Wall Mount
	

SPECIFICATIONS

Operational
- Sensor wirelessly connects with the EVOLUTION Series controller via the Smart Connect receiver (EVO-SC, sold separately)
- Up to 1000' range, line of sight
- EPA WaterSense certified when used in combination with the Toro EVOLUTION Series controller
- FCC Approved

Electrical
- 9 Vdc 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

EVOLUTION® Series controller and Smart Connect® receiver

Certified by
ICC-ES

EPA WaterSense approved when equipped with an EVOLUTION® Series controller

Specifying Information—Wireless ET Weather Sensor

Model	Description
EVO-WS	Wireless ET Weather Sensor for use with EVOLUTION Series controller (equipped with Smart Connect receiver)

WIRELESS RAINSENSOR™

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.

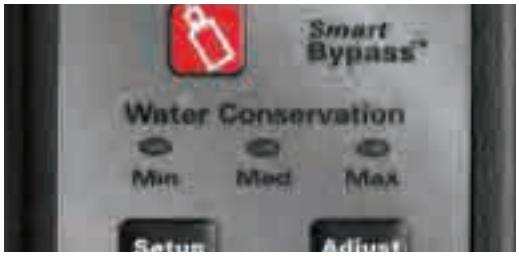
FEATURES & BENEFITS

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 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.*

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

Electrical

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

Warranty

- Five years

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 RAINSENSOR™

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.

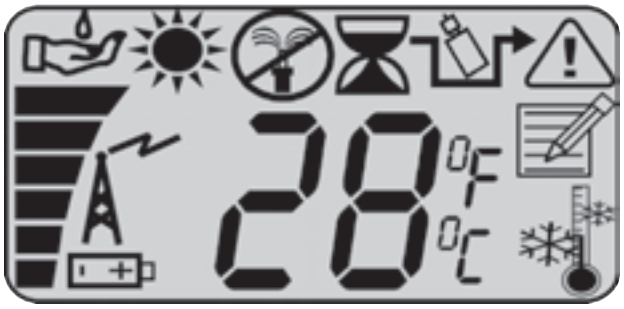
Maintenance Free Hygroscopic Discs

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

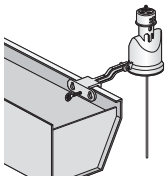
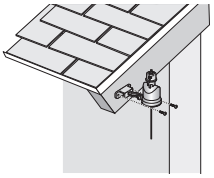
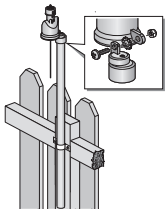
Includes 25 feet of white outdoor-rated, UV-resistant cable.

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.



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

THREE MOUNTING OPTIONS:

Quick Clip Gutter Bracket	
Wall Mount	
Conduit Adapter	

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

Specifying Information–Wired Sensor

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

TFS FLOW SENSORS

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.

Additional Features

- Simple, yet effective 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

FEATURES & BENEFITS

Effective Flow Monitoring Even In Flows Lower 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 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).

SPECIFICATIONS

Operational

- Output: Two-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

TMR MAINTENANCE REMOTE

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.

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

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-424E, Custom Command, and 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

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 upgraes to features or access to data
- Water resistant case
- Battery indicator
- Set the maximum zone count to match the controller

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

Specifying Information—Smart Connect® Remote

Model	Description
EVO-HH	Smart Connect Handheld Remote

EICON REMOTE

FEATURES & BENEFITS

Up to 5-Mile Line-of-Sight Range

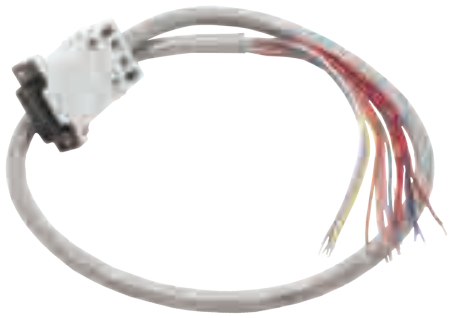
Plus powerful UHF FM signal is the best available tool for communicating with receivers behind walls or in other hard-to-reach locations.

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 date 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 Remote

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

**Only available in RLM Version. Rain Bird® is a registered trade mark of Rain Bird Corporation.*

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.

TORO®

LANDSCAPE DRIP

Pages 150-173

DL2000™ Series Subsurface Dripline	152-155
Drip In® Brown Dripline	156-159
DL2000 Series Microline with ROOTGUARD®	160
Soakerline™ Classic Dripline	160
Drip Fittings & Accessories	161
Blue Stripe® Poly Hose	162-163
NGE® Emitters	164-165
Turbo SC™ Plus Emitter	166
E-2™ Classic Emitter	167
Pressure Regulating Multi-Outlet Manifold	168
Drip Bubblers	169
Varis™ & Varistake™ Adjustable Emitters	170
Pressure Regulators	170
Plastic Y Filters	171
Drip Zone Valve Kits	172-173

Toro® offers DL2000™ with ROOTGUARD® for residential, commercial and sports turf applications. DL2000 with ROOTGUARD is the most technologically advanced subsurface irrigation system available, delivering optimal water application directly to the root zone while impeding roots from clogging the emitters. DL2000 with ROOTGUARD is suited to the irrigation of lawns and gardens, shrub areas, median strips, sports fields, vandal prone areas and more.

Distinctive red stripe on tubing signifies DL2000 with ROOTGUARD

DL2000™ SERIES SUBSURFACE DRIPLINE

FEATURES & BENEFITS

U.S. Government-Approved ROOTGUARD® Protection

The pre-emergent, ROOTGUARD® material 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.

Environmentally Friendly

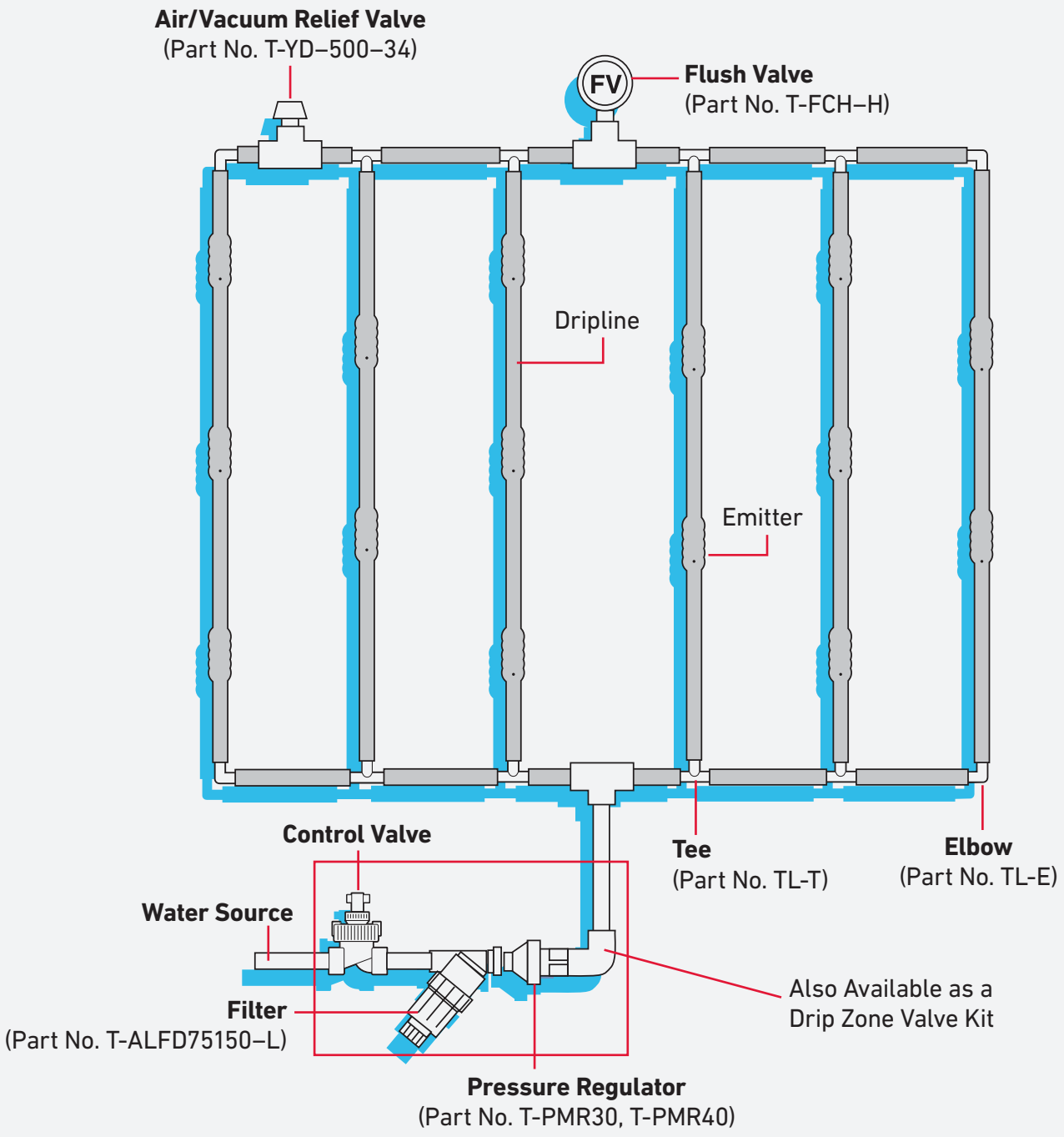
Irrigation takes place at or below grade so there is minimal water loss due to mist, evaporation, run-off or wind. Fertigation needs are reduced because water is applied only at the root zone.

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

HOW IT WORKS



Other fittings available:

- Coupling (Part No. TL-C)
- Adapter (Part No. TL-M50)
- Compression Adapter (Part No. T-CA-710)

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 stripe on tubing signifies DL2000 with ROOTGUARD®

Warranty

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

DL2000 MODEL LIST

Model	Description
5/8" DL2000 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

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 (in./hr.) = Precipitation Rate Formula:

$$\frac{231.1 \times \text{Emitter Flow (gph)}}{\text{Lateral Spacing (in.)} \times \text{Emitter Spacing (in.)}}$$

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

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

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'

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 Tri-Loc™ 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.
WATER SMART
TORO®

DRIP IN® BROWN DRIPLINE

FEATURES & BENEFITS

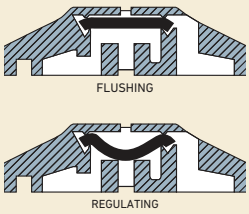
Built-in Emitters
Deliver precise water application directly to the root zone.

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.

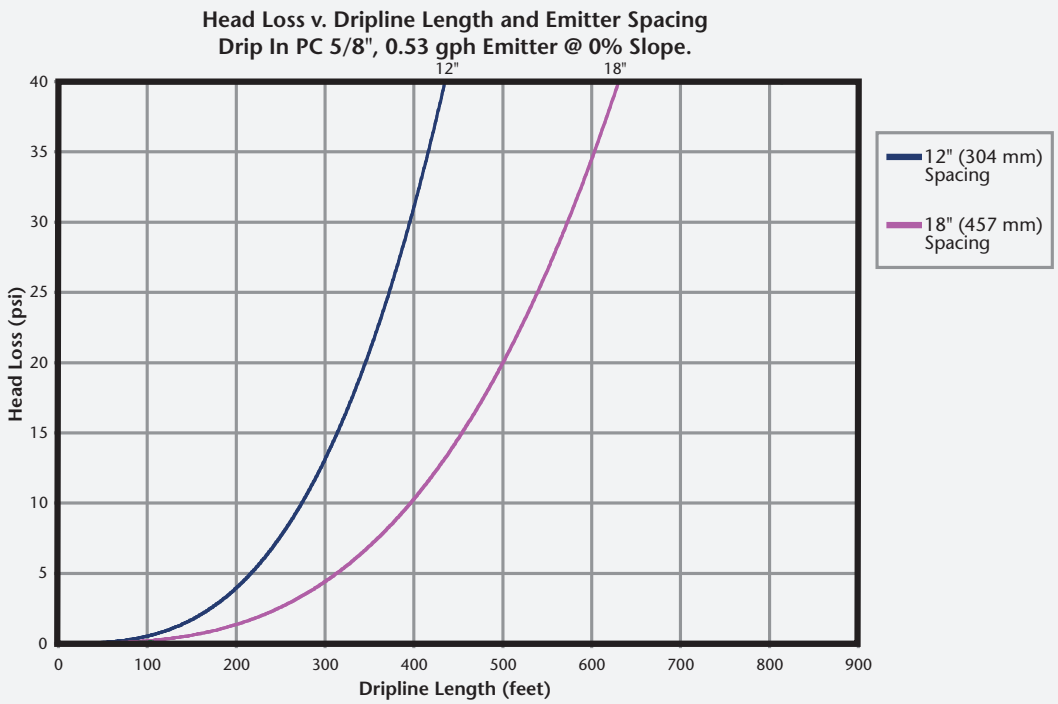
Effluent Options Available

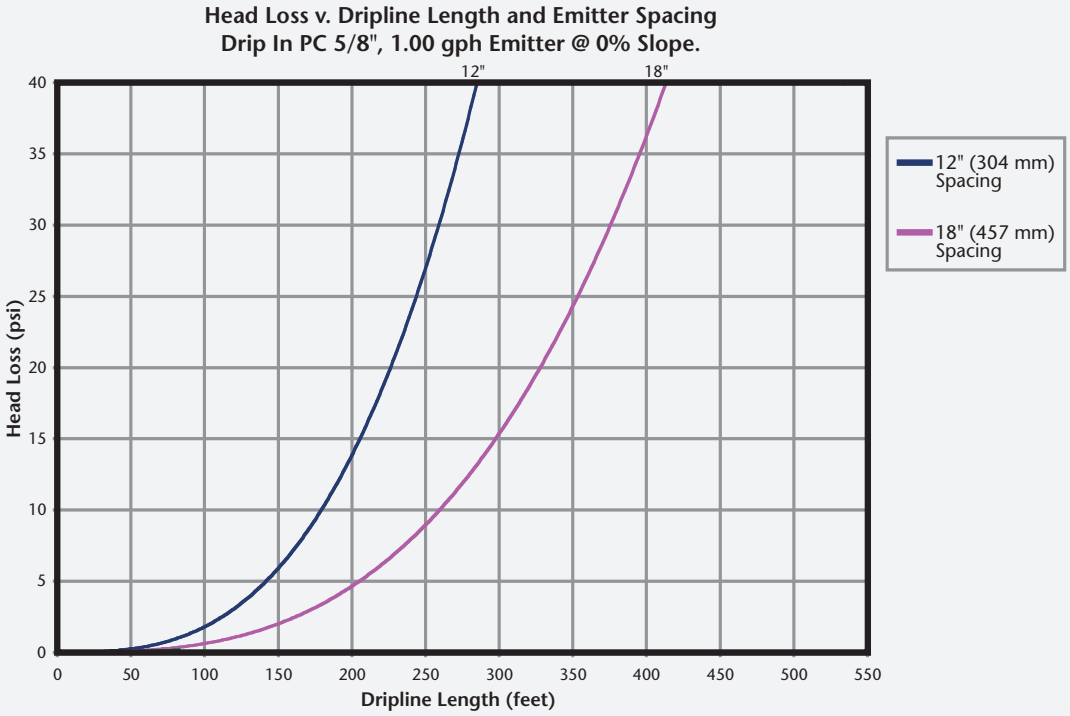


Unique, Continuous Flushing
Flushing occurs at low pressure at start up, during the irrigation cycle if the emitter begins to clog and there is a reduction in flow, and as pressure drops during shut-down.

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.


Head Loss v. Dripline Length and Emitter Spacing
Drip In PC 5/8", 0.53 gph Emitter @ 0% Slope.
12"
18"
Head Loss (psi)
0
5
10
15
20
25
30
35
40
0
100
200
300
400
500
600
700
800
900
Dripline Length (feet)
12" (304 mm) Spacing
18" (457 mm) Spacing


Head Loss v. Dripline Length and Emitter Spacing
Drip In PC 5/8", 1.00 gph Emitter @ 0% Slope.
12"
18"
Head Loss (psi)
0
5
10
15
20
25
30
35
40
0
50
100
150
200
250
300
350
400
450
500
550
Dripline Length (feet)
12" (304 mm) Spacing
18" (457 mm) Spacing

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'

DRIP IN 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

DRIP IN 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

Specifying Information—Drip In 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**					

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 page 191.*

LENGTH OF RUN CHART

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

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.

Specifying Information—Microline

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

SOAKERLINE™ ¼" 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 page 191.*

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.

DRIP FITTINGS AND ACCESSORIES

Tri-Loc™ Fittings

- Fits 16, 17 & 18mm OD Hose and Dripline
- 1 Fitting – 3 Tubing Sizes – Save Time!
- Superior Retention Strength
- Ergonomic Collars Reduce Fatigue
- Easy To Reuse–Save Money!

Specifying Information—Tri-Loc™ Fittings

Model	Description
TL-C	Tri-Loc Coupling
TL-E	Tri-Loc Elbow
TL-T	Tri-Loc Tee
TL-M50	Tri-Loc 1/2" MPT Adapter
TL-M75	Tri-Loc 3/4" MPT Adapter
TL-CAP	Tri-Loc MHT Cap (Flush)
TL-FH75	Tri-Loc 3/4" FHT Adapter
TL-T-F50	Tri-Loc 1/2" FPT Tee
TL-T-S50	Tri-Loc 1/2" Slip Tee
TL-T-M50	Tri-Loc 1/2" MPT Tee

Insert Barb Fittings

- Made from rigid Acetal material
- Double barb for stronger retention
- Fits 18mm OD (5/8" ID) DL2000 and Drip In

Specifying Information—Insert Fittings for Drip In & DL2000 Dripline

Model	Description
I620-C	Insert Coupling
I620-E	Insert Elbow
I620-T	Insert Tee
I620-M50	½" MPT Adapter

T-YD-500-34

T-FCH-H-FIPT

T-FPG02

T-FCH-H-FHT

T-FJQ16

T-IPS1500

T-SS6-50

T-DL-MP9

T-FCC0400

T-FTT0400

T-FEE0400

T-FCV-BB

T-CA-710

T-CEFCH-H

T-FMP16

T-FMP08

T-IPS0104

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

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

BLUE STRIPE® POLYETHYLENE HOSE

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 most requested hose on the market.

FEATURES & BENEFITS

Manufactured From Premium Grade Linear Low Density Polyethylene

For 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.

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
P,X	T-EHD1645-050A (palletized)	5/8"	0.615	0.705	0.045	500	18.9	61
P,X	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 page 191.*

BLUE STRIPE® POLYETHYLENE HOSE MODEL LIST

Model	Description
MICRO-DISTRIBUTION HOSE - COIL STRETCH WRAPPED	
T-EHW0437-100	LLDPE; 1/4"; ID: 0.170''; OD: 0.250''; Wall: 0.040''; 1,000' coil
MICRO-DISTRIBUTION HOSE - COIL BANDED	
T-EHD0437-010	LLDPE, 1/4", ID-0.170'', OD-0.250'', Wall-0.040'', 100' coil
INSIDE DIAMETER (ID) CONTROLLED - COIL STRETCH WRAPPED	
T-EHW1645-010	5/8"; ID: 0.615''; OD: 0.705''; Wall: 0.045''; 100' coil
T-EHW1645-050	5/8"; ID: 0.615''; OD: 0.705''; Wall: 0.045''; 500' coil
INSIDE DIAMETER (ID) CONTROLLED - COIL BANDED	
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

Model	Description
LAVENDER STRIPE ROUND HOSE	
INSIDE DIAMETER (ID) CONTROLLED - COIL BANDED	
T-EHP1645-050A	5/8", ID-0.615'', OD-0.705'', Wall-0.045'', 500' coil (palletized)
T-EHP2057-050A	3/4", ID-0.805'', OD-0.920'', Wall-0.057'', 500' coil (palletized)
WHITE STRIPE™ ROUND HOSE	
INSIDE DIAMETER (ID) CONTROLLED - COIL BANDED	
T-EHX1645-050A	5/8", ID-0.615'', OD-0.705'', Wall-0.045'', 500' coil (palletized)
T-EHX2057-050A	3/4", ID-0.805'', OD-0.920'', Wall-0.057'', 500' coil (palletized)

Specifying Information—Blue Stripe® Polyethylene Hose

T-EH-X-XX-XX-XXX-A				
Model	*Stripe Color/Packaging*	*Tubing Size (ID)*	*Wall Thickness*	*Optional*
T-EH	**X**	**XX**	**XX**	**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 - 4mm (.17") 15 - 15mm (.57") 16 - 16mm (.62") 20 - 20mm (.81") 26 - 26mm (1.06")	37 - .037" 45 - .045" 54 - .054" 57 - .057" 67 - .067"	A- Palletized

NGE® EMITTERS

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

1.0 gph

2.0 gph

0.5 gph

Male Adapter
Option for use with ¼" exit tubing

FEATURES & BENEFITS

Uniform Flow Rates

Make the NGE ideal for use in difficult topographical conditions.

Unique Emitter Design And Pressure Compensating Diaphragm

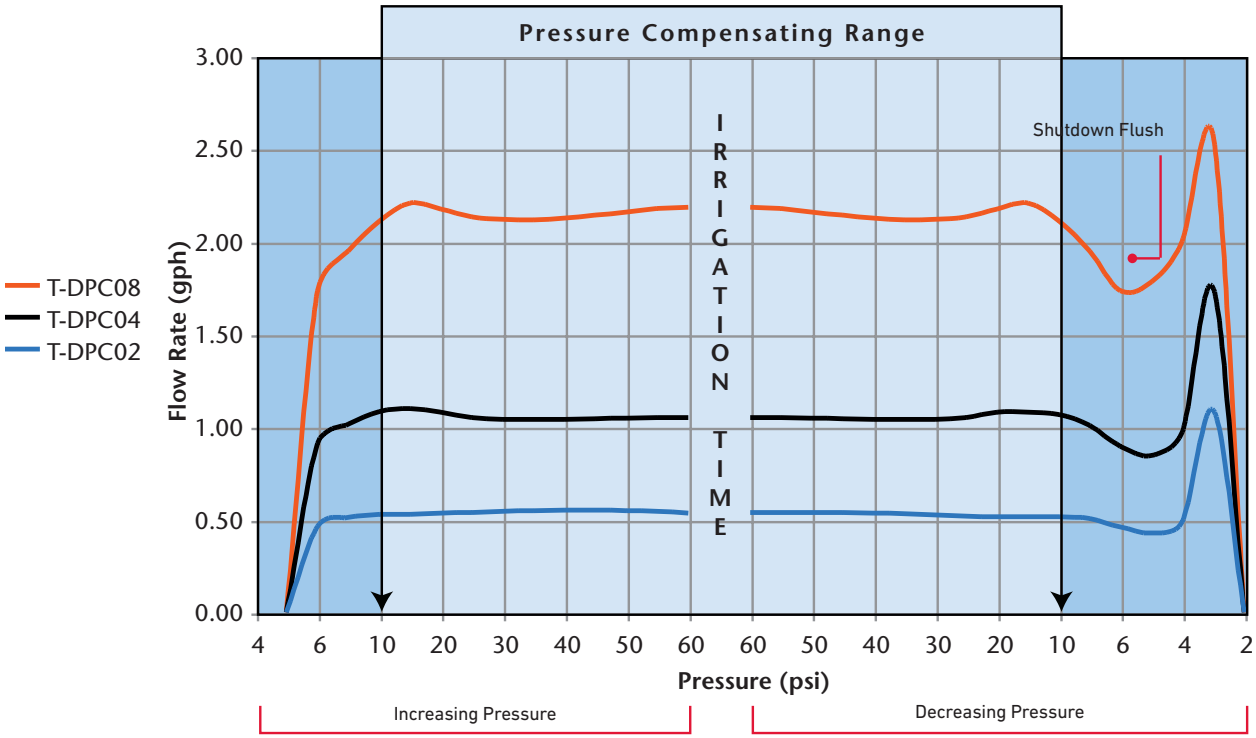
Allows the emitter to self-flush during operation and shut-down to facilitate cleaning. This ensures the emitter is free of debris at start-up and during the emitter operation.

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.



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

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 ¼" tubings

Warranty

- Two years

Specifying Information—NGE® Emitters

Model	Description
	NGE SF (Self-flushing) Pressure-compensating Turbulent Flow Emitter with Male Adapter
T-DPC02-MA	0.5 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black)
T-DPC04-MA	1.0 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black)
T-DPC08-MA	2.0 gph NGE Self-flushing Pressure-compensating Emitter with Male Adapter (black)
	NGE SF (Self-flushing) Pressure-compensating Turbulent Flow Emitter with Dust Cap
T-DPC02-DC-BLUE	0.5 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (blue)
T-DPC04-DC	1.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (black)
T-DPC08-DC-RED	2.0 gph NGE Self-flushing Pressure-compensating Emitter with Dust Cap (red)

TURBO-SC™ PLUS PRESSURE-COMPENSATING EMITTER

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.

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

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.

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)

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

E-2™ CLASSIC TAKE APART EMITTER

First introduced in 1972, the E-2 emitter has a history of being easy to use, and providing consistent and reliable performance. While there have been some improvements over the years, this emitter offering still provides accurate performance at a cost-effective price.

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

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.

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.*

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)

		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)		

PRESSURE REGULATING MULTI-OUTLET DRIP MANIFOLD

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.

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

Specifying Information—Pressure Regulating Drip Manifold

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

DRIP BUBBLERS

Toro's pressure-compensating 1/2" threaded Drip Bubblers are built to perform in tough environments. Bringing commercial-grade ruggedness to drip irrigation, they're easy to install, virtually maintenance-free, and are a more robust alternative to traditional drip emitters connected to 1/4" tubing. The innovative design of these Drip Bubblers combines the low flow rates of drip emitters with the ease of 1/2" PVC riser installation.

Drip Stream Bubbler

Drip Bubbler

FEATURES & BENEFITS

Easy to Install

Easily threads on to a ½" 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.

SPECIFICATIONS

Operational

- Pressure Compensation: 20 – 60 psi
- Recommended operating pressure: 30 psi
- Minimum Filtration Requirement: 80 Mesh
- ½" 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 onto the bubbler for easy identification
- Commercial-grade plastic and chloramine-stabilized silicone diaphragm provide dependable UV- and chemical-resistant performance
- Effluent and non-effluent models
- Installation of pressure-regulating drip zone kit recommended for optimal performance
- Drip Stream Bubbler models feature a unique four-outlet configuration with removable caps to ensure water does not trickle straight down to the PVC riser base if mounted vertically

Warranty

- Two years

DRIP BUBBLERS MODEL LIST

Model	Description
DB-04-PC	4 GPH PC Drip Bubbler (0.067 gpm)
DB-09-PC	9 GPH PC Drip Bubbler (0.15 gpm)
DB-15-PC	15 GPH PC Drip Bubbler (0.25 gpm)
DB-30-PC	30 GPH PC Drip Bubbler (0.5 gpm)
DB-04-PC-E	4 GPH PC Drip Bubbler, Effluent (0.067 gpm)
DB-09-PC-E	9 GPH PC Drip Bubbler, Effluent (0.15 gpm)
DB-15-PC-E	15 GPH PC Drip Bubbler, Effluent (0.25 gpm)
DB-30-PC-E	30 GPH PC Drip Bubbler, Effluent (0.5 gpm)
DSB-04-PC	4 GPH PC Drip Stream Bubbler (0.067 gpm)
DSB-08-PC	8 GPH PC Drip Stream Bubbler (0.13 gpm)
DSB-04-PC-E	4 GPH PC Drip Stream Bubbler, Effluent (0.067 gpm)
DSB-08-PC-E	8 GPH PC Drip Stream Bubbler, Effluent (0.13 gpm)

VARIS™ AND VARISTAKE™ ADJUSTABLE EMITTERS

FEATURES & BENEFITS

Available as Stake Assembly or as Barbed Emitter

Varistake connects to ¼" 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

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

PRESSURE REGULATORS

Specifying Information—Pressure Regulators

Model	Description
T-PMR30	1", 30 psi, 0.1-35 gpm pressure regulator
T-PMR40	1", 40 psi, 0.1-35 gpm pressure regulator

PLASTIC Y-FILTERS

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.

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.

SPECIFICATIONS

Operational
- Recommended pressure range: 5 – 120 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

Dimensions
- L: 11 1/2" H x 9" W x 9" D
- S: 8" H x 5 1/2" W x 5 1/2" D

Warranty
- One year

Specifying Information—Plastic Y-Filters (Disc)

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

Specifying Information—Plastic Y-Filters (Screen)

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

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-AMP0004-1S	3/4" and 1"	Screen	150	Small Body Size Filters
T-AMP0004-2F	3/4", 1" and 1 1/2"	Screen	150	Large Body Size Filters

DRIP ZONE VALVE KITS

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
- Less valve kits also available

Reliable Valve Options

- TPV Series, 1" Inline
- EZ-Flo® Plus, 1" AVB and 1" Inline
- Irritrol® 700 UltraFlow® Valve, 1" Inline

TPV Series Drip Zone Kit

Specifications	TORO EZ-FLO PLUS	TORO EZ-FLO PLUS AVB*	TORO TPV	IRRITROL® 700 ULTRAFLOW IN-LINE
Part Number	DZK-EZF	DZK-EZF-AS	DZK-TPV	DZK-700
Description	Drip Zone Valve Kit, 1" EZ-Flo	Drip Zone Valve Kit, 1" EZ-Flo Plus, AVB	Drip Zone Valve Kit, 1" TPV	Drip Zone Valve Kit, 1" 700 UltraFlow, In-line
Connection Size	1"	1"	1"	1"
Control Valve Solenoid	24 Vac, Inrush: 0.4 amps, 11.5 VA, Holding 0.20 amps, 5.75 VA			
Minimum Flow Rate	0.10 gpm	0.25 gpm	0.10 gpm	0.10 gpm
Maximum Flow Rate	25 gpm	25 gpm	25 gpm	30 gpm
Maximum Pressure	120 psi	120 psi	120 psi	120 psi
Y-Filter Degree of Filtration	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns	150 mesh/ 100 Microns
Regulator-Preset Pressure	30 psi	30 psi	30 psi	40 psi
Thread Connection-Upstream	Female NPT	Female NPT	Female NPT	Female NPT
Thread Connection-Downstream	Female NPT	Female NPT	Female NPT	Female NPT

Note: Consult your local plumbing code for backflow prevention requirements.
**AVB = Atmospheric Vacuum Breaker (Anti-siphon Valve).*

DRIP ZONE VALVE KITS MODEL LIST

Model	Description
DZK-EZF-AS	1" EZ-Flo Plus Valve, AVB, Filter, Regulator & Fittings
DZK-EZF	1" EZ-Flo Plus, Filter, Regulator & Fittings
DZK-TPV	1" TPV, Filter, Regulator & Fittings
DZK-700	1" 700 UltraFlow Inline Valve, Filter, Regulator & Fittings
DZK-X	Drip Zone Kit Less Valve with Filter, Regulator & Fittings

Specifying Information—Drip Zone Valve Kits

DZK-XXX-XX		
Kit	*Valve Type*	
DZK	**XXXXXX**	
DZK—Drip Zone Kit	EZF-AS—1" EZ-Flo Plus AVB EZF—1" EZ-Flo Plus TPV—1" TPV	700—1" In-line X—1" No Valve
Example: A Drip Zone Kit with a 700 Series UltraFlow, 1" commercial valve would be specified as: **DZK-700**		

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.

TORO®

CENTRAL CONTROL

Pages 174-185

Sentinel® Central Control	176-177
Sentinel® Controllers	178-179
Sentinel® Wireless Output Board	180
Sentinel® Compact Control Series	180
Sentinel® Two-Wire Controllers	181
Sentinel® Smart Irrigation	182
Sentinel® Soil Sensing	183
Sentinel® Flow Sensing	183
Sentinel® Handheld Remote	184
Sentinel® Retro Link	184
National Support Network (NSN®)	185

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 effeciency.

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 through NSN® Connect (part of NSN service package).

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.

**Microsoft and Windows are registered trademarks of Microsoft Corproration in the U.S. and other countries.*

***iPhone® and iPad® are registered trademarks of Apple, Inc. in the U.S. and other countries.*

Rain Sensor Compatible

Remote Ready

Soil Sensing Option

ET Adjust

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 (part of NSN service package)

iPhone® and iPad® Connectivity with NSN® Connect

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

Certified by ICC-ES

EPA WaterSense approved when used with a Precision™ ET or on site weather station

PRODUCT HIGHLIGHTS

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.

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)

SENTINEL® CONTROLLERS

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.

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

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.

PRODUCT 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 138 for more details.

Remote Ready

Flow Sensor Compatible

Soil Sensing Option

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
- TPS-SS – Toro Pro Series Soil Sensor

Warranty

- Five years

CABINET CHOICES

WS1 Small Wall Mount
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

Optional Accessories

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

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**			

SENTINEL® WIRELESS OUTPUT BOARDS

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.

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

Specifying Information–Sentinel Wireless Output Boards

W-XX-X-XX			
Configuration	*Station Count*	*Size*	*Radio*
W	XX	X	XX
W – Sentinel wireless output board	12 – 12-station 24 – 24-station 36 – 36-station 48 – 48-station	1 – Large [Empty] – Small (12-station only)	XB – Short-range XBEE radio XS – Mid-range XSC radio XT – Long-range XTND radio
Example: A small 12-station wireless output board with a short-range XBEE radio would be specified as: **W12-XB**			

SENTINEL® COMPACT CONTROL SERIES

Remote Ready

Flow Sensor Compatible

Sentinel Compact 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.

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

Specifying Information–Sentinel® Compact Control Series

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

SENTINEL® TWO-WIRE CONTROLLERS

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, wire):
  - 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

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.

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
SB-DDC-2	2-station with integrated surge protection
SB-DDC-4	4-station with integrated surge protection
SB-TWD-ISP	Sentinel two wire DC inline surge protection

Specifying Information-Sentinel Two-Wire Controller

SBX-XXX-U		
Configuration	*Station Count*	*Enclosure*
SBX	XXX	U
SBA – Sentinel AC Decoder Controller SBD – Sentinel DC 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
Example: A Sentinel DC two-wire controller in a medium powder-coated wall-mount enclosure with UHF communication would be specified as: **SBDWS2U**		

Refer to page 179 for enclosure compatibility.

Remote Ready

Flow Sensor Compatible

Soil Sensing Option

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).

***Davis Instruments, Campbell Scientific, and Irrisoft are trademarks or registered trademarks of their respective companies.*

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)

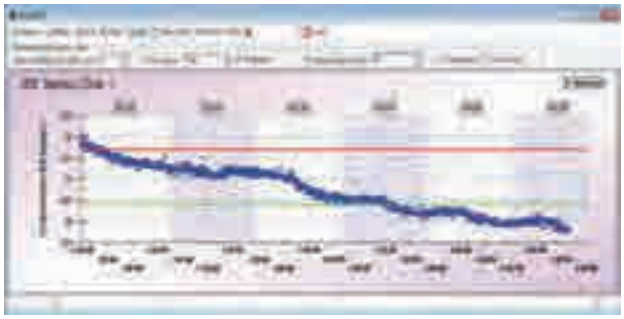
Supported Weather Sources:

- 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® SOIL SENSING

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 139 for additional information on the Toro® Pro Series™ Soil Sensor



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.

SOIL SENSING MODEL LIST

Model	Description
TS-TGB	Toro Pro Series Receiver for Sentinel Controllers
TPS-SS	Toro Pro Series Soil Sensor
TG-S2-R	Turf Guard Soil Sensor

SENTINEL® FLOW SENSING

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.

SENTINEL® HANDHELD REMOTE

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

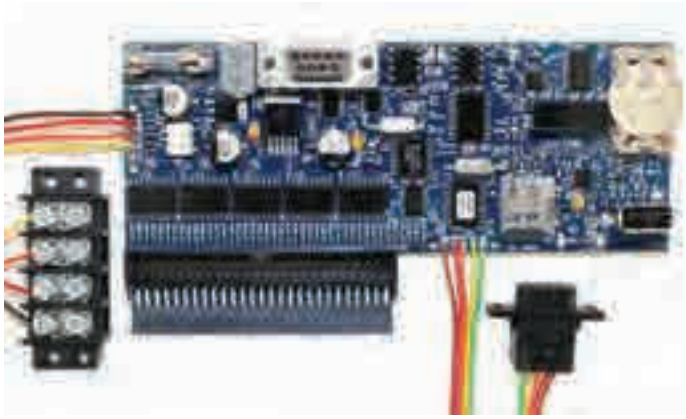
Warranty
- Two years

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

SENTINEL® RETRO LINK



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)

Rain Bird® is a registered trademark of Rain Bird® Corporation

NATIONAL SUPPORT NETWORK (NSN®)

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® Windows opertating 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.).

Toro Product Training — In-Person and Online

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.

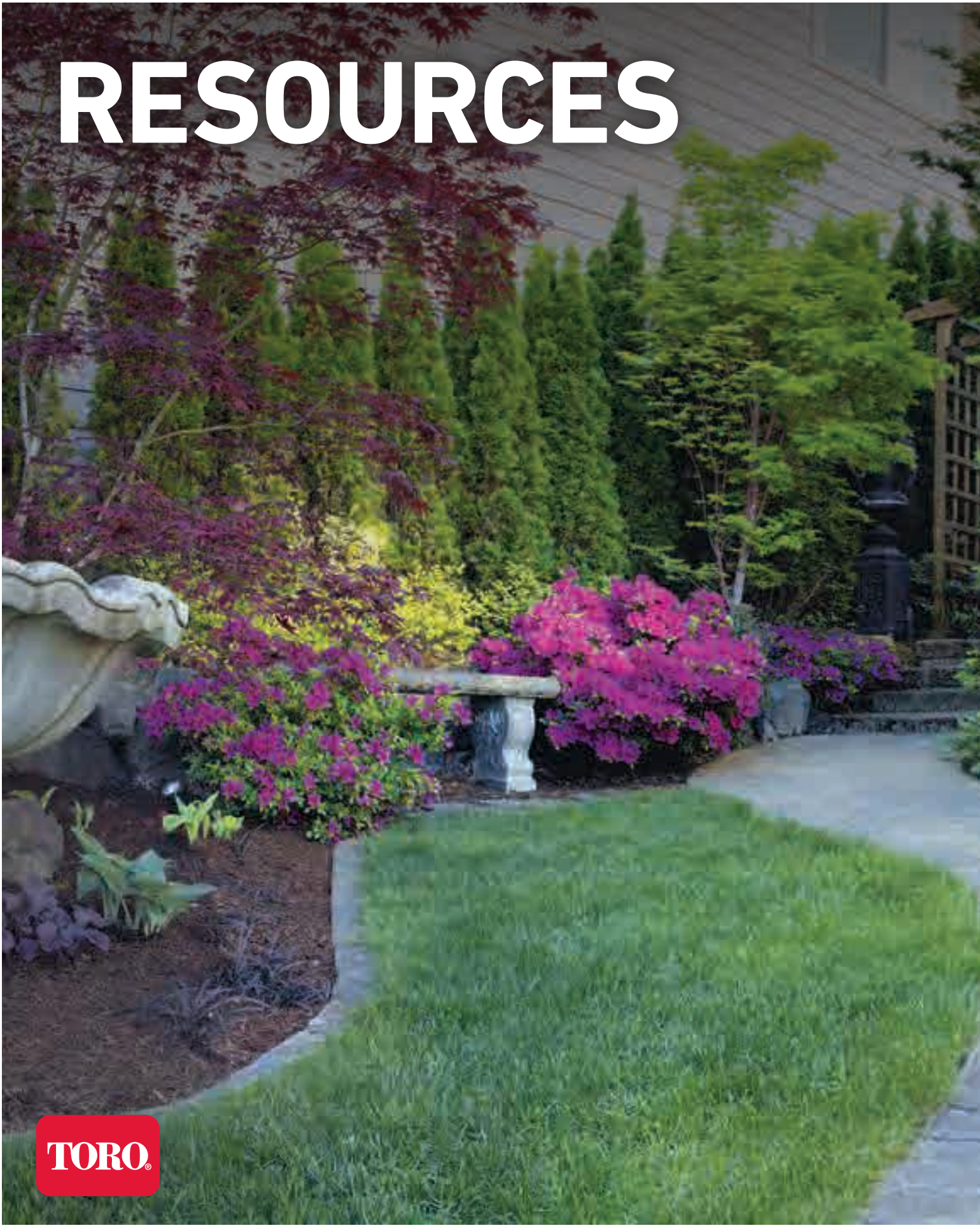
**Microsoft and Windows are registered trademarks of Microsoft Corproration in the U.S. and other countries.*

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.*

RESOURCES



RESOURCES

Pages 186-214

Customer Support	189
Formulas & Conversion Factors	190
Drip Equations	191
Sprinkler Spacing & Winterization	192
Friction Loss Characteristics	192
Pressure Loss Through Water Meters	212
Wire Sizing	213
Toro Limited Warranty for Irrigation Products	214

TORO®

CUSTOMER SUPPORT

Toro Technical Support
877-345-8676

Toro NSN®
888-676-8676
toronsn.com

Toro Controller Repair
877-345-8676

Order Services
800-654-1882

toro.com/irrigation

youtube.com/toro

specifier.toro.com

toro.com/watersmart

FORMULAS AND CONVERSION FACTORS

PRECIPITATION RATES

U.S. (SPACING IN FEET)	METRIC (SPACING IN METERS)
Equilateral Triangular Spacing	
P.R.= (in/hr) $\frac{\text{(GPM of 360) x 96.25}}{\text{(Head Spacing)2 x .866}}$	P.R.= (mm/hr) $\frac{\text{m}^3\text{/hr of 360 x 1000}}{\text{(Head Spacing)2 x .866}}$
Square/Rectangular Spacing	
P.R.= (in/hr) $\frac{\text{(GPM of 360) x 96.25}}{\text{Head Spacing x Row Spacing}}$	P.R.= (mm/hr) $\frac{\text{m}^3\text{/hr of 360 x 1000}}{\text{Head Spacing x Row Spacing}}$
Square/Rectangular Spacing for Specific Arc	
P.R.= (in/hr) $\frac{\text{34650 x GPM (for any arc)}}{\text{Degrees of Arc x Head Spacing x Row Spacing}}$	P.R.= (mm/hr) $\frac{\text{m}^3\text{/hr (for any arc) x 1000}}{\text{Degrees of Arc x Head Spacing x Row Spacing}}$
HORSEPOWER	
H.P. = $\frac{\text{GPM x Ft of Head}}{\text{3,960 x Pump Efficiency (expressed as a decimal)}}$	H.P. = $\frac{\text{LPM x Meters of Head}}{\text{3,433 x Pump Efficiency (expressed as a decimal)}}$
STATION RUN TIME	
S.R.T. = (min/wk) $\frac{\text{Total Weekly Req'd (inch/wk) x 60 (min/hr)}}{\text{Precipitation Rate (in/hr)}}$	S.R.T. = (min/wk) $\frac{\text{Total Weekly Req'd (mm/wk) x 60 (min/hr)}}{\text{Precipitation Rate (mm/hr)}}$
PIPE VELOCITY	
V= (ft/sec) $\frac{\text{0.4085 x Flow (GPM)}}{\text{(Inside Pipe Diameter in Inches)}^2}$	V= (m/sec) $\frac{\text{1273.24 x Flow (l/sec)}}{\text{(Inside Pipe Diameter in Millimeters)}^2}$
SLOPE	
S = $\frac{\text{Rise (Measure of Length)}}{\text{Run (Measure of Length)}}$	

TO CONVERT	FROM	TO	MULTIPLY BY
Area	acres	feet^2	43,560
	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	0.00047
	feet^3/second	meters^3/second	0.02832
	yards^3/minute	meters^3/second	0.01274
	gallons/minute	meters^3/hour	0.22716
	gallons/minute	liters/minute	3.7854
	gallons/minute	liters/second	0.06309
	meters^3/hour	liters/minute	16.645
	meters^3/hour	liters/second	0.2774
	liters/minute	liters/second	60
Length	feet	inches	12
	inches	centimeters	2.540
	feet	meters	0.30481
	kilometers	miles	0.6214
	miles	feet	5,280
	miles	meters	1609.34
	millimeters	inch	0.03937

TO CONVERT	FROM	TO	MULTIPLY BY
Pressure	psi	kilopascals	6.89476
	psi	bars	.06895
	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

DRIP EQUATIONS

NUMBER OF EMITTERS PER PLANT

$$\text{Emitters per tree} = \frac{\text{canopy area (sq.ft.)} \times 0.75}{\text{wetted area per emitter (sq.ft.)}}$$

	WETTED AREA	
Soil Type	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

$$\text{Flow per zone (gpm)} = \frac{\text{Total number of drippers x dripper flow rate (gph)}}{\text{“60 (minutes)”}}$$

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:

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

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:

$$\text{Precipitation Rate (in/hr.)} = \frac{\text{231.1 x Emitter Flow (gph)}}{\text{Width of Contained Area “ (“in.”)”x Emitter SPacing (in.)}}$$

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 rating for the tubing selected. 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 and the quality of backfill material. Failure to follow these installation protocols will shorten the life of the tubing and may void the warranty.

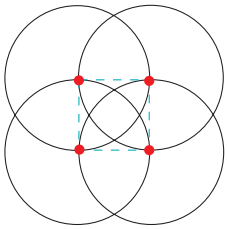
SPRINKLER SPACING & WINTERIZATION SPECIFICATIONS

The Toro Company does not recommend designing for 0 mph wind conditions.
Design in consideration of the worst wind conditions.

PRECIPITATION RATE FORMULAS

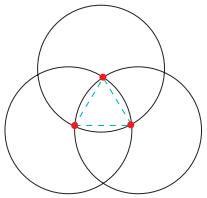
Square-spaced sprinklers in pattern:

$$\frac{96.3 \times \text{gpm applied to irrigated area}}{(\text{Spacing between sprinklers})^2}$$



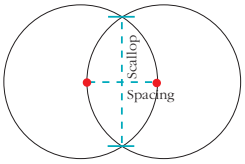
Triangular-spaced sprinklers in pattern:

$$\frac{\text{gpm of full circle} \times 96.3}{(\text{Spacing between sprinklers})^2 \times 0.866}$$



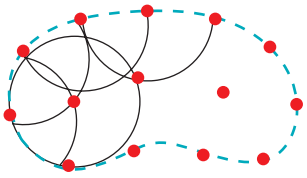
Single row:

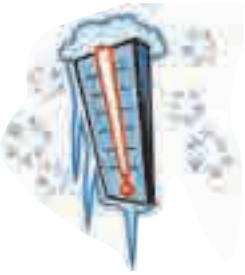
$$\frac{\text{gpm of full circle} \times 96.3}{(\text{Spacing})\ (\text{Scallop})}$$



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:

$$V = (0.408 \times Q_{gpm})\ /\ d^2$$

(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)

FRICTION 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	Velocity	Loss	Velocity	Loss	Velocity	Loss	Velocity	Loss
gpm	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	Velocity	Loss	Velocity	Loss	Velocity	Loss	Velocity	Loss
gpm	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	11.98	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 page 192 for friction loss formulas.

FRICTION 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 page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

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															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

Shaded area represents velocities over 5 fps.
Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

PVC CLASS 160 IPS PLASTIC PIPE

Size: ½" thru 6" Flow: 1 thru 500GPM

ASTM D-2241 (1120, 1220) SDR 26 C=150 PSI LOSS PER 100 FEET OF PIPE (PSI/100 FT)

size	1"		1¼"		1½"		2"		2½"		3"		4"		6"	
Avg.ID	1.175		1.512		1.734		2.173		2.635		3.210		4.134		6.084	
Pipe OD	1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg Wall	0.070		0.074		0.083		0.101		0.120		0.145		0.183		0.271	
MinWall	0.060		0.064		0.073		0.091		0.110		0.135		0.173		0.255	
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
1	0.30	0.02	0.18	0.01	0.14	0.00										
2	0.59	0.07	0.36	0.02	0.27	0.01	0.17	0.00								
3	0.89	0.15	0.54	0.04	0.41	0.02	0.26	0.01								
4	1.18	0.25	0.71	0.07	0.54	0.04	0.35	0.01	0.24	0.00						
5	1.48	0.38	0.89	0.11	0.68	0.06	0.43	0.02	0.29	0.01						
6	1.77	0.54	1.07	0.16	0.81	0.08	0.52	0.03	0.35	0.01	0.24	0.00				
7	2.07	0.71	1.25	0.21	0.95	0.11	0.60	0.04	0.41	0.01	0.28	0.01				
8	2.36	0.91	1.43	0.27	1.09	0.14	0.69	0.05	0.47	0.02	0.32	0.01				
9	2.66	1.14	1.61	0.33	1.22	0.17	0.78	0.06	0.53	0.02	0.36	0.01				
10	2.96	1.38	1.78	0.40	1.36	0.21	0.86	0.07	0.59	0.03	0.40	0.01				
12	3.55	1.94	2.14	0.57	1.63	0.29	1.04	0.10	0.71	0.04	0.48	0.01				
14	4.14	2.58	2.50	0.76	1.90	0.39	1.21	0.13	0.82	0.05	0.55	0.02				
16	4.73	3.30	2.86	0.97	2.17	0.50	1.38	0.17	0.94	0.06	0.63	0.02	0.38	0.01		
18	5.32	4.10	3.21	1.20	2.44	0.62	1.56	0.21	1.06	0.08	0.71	0.03	0.43	0.01		
20	5.91	4.99	3.57	1.46	2.71	0.75	1.73	0.25	1.18	0.10	0.79	0.04	0.48	0.01		
22	6.50	5.95	3.93	1.74	2.99	0.90	1.90	0.30	1.29	0.12	0.87	0.04	0.53	0.01		
24	7.09	6.99	4.28	2.05	3.26	1.05	2.07	0.35	1.41	0.14	0.95	0.05	0.57	0.02		
26	7.68	8.11	4.64	2.38	3.53	1.22	2.25	0.41	1.53	0.16	1.03	0.06	0.62	0.02		
28	8.27	9.30	5.00	2.73	3.80	1.40	2.42	0.47	1.65	0.18	1.11	0.07	0.67	0.02		
30	8.87	10.57	5.35	3.10	4.07	1.59	2.59	0.53	1.76	0.21	1.19	0.08	0.72	0.02		
32	9.46	11.91	5.71	3.49	4.34	1.79	2.76	0.60	1.88	0.23	1.27	0.09	0.76	0.03	0.35	0.00
34	10.05	13.32	6.07	3.91	4.61	2.01	2.94	0.67	2.00	0.26	1.35	0.10	0.81	0.03	0.37	0.00
36	10.64	14.81	6.42	4.34	4.88	2.23	3.11	0.74	2.12	0.29	1.43	0.11	0.86	0.03	0.40	0.00
38	11.23	16.37	6.78	4.80	5.16	2.46	3.28	0.82	2.23	0.32	1.50	0.12	0.91	0.04	0.42	0.01
40	11.82	18.00	7.14	5.28	5.43	2.71	3.46	0.90	2.35	0.35	1.58	0.14	0.95	0.04	0.44	0.01
42	12.41	19.70	7.50	5.78	5.70	2.97	3.63	0.99	2.47	0.39	1.66	0.15	1.00	0.04	0.46	0.01
44	13.00	21.47	7.85	6.30	5.97	3.23	3.80	1.08	2.59	0.42	1.74	0.16	1.05	0.05	0.48	0.01
46	13.59	23.32	8.21	6.84	6.24	3.51	3.97	1.17	2.70	0.46	1.82	0.18	1.10	0.05	0.51	0.01
48	14.18	25.23	8.57	7.40	6.51	3.80	4.15	1.27	2.82	0.50	1.90	0.19	1.15	0.06	0.53	0.01
50	14.78	27.21	8.92	7.98	6.78	4.10	4.32	1.37	2.94	0.53	1.98	0.20	1.19	0.06	0.55	0.01
55			9.82	9.52	7.46	4.89	4.75	1.63	3.23	0.64	2.18	0.24	1.31	0.07	0.61	0.01
60			10.71	11.18	8.14	5.74	5.18	1.91	3.53	0.75	2.38	0.29	1.43	0.08	0.66	0.01
65			11.60	12.97	8.82	6.66	5.62	2.22	3.82	0.87	2.57	0.33	1.55	0.10	0.72	0.01
70			12.49	14.88	9.50	7.64	6.05	2.55	4.11	1.00	2.77	0.38	1.67	0.11	0.77	0.02
75			13.38	16.90	10.18	8.68	6.48	2.89	4.41	1.13	2.97	0.43	1.79	0.13	0.83	0.02
80			14.28	19.05	10.86	9.78	6.91	3.26	4.70	1.28	3.17	0.49	1.91	0.14	0.88	0.02
85					11.53	10.94	7.34	3.65	4.99	1.43	3.37	0.55	2.03	0.16	0.94	0.02
90					12.21	12.16	7.78	4.06	5.29	1.59	3.56	0.61	2.15	0.18	0.99	0.03
95					12.89	13.45	8.21	4.48	5.58	1.76	3.76	0.67	2.27	0.20	1.05	0.03
100					13.57	14.79	8.64	4.93	5.88	1.93	3.96	0.74	2.39	0.22	1.10	0.03
110					14.93	17.64	9.50	5.88	6.46	2.30	4.36	0.88	2.63	0.26	1.21	0.04
120							10.37	6.91	7.05	2.71	4.75	1.04	2.86	0.30	1.32	0.05
130							11.23	8.02	7.64	3.14	5.15	1.20	3.10	0.35	1.43	0.05
140							12.10	9.20	8.23	3.60	5.54	1.38	3.34	0.40	1.54	0.06
150							12.96	10.45	8.81	4.09	5.94	1.57	3.58	0.46	1.65	0.07
160							13.82	11.77	9.40	4.61	6.34	1.76	3.82	0.52	1.76	0.08
170							14.69	13.17	9.99	5.16	6.73	1.97	4.06	0.58	1.87	0.09
180									10.58	5.73	7.13	2.19	4.30	0.64	1.98	0.10
190									11.16	6.34	7.52	2.42	4.54	0.71	2.09	0.11
200									11.75	6.97	7.92	2.67	4.77	0.78	2.20	0.12
220									12.93	8.31	8.71	3.18	5.25	0.93	2.42	0.14
240									14.10	9.77	9.50	3.74	5.73	1.09	2.65	0.17
260											10.29	4.33	6.21	1.27	2.87	0.19
280											11.09	4.97	6.68	1.45	3.09	0.22
300											11.88	5.65	7.16	1.65	3.31	0.25
320											12.67	6.37	7.64	1.86	3.53	0.28
340											13.46	7.12	8.12	2.08	3.75	0.32
360											14.25	7.92	8.59	2.31	3.97	0.35
380													9.07	2.56	4.19	0.39
400													9.55	2.81	4.41	0.43
420													10.30	3.08	4.63	0.47
440													10.50	3.35	4.85	0.51
460													10.98	3.64	5.07	0.56
480													11.46	3.94	5.29	0.60
500													11.94	4.25	5.51	0.65

Shaded area represents velocities over 5 Feet Per Second (FPS). Use with caution.

See page 192 for friction loss formulas.

FRICTION 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	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	0.18	0.00								
3	2.53	1.90	1.48	0.52	0.90	0.15	0.56	0.05	0.42	0.02	0.27	0.01								
4	3.37	3.24	1.97	0.88	1.19	0.26	0.74	0.08	0.56	0.04	0.36	0.01	0.24	0.01						
5	4.21	4.89	2.46	1.33	1.49	0.39	0.93	0.12	0.71	0.06	0.45	0.02	0.31	0.01						
6	5.05	6.86	2.96	1.86	1.79	0.55	1.11	0.17	0.85	0.09	0.54	0.03	0.37	0.01	0.25	0.00				
7	5.90	9.12	3.45	2.47	2.09	0.73	1.30	0.23	0.99	0.12	0.63	0.04	0.43	0.02	0.29	0.01				
8	6.74	11.68	3.94	3.17	2.39	0.94	1.49	0.30	1.13	0.15	0.72	0.05	0.49	0.02	0.33	0.01				
9	7.58	14.53	4.43	3.94	2.69	1.17	1.67	0.37	1.27	0.19	0.81	0.06	0.55	0.02	0.37	0.01				
10	8.42	17.66	4.93	4.79	2.99	1.42	1.86	0.45	1.41	0.23	0.90	0.08	0.61	0.03	0.41	0.01				
12	10.11	24.75	5.91	6.71	3.58	1.98	2.23	0.63	1.69	0.32	1.08	0.11	0.73	0.04	0.49	0.02				
14	11.79	32.93	6.90	8.93	4.18	2.64	2.60	0.83	1.98	0.43	1.26	0.14	0.86	0.06	0.58	0.02				
16	13.48	42.16	7.88	11.44	4.78	3.38	2.97	1.07	2.26	0.55	1.44	0.18	0.98	0.07	0.66	0.03	0.40	0.01		
18	15.16	52.44	8.87	14.23	5.37	4.21	3.34	1.33	2.54	0.68	1.62	0.23	1.10	0.09	0.74	0.03	0.45	0.01		
20			9.85	17.29	5.97	5.11	3.72	1.61	2.82	0.83	1.80	0.28	1.22	0.11	0.82	0.04	0.50	0.01		
22			10.84	20.63	6.57	6.10	4.09	1.92	3.11	0.99	1.98	0.33	1.35	0.13	0.91	0.05	0.55	0.01		
24			11.82	24.24	7.17	7.17	4.46	2.26	3.39	1.16	2.16	0.39	1.47	0.15	0.99	0.06	0.60	0.02		
26			12.81	28.11	7.76	8.31	4.83	2.62	3.67	1.34	2.34	0.45	1.59	0.18	1.07	0.07	0.65	0.02		
28			13.80	32.25	8.36	9.53	5.20	3.01	3.95	1.54	2.52	0.52	1.71	0.20	1.15	0.08	0.70	0.02		
30			14.78	36.64	8.96	10.83	5.57	3.41	4.24	1.75	2.70	0.59	1.84	0.23	1.24	0.09	0.75	0.03		
32					9.55	12.21	5.94	3.85	4.52	1.97	2.88	0.66	1.96	0.26	1.32	0.10	0.80	0.03	0.37	0.00
34					10.15	13.66	6.32	4.31	4.80	2.21	3.06	0.74	2.08	0.29	1.40	0.11	0.85	0.03	0.39	0.00
36					10.75	15.18	6.69	4.79	5.08	2.45	3.24	0.82	2.20	0.32	1.48	0.12	0.90	0.04	0.41	0.01
38					11.35	16.78	7.06	5.29	5.36	2.71	3.42	0.91	2.33	0.36	1.57	0.14	0.95	0.04	0.44	0.01
40					11.94	18.45	7.43	5.82	5.65	2.98	3.60	1.00	2.45	0.39	1.65	0.15	1.00	0.04	0.46	0.01
42					12.54	20.20	7.80	6.37	5.93	3.27	3.78	1.09	2.57	0.43	1.73	0.16	1.05	0.05	0.48	0.01
44					13.14	22.02	8.17	6.94	6.21	3.56	3.96	1.19	2.69	0.47	1.81	0.18	1.10	0.05	0.51	0.01
46					13.73	23.91	8.55	7.54	6.49	3.86	4.14	1.29	2.82	0.51	1.90	0.19	1.15	0.06	0.53	0.01
48					14.33	25.87	8.92	8.15	6.78	4.18	4.32	1.40	2.94	0.55	1.98	0.21	1.20	0.06	0.55	0.01
50					14.93	27.90	9.29	8.79	7.06	4.51	4.50	1.51	3.06	0.59	2.06	0.23	1.25	0.07	0.58	0.01
55							10.22	10.49	7.76	5.38	4.95	1.80	3.37	0.71	2.27	0.27	1.37	0.08	0.63	0.01
60							11.15	12.33	8.47	6.32	5.40	2.11	3.67	0.83	2.47	0.32	1.50	0.09	0.69	0.01
65							12.07	14.30	9.18	7.33	5.85	2.45	3.98	0.96	2.68	0.37	1.62	0.11	0.75	0.02
70							13.00	16.40	9.88	8.41	6.30	2.81	4.29	1.10	2.89	0.42	1.74	0.12	0.81	0.02
75							13.93	18.63	10.59	9.56	6.75	3.20	4.59	1.25	3.09	0.48	1.87	0.14	0.86	0.02
80							14.86	21.00	11.29	10.77	7.20	3.60	4.90	1.41	3.30	0.54	1.99	0.16	0.92	0.02
85									12.00	12.05	7.65	4.03	5.21	1.58	3.50	0.60	2.12	0.18	0.98	0.03
90									12.71	13.40	8.10	4.48	5.51	1.76	3.71	0.67	2.24	0.20	1.04	0.03
95									13.41	14.81	8.55	4.95	5.82	1.94	3.92	0.74	2.37	0.22	1.09	0.03
100									14.12	16.28	9.00	5.45	6.12	2.13	4.12	0.81	2.49	0.24	1.15	0.04
110											9.90	6.50	6.74	2.55	4.53	0.97	2.74	0.29	1.27	0.04
120											10.80	7.63	7.35	2.99	4.95	1.14	2.99	0.34	1.38	0.05
130											11.70	8.85	7.96	3.47	5.36	1.32	3.24	0.39	1.50	0.06
140											12.60	10.16	8.57	3.98	5.77	1.52	3.49	0.45	1.61	0.07
150											13.50	11.54	9.19	4.52	6.18	1.73	3.74	0.51	1.73	0.08
160											14.40	13.01	9.80	5.10	6.60	1.95	3.99	0.57	1.84	0.09
170													10.41	5.70	7.01	2.18	4.24	0.64	1.96	0.10
180													11.02	6.34	7.42	2.42	4.49	0.71	2.07	0.11
190													11.64	7.01	7.83	2.67	4.74	0.79	2.19	0.12
200													12.25	7.71	8.24	2.94	4.98	0.86	2.30	0.13
220													13.47	9.19	9.07	3.51	5.48	1.03	2.53	0.16
240													14.70	10.80	9.89	4.12	5.98	1.21	2.76	0.18
260															10.72	4.78	6.48	1.41	2.99	0.21
280															11.54	5.48	6.98	1.61	3.22	0.25
300															12.37	6.23	7.48	1.83	3.45	0.28
320															13.19	7.02	7.98	2.06	3.68	0.31
340															14.02	7.86	8.47	2.31	3.91	0.35
360															14.84	8.73	8.97	2.57	4.14	0.39
380																	9.47	2.84	4.37	0.43
400																	9.97	3.12	4.60	0.48
420																	10.47	3.42	4.83	0.52
440																	10.97	3.72	5.06	0.57
460																	11.46	4.04	5.29	0.62
480																	11.96	4.37	5.52	0.67
500																	12.46	4.72	5.75	0.72

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

PVC CLASS 315 IPS PLASTIC PIPE

Size: ½" thru 6" Flow: 1 thru 500GPM

ASTM D-2241 (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

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

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 page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

SCHEDULE 40 PVC 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									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										

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION 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															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

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

SCHEDULE 80 PVC 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									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										

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

TYPE 'K' COPPER TUBING

Size: ½" thru 3" Flow: 1 thru 600 GPM

ASTM B 88 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	0.527		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													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																	15.45	11.72
340																	16.42	13.11
360																	17.38	14.58
380																	18.35	16.11
400																		
420																		
440																		
460																		
480																		
500																		

Shaded area represents velocities over 7 fps.

Use with caution, where water hammer is a concern.

See page 192 for friction loss formulas.

FRICTION 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																		

Shaded area represents velocities over 7 fps.
Use with caution, where water hammer is a concern.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

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																		

Shaded area represents velocities over 7 fps.
Use with caution, where water hammer is a concern.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

HDPE DR 7 265 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18" Flow: 50 thru 4000GPM

ANSI/ASÆ 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	0.09
1200									8.72	1.19	6.19	0.52	5.14	0.33	3.93	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	0.10
1300									9.44	1.38	6.71	0.60	5.57	0..38	4.26	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	0.12
1400									10.17	1.58	7.23	0.69	6.00	0.44	4.59	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	0.14
1500									10.90	1.80	7.74	0.78	6.42	0.50	4.92	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	0.16
1600									11.62	2.03	8.26	0.88	6.85	0.56	5.25	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

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

HDPE DR 9 200 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18" Flow: 50 thru 4000GPM

ANSI/ASÆ 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 page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

HDPE DR 11 160 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18" Flow: 50 thru 4000GPM

ANSI/ASÆ 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	2.826		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											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

Shaded area represents velocities over 5 fps. Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

HDPE DR 13.5 128 PSI (IPS SIZE, OD CONTROLLED)

Size: 3" thru 18" Flow: 1 thru 4000GPM

ANSI/ASÆ 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 page 192 for friction loss formulas.

FRICTION 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										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

Shaded area represents velocities over 5 fps.
Use with caution.

See page 192 for friction loss formulas.

FRICTION LOSS CHARACTERISTICS

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										
3300										
3400										
3500										
3600										
3800										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

Shaded area represents velocities over 5 fps.
Use with caution.

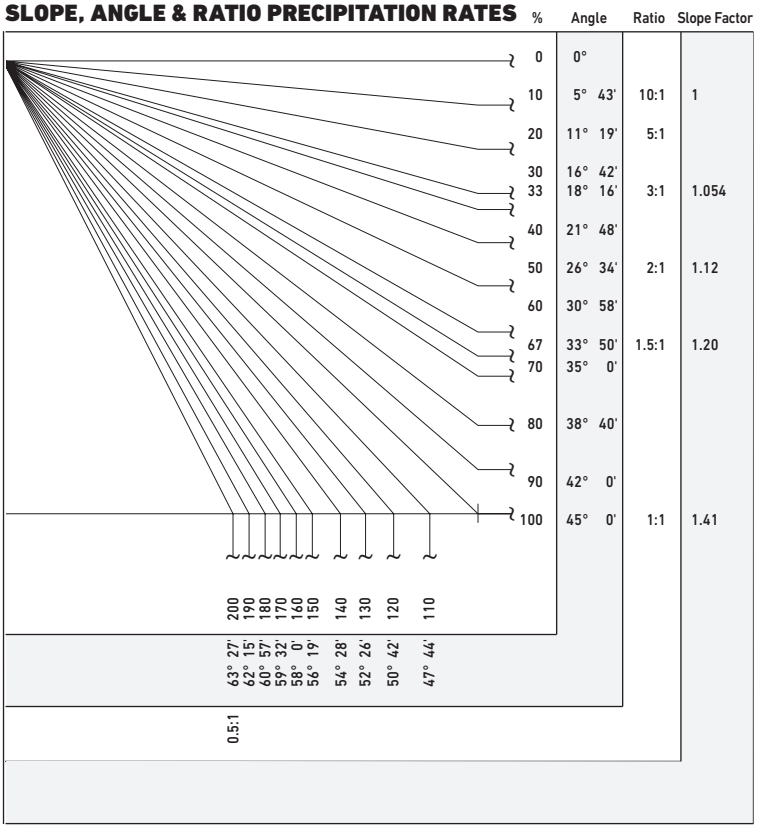
See page 192 for friction loss formulas.

PRESSURE LOSS THROUGH WATER METERS

WATER METER PRESSURE LOSS (PSI)

FLOW GPM	NOMINAL SIZE						
	5/8"	3/4"	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.

WIRE SIZING

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:

$$R = \frac{*500 \times Vd}{F \times 1}$$

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 Vac-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 Vac controller output with a model 24 Vac-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 VAC SOLENOID)

CHART 1

Minimum Solenoid Operating Voltage Under Various Line Pressure

Line Pressure	Voltage (Internal Bleed Configurations)	Voltage (External Bleed Configurations)
200 psi	21.1	
175 psi	20.2	
150 psi	19.1	20.0
125 psi	18.2	19.1
100 psi	17.1	18.2
75 psi	16.1	17.3
50 psi	16.0	16.4

CHART 2

Copper Wire Resistance of Various Sizes

Sizes AWG	Resistance at 20°C Ohms per 1000 ft.
4	0.25
6	0.40
8	0.64
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 5

Controller Output Voltage	24-Volt Solenoids		
	24 Vac	24 Vac-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 Vac	12 Vac-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

TORO LIMITED WARRANTY FOR IRRIGATION PRODUCTS

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 Business 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, AC and DC Decoders

Sensors & Accessories: TWRS Wireless RainSensor™ Series (receiver and transmitter), Smart Connect®, EVO-WS, EVO-AR, EVO-HH, SMRT-T.

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®
Irrigation
5825 JASMINE STREET

www.toro.com

5825 Jasmine Street
Riverside, CA 92504-1183
Phone: 877-345-8676
Fax: 800-862-8676

©2018 The Toro Company
All Rights Reserved

PN: 18-1001-IRC

We reserve the right to improve our products and make changes in the specifications and designs without notice and without incurring obligation.

Products depicted in this brochure are for demonstration purposes only. Actual products offered for sale may vary in design and features.

facebook.com/Toro.Company
twitter.com/thetorocompany
youtube.com/toro