

# HYDRO RAIN<sup>®</sup>

*Built for Speed<sup>®</sup>*



**IRRIGATION** and **LIGHTING PRODUCT CATALOG**

**VOLUME 6**

**HYDRORAIN.COM**

# WHY US

**Hydro-Rain®**  
Not “just another  
name” in the  
marketplace.

We understand that time is money, so our products are designed to save you time. Whether it is programming a controller, installing the system, or adjusting the system our products go together faster and easier.

You have better things to do, than doing a job twice. Every product we sell goes through rigorous testing before we put our name on it.

Have a problem with one of our products? We want to know about it. If any product fails in three years, we will replace it. And we'll probably ask to have the product that failed back, so we can make it better.

The heart of Hydro-Rain values are integrity, fair dealing, and lasting relationships between manufacturer, distributor, and contractor. We want to build lasting relationships that benefit all parties.



**Certificate  
of Registration**



QUALITY MANAGEMENT SYSTEM ISO 9001:2008

Hydro-Rain® products are manufactured in facilities complying with ISO 9001:2015 quality requirements for the following scope: Design, manufacturing and distribution of residential and commercial irrigation products. Factories hold Certificate No: FM 541922





**04 Software**  
 Hydro-Quote & Hydro-Plan  
 Irrigation Audit  
 B-hyve® Dashboard

**07 Controllers**  
 HRC 400 Wi-Fi  
 HRC 410 Wi-Fi  
 HRC 100 C  
 HRC 990  
 HRC 980

**13 Controller Accessories**  
 HRC Rain Sensors  
 HRC PSR

**15 Valves**  
 HRP 100  
 HRB Series  
 HRV 100  
 HRJ 100  
 HRA Series  
 HRZ Series

**28 Valve Accessories**  
 Solenoids  
 HRW Waterproof Wire Connectors  
 HRM 100 Manifold  
 Valve Box and Base

**32 Nozzles**  
 HRN Series

**36 Sprinklers**  
 HRS 200  
 HRS 100  
 HRX 075  
 HRX 050

**40 Micro-Irrigation**  
 Manifolds  
 Pipe & Tubing  
 Sprays & Emitters  
 Accessories

**42 Fittings**  
 Drip-Lock®  
 PVC-Lock®  
 Blu-Lock®  
 BLS Nitro Saddles

**54 Lighting**  
 Controller & Motion Sensor  
 Path Lights  
 Spot Lights

**58 Rewards**  
 Contractor Advantage

**60 Reference**

software  
 controllers  
 valves  
 nozzles  
 sprinklers  
 micro  
 fittings  
 lighting  
 rewards  
 reference

**Warranty**

**3  
 YEAR**

Hydro-Rain® warrants to its customers that its products will be free from defects in materials and workmanship for a period of three years from the date of purchase. We will replace, free of charge, the defective part or parts found to be defective under normal use and service for a period of up to three years after purchase (proof of purchase required). We reserve the right to inspect the defective part prior to replacement. Hydro-Rain® will not be responsible for consequential or incidental cost or damage caused by the product failure. Hydro-Rain® liability under this warranty is limited solely to the replacement or repair of defective parts. To exercise your warranty, return the unit to your dealer with a copy of the sales receipt.

\*Two year warranty extension available to Hydro-Rain® Contractor Advantage "Premier Level" contractors.

## HYDRO-PLAN® & HYDRO-QUOTE®

software  
Make Quote Preparation Faster and Easier

### Hydro-Plan® Features

- Trace over the top of a scanned image or a satellite image that you have download to your computer
- Use the drawing tools in the designer to quickly and easily draw the property online
- View the plan online and make changes as needed
- Review trenching, wiring, piping, and head placement maps and layouts for each zone
- Export to Hydro-Quote® to see a complete list of parts, and generate quotes with your company information

### Contractor Benefits

- Trace over the top of a scanned image or a satellite image that you have download to your computer
- Create custom plans in minutes
- Generate a parts list and installation plan
- Plans are saved for later use
- Export directly to Hydro-Quote®

### Hydro-Quote® Features

- Import from Hydro-Plan® to start quoting
- Your company information is printed out at the beginning of each quote

### Contractor Benefits

- Easily quote new systems from your office
- Generate customized contract ready quotes

Create a free account at:  
<http://hydroquote.hydrorain.com>



# IRRIGATION AUDIT & HRT CUP

Make Auditing Easier and Faster Than Ever Before

## Features

- Industry standard 16.25 square inch average throat area
- Measures sprinkler application in milliliters and centimeters
- Hydro-Rain®'s B-hyve™ Pro App gives readouts on the go. Works with all major mobile devices and tablets
- UV protected plastic cups and stakes make for long-lasting catch cups that will withstand the pressures of professional use
- Catch cups come in packs of twelve, and can easily be expanded to provide more accuracy
- Installed and gathered quickly so you can get on to the next job
- 7" stake securely holds the catch cup

## Contractor Advantages

- Helps identify issues with the irrigation system
- B-hyve™ Pro app does all the calculations in seconds
- Results are automatically imported into B-hyve™ software



software



[irrigationaudit.hydrorain.com](http://irrigationaudit.hydrorain.com)



## How to Specify

	Model
HRT	Hydro-Rain Tools
	Series
CUP	200 ML Cup

## Models (SKU)

- HRT-CUP (26600)

## B-HYVE PRO DASHBOARD AND APP

Simplify Irrigation System Management



### Easy to Use

Access your customers controllers from the app using your phone, tablet, computer, or at the controller itself.

### Save Water

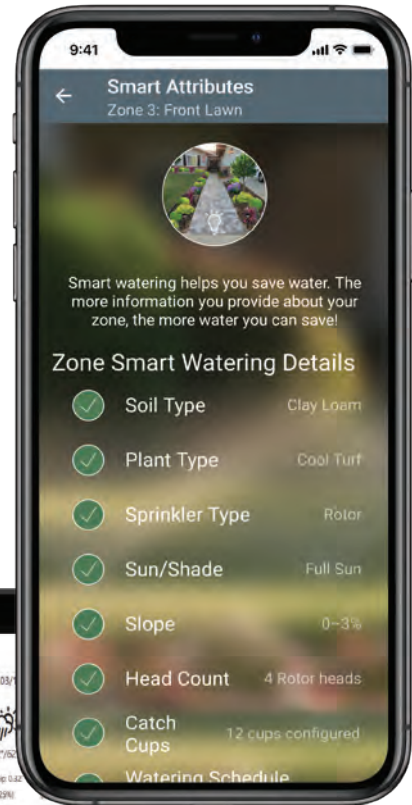
WeatherSense™ technology accesses real-time local weather and soil data to ensure that lawns and gardens get exactly the water they need, when they need it. No more watering in the rain.

### Multi-Site Management

Allows you to monitor and control all your customer's controllers from anywhere in the world. Add an unlimited number of controllers to your account.

### Save Time

No more driving back and forth to customer's homes for simple programming adjustments; control it from wherever you are. Or simply set it to smart water and let Mother Nature determine the watering schedule.





	HRC 400	HRC 410	HRC100C	HRC 990	HRC 980
<b>Application</b>					
Residential	●	●	●	●	●
Light Commercial	●	●	●	●	
Stand Alone				●	
Hose Bib					●
<b>Type of Controller</b>					
Smart	●	●			
Hybrid	●		●	●	
Battery Operated				●	●
<b>Features</b>					
Stations	8, 16	8	4, 6, 9, 12	1-4	1
Programs	4	4	3	2	1
*Run Time/Stn Min	1-240	1-240	1-240	1-240	1-240
Cycle Start Times/Program	4	4	4	4	2
Surge Protection	●		●		
Master Valve/Pump Start	●		●		
Submersible				●	
Low Battery Indicator	●	●	●	●	●
Cycle and Soak	●	●			
Concurrent Programs	●	●			
Circuit Breaker	●		●		
Water Budgeting	●	●	●	●	
24 VAC Out	●	●	●		
1 Amp Transformer	●				
WaterSense Certified	●	●			
Wi-Fi Enabled	●	●			
Bluetooth Ready	●	●			
Mobile App	●	●			
Multi-Site Management	●	●			
<b>Enclosure</b>					
Indoor/Outdoor	●		●	●	
Pigtail Included	●		●	NA	NA
ABS-with Lock	●		●		
IP 68 Rating				●	
UL/CTL/CSA	●	●	●		
<b>Programming Schedule</b>					
7 Day of Week	●	●	●	●	
Odd/Even Cycle	●	●	●	●	
1-31 Variable Cycle	●	●	●	●	
Rain Delay	●	●	●	●	●
365 Day Calendar	●	●	●	●	
Event Day Off	●	●			
Smart Watering Mode	●	●			
Manual Mode	●	●	●	●	●
<b>Hardware/Accessories</b>					
Moisture Sensor Ready				●	
Rain/Freeze Sensor Ready	●	●	●		

controllers

\*With assignment to multiple programs, start times & budgeting times can be extended

### HRC 400

Smart Wi-Fi  
Indoor/Outdoor  
Controller

b•hyve  
PRO™



#### Features

- Available in 8 or 16 station
- Indoor and outdoor locking enclosure
- Bluetooth® and Wi-Fi enabled
- B-hyve Pro™ and B-hyve™ compatible
- Dedicated master valve/pump start terminal
- EPA WaterSense® certified
- Rain delay from 24 hours up to 32 days
- Advanced sensor ports
- 4 programs with 4 start times per program
- Programs stored in non-volatile memory



#### Specifications

- Transformer:  
Input 120VAC  
Output 24-26VAC 1A
- Max holding 24VAC 0.5A  
Max inrush 24VAC 2.25A
- Pump/master valve:  
Holding 24-26VAC 0.4A  
Inrush 24VAC 2.2A
- Station timing from 1-240 minutes
- Up to 16 start times per day
- Programming schedule: days of week, watering intervals, and odd/even days
- Water budgeting: adjusts 10% to 200% in 10% increments

#### Approvals

- FCC, CSA

#### How to Specify

	Model
HRC	Controller
	Series
400	Smart Indoor/Outdoor
	Type
WF	Wi-Fi
	Stations
8	8 Station
16	16 Station
	Options
L	Custom Logo Imprint

#### Models (SKU)

- HRC-400-WF-8 (04080)
- HRC-400-WF-8L (04080L)
- HRC-400-WF-16 (04082)
- HRC-400-WF-16L (04082L)





# HRC 410

Smart Wi-Fi  
Indoor Controller



## Features

- Available in 8 station
- Indoor enclosure
- Bluetooth® and Wi-Fi enabled
- B-hyve Pro™ and B-hyve™ compatible
- Master valve capable
- EPA WaterSense® certified
- Rain delay from 24 hours up to 32 days
- Advanced sensor ports
- 4 programs with 4 start times per program
- Programs stored in non-volatile memory



controllers

## Specifications

- Transformer:  
Input 120VAC  
Output 24-26VAC 0.75A
- Max holding 24VAC 0.5A  
Max inrush 24VAC 1.2A
- Station timing from 1-240 minutes
- Up to 16 start times per day
- Programming schedule: days of week, watering intervals, and odd/even days
- Water budgeting: adjusts 10% to 200% in 10% increments

## Approvals

- FCC, CSA

## How to Specify

	Model
HRC	Controller
	Series
410	Smart Indoor
	Type
WF	Wi-Fi
	Stations
8	8 Station
	Options
L	Custom Logo Imprint

## Models (SKU)

- HRC-410-WF-8 (04060)
- HRC-410-WF-8 (04060L)



### HRC 100

Basic  
Indoor/Outdoor  
Controller

controllers

#### Features

- Available in 4, 6, 9, or 12 stations
- Indoor and outdoor locking enclosure
- Simple programming
- Dedicated master valve/pump start terminal
- Rain delay from 24 hours up to 32 days
- Rain/freeze sensor port
- Wireless rain/freeze sensor port
- 3 programs with 4 start times per program

#### Specifications

- Transformer:  
Input 120VAC or 220/230VAC  
Output 24-26VAC 0.6A
- Station output: 24-26VAC 0.25A
- Pump/master valve output:  
Max holding 24VAC 0.4A  
Max inrush 24VAC 0.6A
- Station timing from 1-240 minutes
- Up to 12 start times per day
- Programming schedule: days of week, watering intervals, and odd/even days
- Water budgeting: adjusts 10% to 200% in 10% increments.

#### Approvals

- FCC, CSA, CE



### CUSTOMIZED CONTROLLERS



Advertise your company, build your brand, and differentiate yourself from your competition with your company name, logo, phone number, and website printed on every HRC 400 and HRC 100 controller you install. See your authorized Hydro-Rain distributor for details and ordering instructions.

#### How to Specify

	Model
HRC	Controller
	Series
100	Basic
	Type
C	Controller
	Stations
4	4 Station
6	6 Station
9	9 Station
12	12 Station
	Options
L	Custom Logo Imprint

#### Models (SKU)

- HRC-100-C-04 (04054)
- HRC-100-C-04L (04054P)
- HRC-100-C-06 (04056)
- HRC-100-C-06L (04056P)
- HRC-100-C-09 (04059)
- HRC-100-C-09L (04059P)
- HRC-100-C-12 (04052)
- HRC-100-C-12L (04052P)

# HRC 990

Battery Operated Controller

## Features

- Controls up to 4 latching solenoids
- Water resistant (IP68 rated)
- Battery operated
- 2 programs with 4 start times per program
- Manual start and advance buttons
- Rain delay from 24 to 72 hours
- Rain/freeze sensor port

## Specifications

- Operates DC latching solenoids only
- 4 solenoids ports
- 2 module ports
- Power source: 3 AA batteries (included) or 3 AA rechargeable batteries with solar panel
- Station timing from 1-240 minutes
- Up to 6 start times per day
- Programming schedule: days of week, watering intervals, and odd/even days
- Water budgeting: adjusts 10% to 200% in 10% increments.

## Approvals

- UL, FCC, CE



**HRC-990-SP-MD**



### How to Specify

Model	
HRC	Controller
Series	
990	Battery Powered Isolation Controller
Type	
SD	Solenoid
SP	Solar Panel
MS	Moisture Sensor
PB	PEB Solenoid
DV	DV Solenoid
UN	Universal
HT	Hunter PGV
01	1 Solenoid
Class	
MD	Module
AD	Adapter
PF	Push-Fit

### Models (SKU)

- HRC-990-01 (04020)
- HRC-990-SD-MD (04010)
- HRC-990-SP-MD (04011)
- HRC-990-MS-MD (04021)
- HRC-990-PB-AD (04022)
- HRC-990-DV-AD (04023)
- HRC-990-UN-AD (04024)
- HRC-990-HT-AD-PF (04019)
- HRC-990-DV-AD-PF (04023L)

controllers

### HRC 980

Hose Bib  
Controller

#### Features

- Battery operated
- Outdoor enclosure (IP35 rated)
- Intuitive rotary dial is quick and easy to program
- Manual water from 1-360 minutes
- Rain delay from 24-72 hours
- 1 program with 4 cycles/start times
- Programs stored in non-volatile memory
- Brass hose swivel



#### Specifications

- Power source: 2 AA batteries
- Operating pressure: 10-80 psi (0.69-5.52 bar)
- Operating flow: 2.5 GPM-8 GPM (9.4-30 LPM)
- Cycle run time from 1-360 minutes
- Up to 4 start times per day
- Programming schedule: days of week or watering intervals

#### Approvals

- UL, FCC, CSA, CE

#### How to Specify

	Model
HRC	Controller
	Series
980	Battery Powered Hose Bib
	Type
MULTI	Multiple Programs
	Options
01	1 Outlet

#### Models (SKU)

- HRC-980-MULTI-01 (04035)



# HRC 100

## Rain/Freeze Sensors

### Features

- Rain gutter mounting bracket is equipped with a tool free bolt system that is quick and intuitive to install
- Adjustable moisture activation
- Uses industry-standard hygroscopic discs
- Freeze sensor activates at 37°F or 3°C
- Universal 2 wire system for use with most brands
- Normal open & normal close 3A@24VAC
- 100-RF manual override deactivates the wireless sensors during irrigation system maintenance

### Specifications

- Rain sensitivity: adjustable nominal 1/8"-1" (3-25mm)
- Freeze sensitivity: 37°F (2.7°C) +/- 1°F
- Operating temperature: 14°F to 140°F (-10°C to 60°C)
- Housing material: UV-resistant engineered polymer

### RF Receiver

#### Specific Specifications

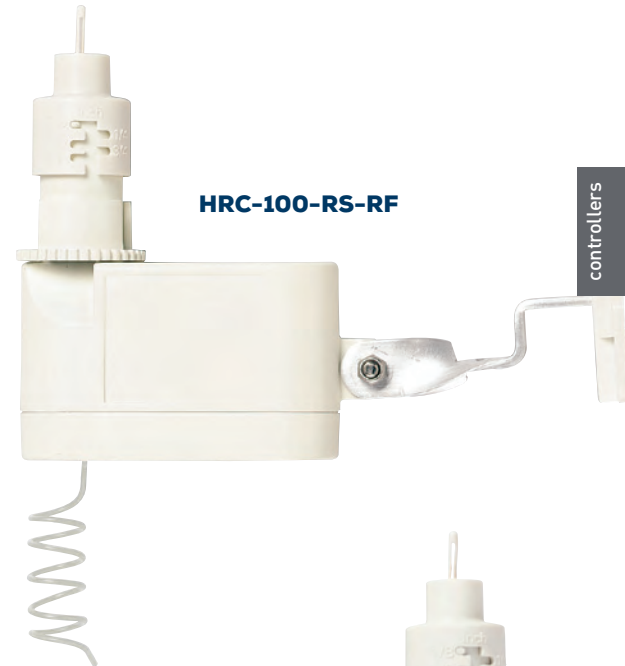
- Receiver power: 22-28VAC
- Transmitter power: 2 CR2032 3V cell

### RF Receiver Dimensions

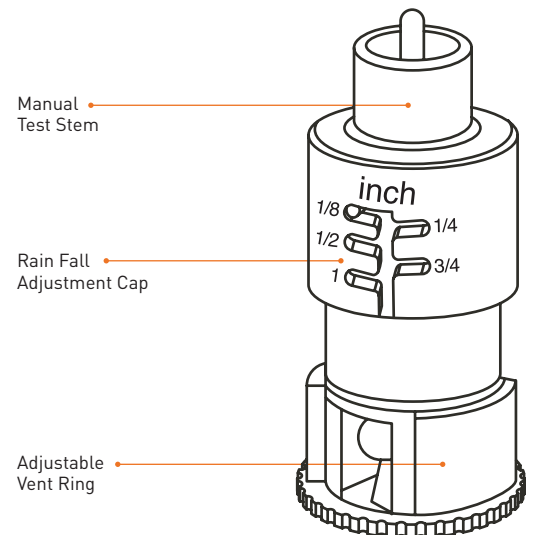
- Height: 3.75" (9.5 cm)
- Length: 1.1" (2.7 cm)

### RF Transmitter Dimensions

- Height: 4" (10.1 cm)
- Length: 3.15" (8.0 cm)



### Product Detail



How to Specify	
	Model
HRC	Controller
	Series
100	Basic Sensor
	Type
RS	Rain/Freeze Sensor
	Connection
RF	Wireless
HW	Hard Wire

### Models (SKU)

- HRC-100-RS-RF (04008)
- HRC-100-RS-HW (04007)

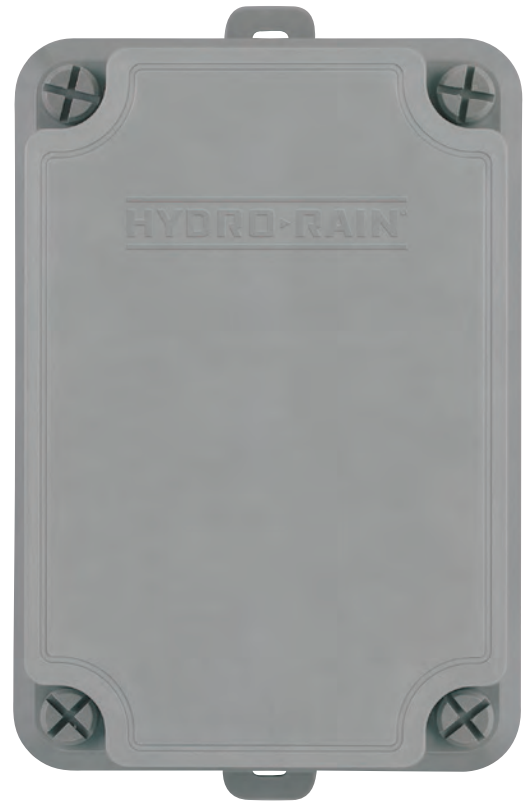
## HRC PSR

Pump Start Relay

controllers

### Features

- Works with 1 HP 110VAC or 2 HP 220VAC pumps
- Works with 24VAC sprinkler controllers
- Automatically activates pump when the controller activates a valve
- Locking, weather-resistant case
- Covered wiring compartment for extra protection
- Simple, trouble-free design
- Wide-range AC-activated coil that handles 100-120VAC or 200-240VAC at either 50 or 60 Hz
- Conforms to UL, CSA, TUV and meets IEC950



### How to Specify

	Model
HRC	Controller
	Type
PSR	Pump Start Relay

### Models (SKU)

- HRC-PSR (07009)

### Specifications

- 24VAC 50/60Hz
- Inrush: 79mA
- Sealed: 71mA
- Resistance ( $\pm 10\%$ ) 303  $\Omega$
- Contractor rating (single phase)
- Double pole, single throw
- Inductive: 15 AMP
- Resistive: 25 AMP
- Input:
  - 110VAC–up to 1 HP
  - 220VAC–up to 2 HP





	HRP 100	HRJ 100	HRV 100	HRB	HRA	HRZ 100
<b>Size</b>						
1", 1½", & 2"				•		
¾", 1"			•		•	
1" only	•	•				•
<b>Inlet</b>						
FNPT		•	•	•	•	
MNPT						•
BSP			•	•		•
Push-fit	•					
Bottom Inlet					•	
<b>Rating/Flow</b>						
20 to 200 psi Rated				•		
15 to 150 psi Rated	•	•	•		•	•
.25 to 200 GPM				•		
.2 to 40 GPM	•	•	•	•	•	
.1 to 5 GPM						•
<b>Features</b>						
Manual Internal Bleed	•	•	•	•	•	•
Manual External Bleed		•		•		•
30 psi Regulator and Filter Included						•
Anti-Siphon Feature					•	
Dirty Water Screen				•		•
PVC	•	•	•		•	
Slip Version	•		•			
Stainless Steel Studs Molded In	•			•		
Accepts Latching Solenoid	•	•	•	•	•	•
Filtered Pilot Hole			•	•		
Balanced Pressure Diaphragm			•			
24VAC 50/60 Hz	•	•	•	•	•	•
Threaded Bonnet		•				•
Glass Filled Nylon Body				•		
One Piece Solenoid/Plunger	•			•		
Slow Closing	•	•		•	•	•
Low Flow Capability	•	•	•	•	•	•
Normally Closed Forward Flow		•		•	•	•

valves



### HRP SERIES

Revolutionary  
Push-fit  
Technology

#### Features

- Push-fit glue-less design for a fast and clean installation
- Internal bleed solenoid makes at the valve operation easy and spray-free
- Captive solenoid plunger prevents accidental loss during servicing
- Captive bonnet screws provide trouble-free servicing with a flat, Phillips, or hex driver
- A balanced flow design keeps equal pressure on both sides of the diaphragm while the valve is off, increasing the valve's life
- Snap-fit diaphragm spring holds the spring on the bonnet
- Glass-filled polypropylene for extra strength
- Self-cleaning solenoid filter with pilot-flow 90-mesh (200 micron) screen
- The balanced flow design reduces the chance of a flooding event due to a diaphragm failure
- Accepts DC latching solenoids for use with HRC battery-operated controllers

#### Specifications

- Pressure: 15-150 psi
- Flow: 0.2-40 GPM
- Water temperature: up to 110°F (43°C)
- Ambient temperature: up to 125°F (51°C)
- 24VAC 50/60 (Cycle) Solenoid
- Inrush current: .30 A at 60 Hz
- Holding current: .23 A at 60 Hz
- Coil resistance: 61 Ω

#### Dimensions

- Height: 4.7" (11.93 cm)
- Length: 6.1" (15.49 cm)
- Width: 2.5" (6.35 cm)



HRP-100-PF-BL



HRP-100-PF-FCBL

**Blu-Lock® 3X**



HRP-100-PF-PVC



HRP-100-PF-FCPVC

**PVC-Lock®**



#### How to Specify

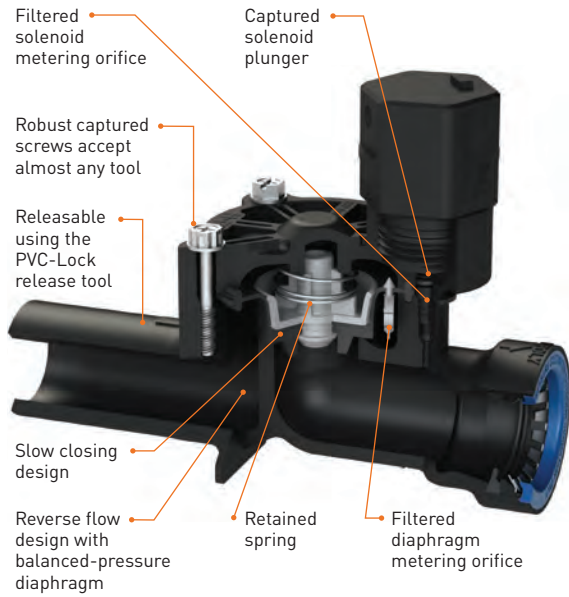
Model	
HRP	Push-fit
Size	
100	1"
Type	
PF	Push-fit
BL	Blu-Lock
PVC	PVC-Lock
FC	Flow Control

#### Models (SKU)

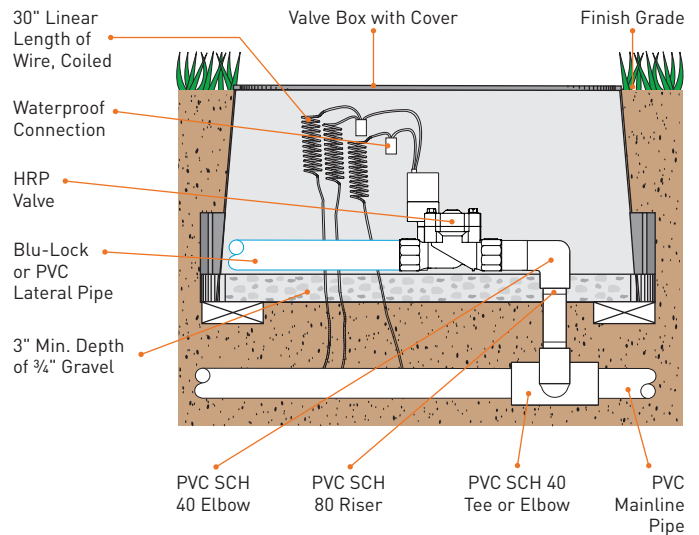
- HRP-100-PF-BL (02030)
- HRP-100-PF-PVC (02031)
- HRP-100-PF-FCBL (02130)
- HRP-100-PF-FCPVC (02131)



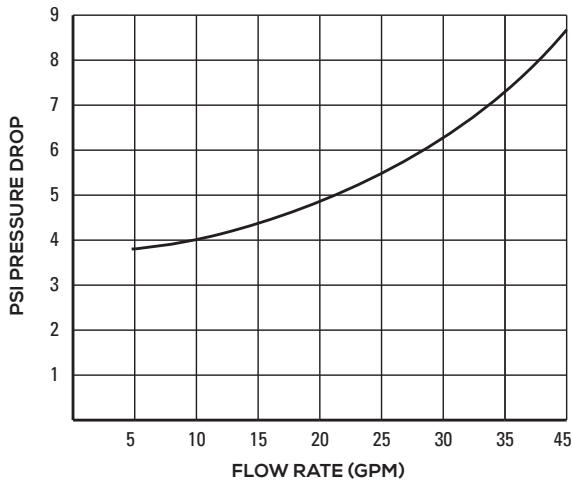
HRP Cutaway



Installation Specification Detail



FRICITION LOSS CHART



HRZ 100 2-in-1

The 2-in-1 push-fit pressure regulated drip filter is designed to be used with the HRP 100, creating a complete push-fit solution for drip applications.

- 200 mesh filter
- Jar top with flush port cap for easy serviceability
- Integrated 30 psi pressure regulator

See page 28 for more information



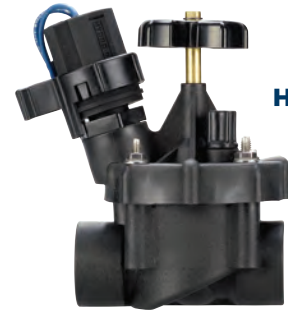
valves

### HRB SERIES

The industry's fastest, best built commercial valve.

#### Features

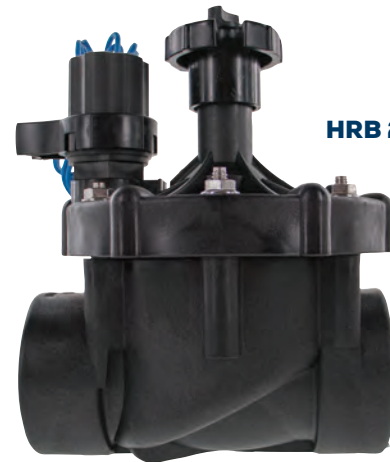
- Fiber reinforced body delivers superior strength under extreme conditions
- Solid brass and stainless steel components ensure corrosion resistance
- Slow-closing reinforced diaphragm protects against water hammer
- Pilot hole filter screen reduces risk of clogging
- Stainless steel studs prevent possible damage due to over tightening and corrosion
- Manual internal bleed enables convenient, water efficient manual operation
- Manual external bleed enables fast seasonal startup and shutdown
- Low and high flow satisfies a wide range of flow conditions and application requirements
- Flow control stem provides ability to adjust flow over a wide range
- One-piece solenoid design secures plunger in solenoid body
- Normally closed, forward flow design
- Accepts DC latching solenoids for use with HRC battery-operated controllers



**HRB 100**



**HRB 150**



**HRB 200**



#### How to Specify

Model	
HRB	Commercial
Size	
100	1"
150	1 1/2"
200	2"
Inlet/Outlet	
FF	Female Pipe Thread
Options	
FC	Flow Control

#### Models (SKU)

- HRB-100-FF-FC (05100)
- HRB-150-FF-FC (05101)
- HRB-200-FF-FC (05102)

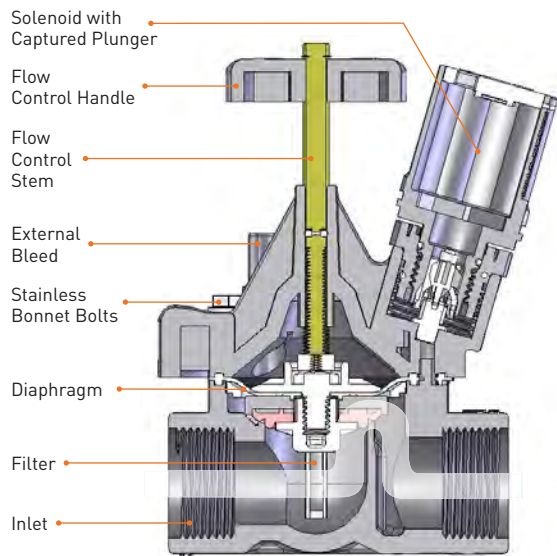
#### Specifications

- Pressure: 20-200 psi (1.38-13.80 bar)
- Flow: 0.25-200 GPM (0.06-45.40 m<sup>3</sup>/h; 0.32-12.60 l/s)
- Water temperature: up to 105°F (66°C)
- Ambient temperature: up to 150°F (66°C)

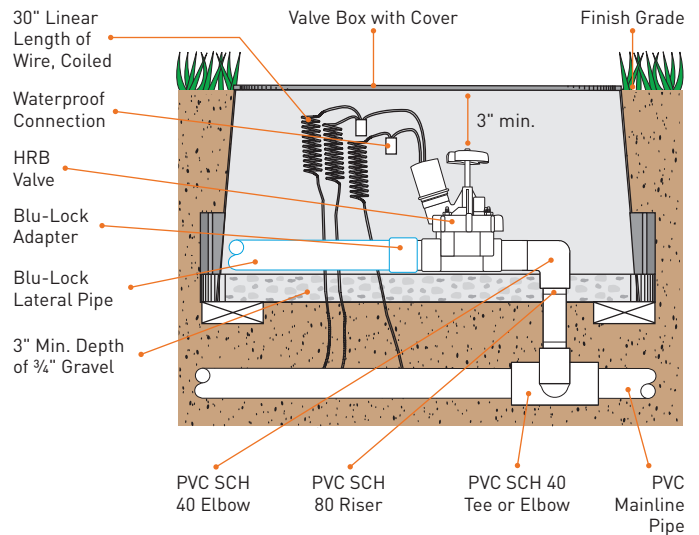
#### Electrical Specifications

- 24VAC 50/60 (Cycle/Sec) solenoid
- Inrush current: .30A (7.2VAC) at 60 Hz
- Holding current: .19A (4.6VAC) at 60 Hz
- Coil resistance: 22 Ω

HRB Cutaway



Installation Specification Detail



HRB Series Pressure Loss

FLOW GPM	HRB 100	HRB 150	HRB 200	Metric				
				FLOW M <sup>3</sup> /H	FLOW L/S	HRB 100	HRB 150	HRB 200
0.25	0.8	-	-	0.6	0.02	0.05	-	-
0.5	1.0	-	-	1	0.28	0.11	-	-
1	1.3	-	-	2	0.56	0.12	-	-
5	1.7	-	-	3	0.83	0.15	-	-
10	1.8	-	-	4	1.11	0.18	-	-
20	2.9	3.9	-	5	1.39	0.24	0.27	-
30	5.6	3.6	-	6	1.67	0.32	0.26	-
40	10	3.5	-	7	1.93	0.41	0.25	-
50	15.6	3.6	4.8	8	2.22	0.54	0.25	-
75	-	5.4	4.5	9	2.50	0.68	0.24	-
100	-	9.6	5.2	10	2.78	0.84	0.24	-
125	-	14.6	8.2	12	3.33	-	0.26	0.33
150	-	21.2	11.8	14	3.89	-	0.29	0.32
175	-	-	15.5	16	4.44	-	0.34	0.31
200	-	-	19.5	22	6.11	-	0.62	0.34
				28	7.78	-	0.97	0.55
				43	9.45	-	1.46	0.83
				40	11.11	-	-	1.09
				45	12.50	-	-	1.32

NOTES:

1. Hydro-Rain recommends flow rates in the supply line not to exceed 7.5 ft/sec. (2.29m/s) in order to reduce the effects of water hammer.
2. For flows below 5 GPM Hydro-Rain recommends the use of upstream filtration to prevent debris from collecting below the diaphragm.
3. For flows below 10 GPM (2.27 m<sup>3</sup>/h; 0.63 l/s) Hydro-Rain recommends the flow control stem be turned down two full turns from the fully open position.

### HRV SERIES

Tried and True

#### Features

- Internal bleed solenoid makes at-the-valve operation easy and spray-free
- Bonnet screws provide trouble-free servicing without the use of tools
- A balanced flow design keeps equal pressure on both sides of the diaphragm while the valve is off, increasing the valve's life
- Glass-filled polypropylene bonnet for extra strength
- Self-cleaning solenoid filter with pilot-flow 90-mesh (200 micron) screen
- The balanced flow design reduces the chance of a flooding event due to a diaphragm failure
- Accepts DC latching solenoids for use with HRC battery-operated controllers

#### Specifications

- Pressure: 15-150 psi
- ¾" flow: 5-22 GPM (18-83 L/min)
- 1" flow: 5-40 GPM (18-151 L/min)
- Water temperature: up to 110°F (43°C)
- Ambient temperature: up to 137°F (58.3°C)

#### Solenoid Specifications

- 24VAC 50/60 (Cycle/Sec) solenoid
- Inrush current: .30A (7.2VAC) at 60 Hz
- Holding current: .19A (4.6VAC) at 60 Hz
- Coil resistance: 32 Ω



**HRV-100-FF-FC**



**HRV-100-SS-FC**

#### How to Specify

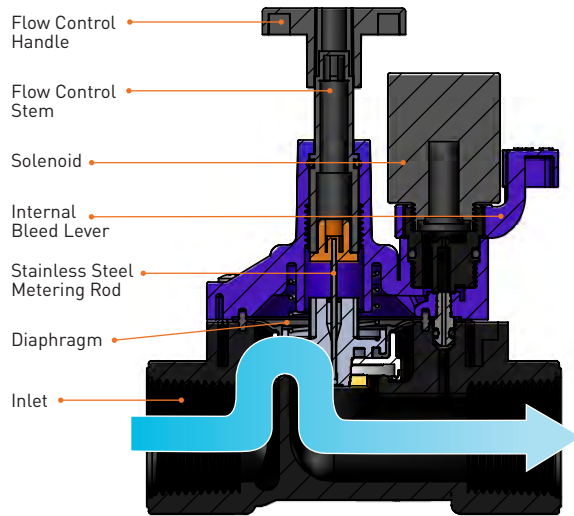
	Model
HRV	Residential/ Light Commercial Valves
	Size
100	1"
	Options
FF	Female Pipe Thread
SS	PVC Slip
FC	Flow Control

#### Models (SKU)

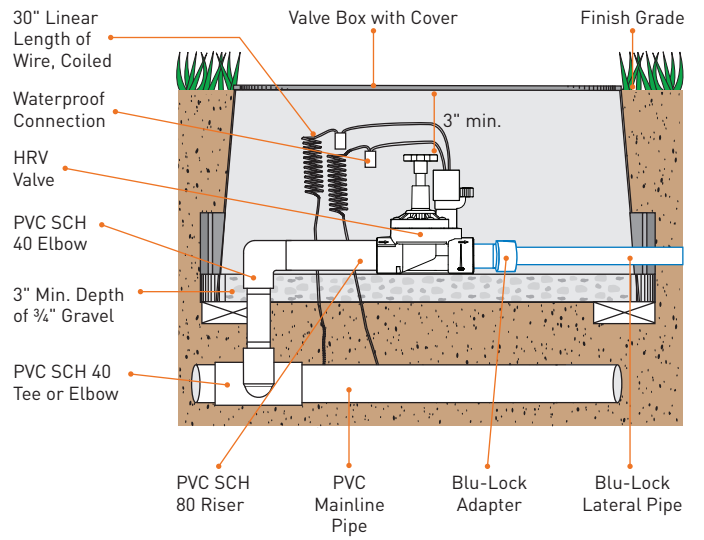
- HRV-100-FF-FC (03125)
- HRV-100-SS-FC (03126)



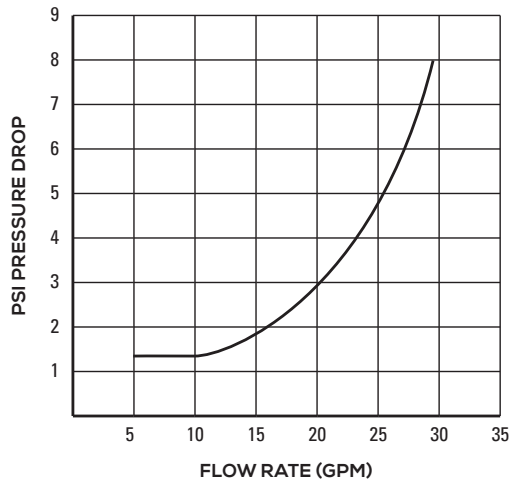
HRV Cutaway



Installation Specification Detail



FRICION LOSS CHART



### HRJ 100

Entry Level

#### Features

- Internal bleed solenoid makes at-the-valve operation easy and spray-free
- Jar top bonnet provides trouble-free servicing without the use of tools
- Manual external bleed enables fast seasonal startup and shutdown
- Glass-filled nylon bonnet for extra strength
- Self-cleaning solenoid filter with pilot-flow 90-mesh (200 micron) screen
- Forward-flow design
- Accepts DC latching solenoids for use with HRC battery-operated controllers

#### Specifications

- Pressure: 25-150 psi (1.72-10.34 bar)
- Flow: 15-30 GPM (56-113.6 l/min)
- Water temperature: up to 110°F (43°C)
- Ambient temperature: up to 125°F (51°C)

#### Solenoid Specifications

- 24VAC 50/60 Hz (Cycles/Sec) solenoid
- Inrush current: .30A (7.2VAC) at 60 Hz
- Holding current: .19A (4.6VAC) at 60 Hz
- Coil resistance: 32 Ω



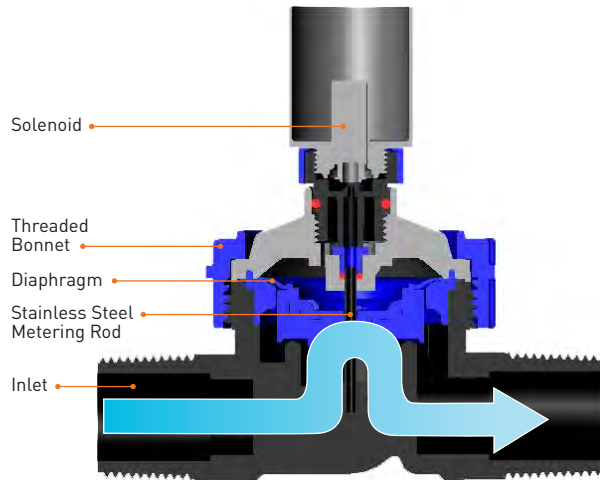
#### How to Specify

Model	
HRJ	Jar Top
Size	
100	1"
Options	
FF	Female Pipe Thread

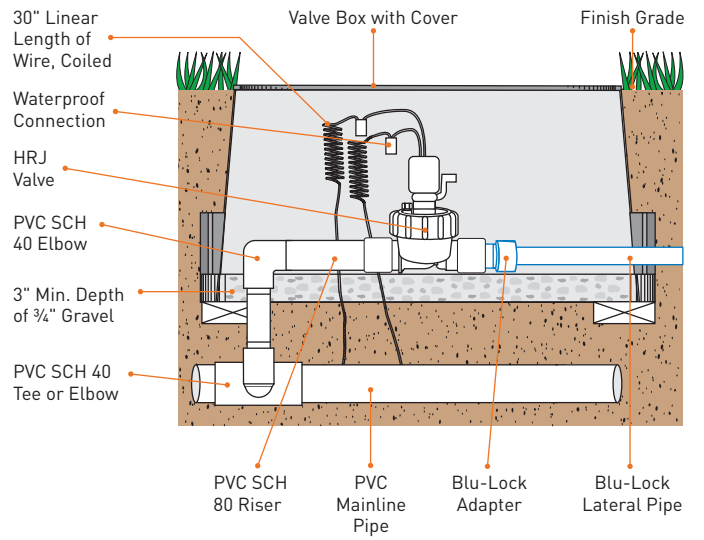
#### Models (SKU)

- HRJ-100-FF (02001)

HRJ Cutaway



Installation Specification Detail



valves



HRJ 100 Pressure Loss

FLOW GPM	PSI	FLOW LPM	BAR
0.25	5	1	0.35
2	4.6	8	0.32
5	3.5	20	0.24
10	4	40	0.30
15	2.97	60	0.21
20	3.26	80	0.23
30	6.2	100	0.30

### HRA SERIES

Reliable, Tough and Easy to Use

#### Features

- Internal bleed solenoid makes at-the-valve operation easy and spray-free
- Bonnet screws provide trouble-free servicing with a Phillips driver
- Buna-N valve seat delivers positive closure and eliminates weeping
- Atmospheric vacuum breaker—prevents back flow into water source (meets applicable ASSE, CSA and IAPMO standards)
- Glass-filled polypropylene lid design for extra strength and heat resistance
- Forward-flow design
- Accepts DC latching solenoids for use with HRC battery-operated controllers

#### Specifications

- Flow: 1-30 GPM (1-115 LPM)
- Pressure range: 10-150 psi (0.7-10 bar)
- Water temperature: up to 110°F (43°C)
- Ambient temperature: up to 137°F (58.3°C)

#### Solenoid Specifications

- 24VAC 50/60 (Cycle/Sec) solenoid
- Inrush current: .30A (7.2VAC) at 60 Hz
- Holding current: .19A (4.6VAC) at 60 Hz
- Coil resistance: 32 Ω



**HRA-075**



**HRA-100**

#### How to Specify

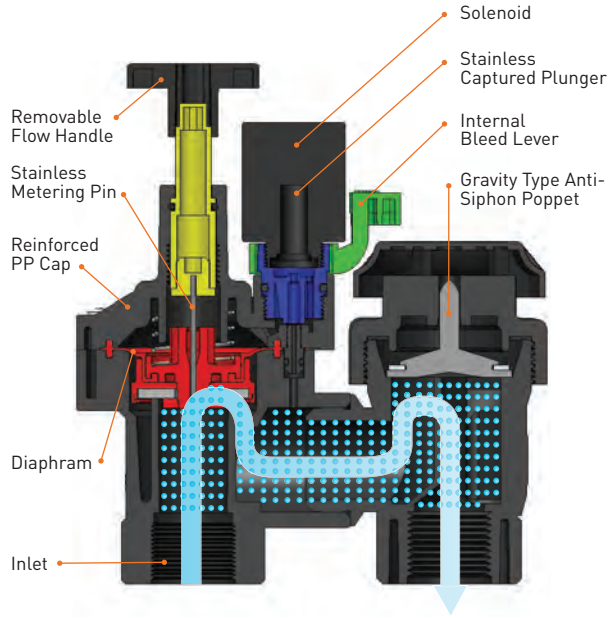
Model	
HRA	Anti-Siphon
Size	
075	¾"
100	1"
Options	
FF	Female Pipe Thread
FC	Flow Control

#### Models (SKU)

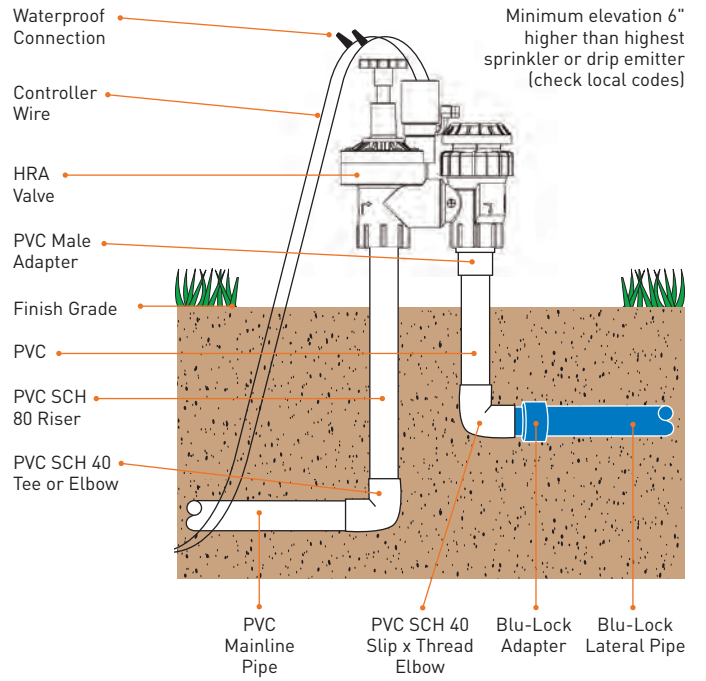
- HRA-075-FF-FC (02013)
- HRA-100-FF-FC (02014)



HRA Cutaway



Installation Specification Detail



HRA Series Pressure Loss

FLOW GPM	HRA 075	HRA 100
5	5	4
10	6	5
15	6	5
20	8	7
25		10



valves

### HRZ SERIES

An Industry First

#### Features

- Ultra low flow allows operation at lowest possible flows to boost water savings
- Lowest overall footprint reduces control zone kit and valve box waste
- Made from 100% recyclable materials and PVC free
- Stainless steel metering pin ensures optimal diaphragm performance
- Manual external bleed allows for fast seasonal startup and shutdown
- Stainless steel 200 mesh filter provides large surface area for low maintenance
- Filter/regulators have a NPT flush port

#### Specifications

- Flow: 0.2-5.0 GPM (0.76-18.9 l/min)
- Flow: 12-300 GPH (45-1,136 l/hour)
- Inlet pressure: 25-150 psi (1.72-10.34 bar)
- Regulated pressure: 30 psi (2.1 bar)
- Filtration: 200 mesh filter

#### Solenoid Specifications (VFR only)

- 24VAC 50/60 Hz (Cycles/Sec) solenoid
- Inrush current: .30A (7.2VAC) at 60 Hz
- Holding current: .19A (4.6VAC) at 60 Hz
- Coil resistance: 32 Ω



HRZ-100-VFR



HRZ-075-FR



HRZ-100-FR



HRZ-100-BL



HRZ-100-PVC

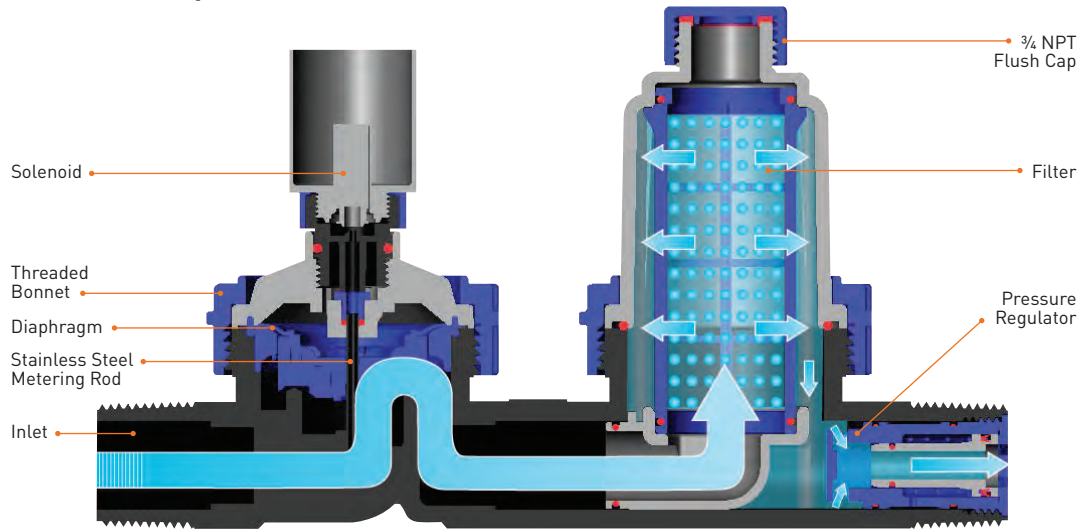
#### How to Specify

Model	
HRZ	Micro-Irrigation
Inlet Size	
075	3/4"
100	1"
Type	
FR	Filter Regulator with 1" MPT
VFR	Valve and Filter Regulator with 1" MPT
BL	Blu-Lock Inlet Connection
PVC	PVC-Lock Inlet Connection
Options	
30	30 psi Regulator

#### Models (SKU)

- HRZ-100-VFR-30 (02110)
- HRZ-075-FR-30 (02115)
- HRZ-100-FR-30 (02116)
- HRZ-100-BL-30 (02117)
- HRZ-100-PVC-30 (02118)

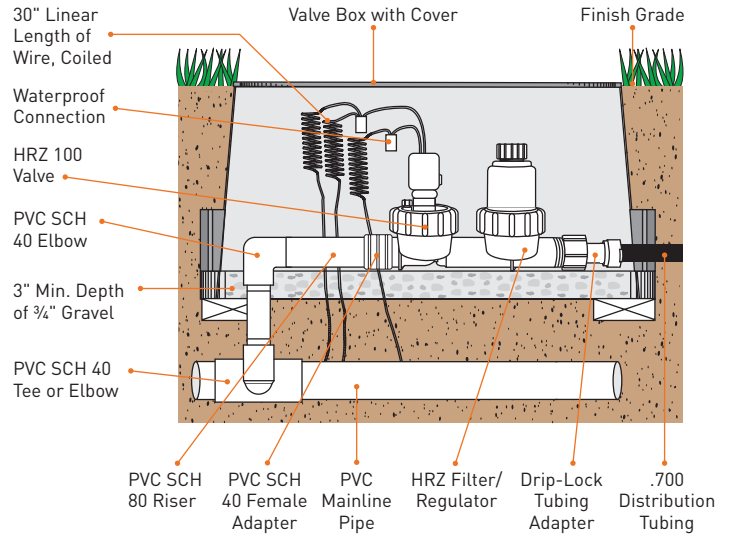
HRZ Cutaway



valves



Installation Specification Detail



HRZ 100 Pressure Loss

FLOW GPM	PSI	FLOW LPM	BAR
0.2	31.3	0.8	2.1
1.0	32.1	3.8	2.2
2.0	35.3	7.6	2.4
3.0	40.2	11.3	2.8
4.0	46.0	15.1	3.2
5.0	52.3	18.9	3.6

### SOLENOIDS

Control the Flow

#### Features

- Various thread sizes to fit most brands
- HRJ solenoids are compatible with HRC 990 adapters
- Constructed with glass-filled nylon
- 12" of lead wire

#### Specifications

- 24VAC 50/60 (Cycle/Sec)

#### HRV-XXX-SD-RP Specifications

- Inrush current: 0.45A @ 24VAC
- Holding current: 0.30A @ 24VAC
- Coil resistance: 23 Ω

#### HRB-XXX-SD-RP Specifications

- Inrush current: 0.30 A @ 24VAC
- Holding current: 0.17A @ 24VAC
- Coil resistance: 21 Ω

#### HRJ-XXX-SD-RP Specifications

- Inrush current: 0.32A @ 24VAC
- Holding current: 0.18A @ 24VAC
- Coil resistance: 32 Ω

#### HRJ-SD2-RP Specifications

- Inrush current: 0.36A @ 24VAC
- Holding current: 0.23A @ 24VAC
- Coil resistance: 56 Ω

#### HRP-SD-RP Specifications

- Inrush current: 0.35A @ 24VAC
- Holding current: 0.21A @ 24VAC
- Coil resistance: 59 Ω



HRV-XXX-SD-RP



HRB-XXX-SD-RP



HRJ-XXX-SD-RP



HRJ-SD2-RP



HRP-SD-RP

#### How to Specify

	Model
HRV	Hydro-Rain Valve
HRB	Commercial Valve
HRJ	Jar Top Valve
HRP	Push-fit Valve
	Series
XXX	Placeholder
SD	Solenoid
SD2	2nd Generation Solenoid
	Type
RP	Replacement

#### Models (SKU)

- HRV-XXX-SD-RP (03124)
- HRB-XXX-SD-RP (05103)
- HRJ-XXX-SD-RP (02004)
- HRJ-SD2-RP (03084)
- HRP-SD-RP (02034)

# HRW SERIES

Speed Seal  
Waterproof Wire  
Connectors



## Features

- Metal helical insert twists wires together
- Silicone sealant creates a waterproof connection
- Wires are securely locked into place when twisted in a clockwise direction
- Ergonomic grip increases rapid turn capability and provides comfort and low hand stress
- High density and corrosion resistant material provide extended use and reliability
- Maximum voltage: 600VAC maximum building wire (1000VAC max. signs or luminaries)
- For irrigation systems and landscape lighting applications



valves

## Specifications

- Max. voltage: 600VAC max. building wire (1000VAC max. signs or luminaries)
- Wire type: copper/copper
- Temperature rating: 105°C (221°F)
- Silicone sealant: -45°F- 400°F

## How to Specify

Model	
HRW	Wirenut
Quantity	
61135	25 per Bag 1000 per Case
61146	150 per Jar 900 per Case
10222	20 per Bag 200 per Case
10241	100 per Jar 600 per Case
20111	15 per Bag 150 per Case
20136	50 per Jar 300 per Case
Color	
PK	Orange
BL	Blue
TN	Tan

## Models (SKU)

- HRW-61135-PK (03127)
- HRW-61146-PK (03130)
- HRW-10222-BL (03128)
- HRW-10241-BL (03131)
- HRW-20111-TN (03129)
- HRW-20136-TN (03132)



### HRM 100

#### Union Manifold and Adapters

#### Features

- No cutting, priming, gluing, or waiting
- Takes the estimation out of the installation process
- Built to high industry specifications (ISO 228, ASTM2466)
- Blu-Lock® adapters allow you to go straight out of valves to headers and laterals with environmentally friendly Blu-Lock® pipe
- Oversized O-ring allows more torque and compression to satisfy a wider variety of angles
- Large sealing surface area at critical connections to ensure no leaks
- Maximum pressure of 350 psi @ ambient temperature of 120°F
- 1" I.D. and ultra-smooth core maximizes flow and minimizes friction loss



#### Specifications

- Max working pressure: 200 psi @ 73°F
- Burst pressure: exceeds >600 psi @ 73°F

#### How to Specify

Model	
HRM	Hydro-Rain Manifold System
Size	
100	1"
Type	
01	1 Port
02	2 Port
03	3 Port
UM	Union Swivel by MPT
UF	Union Swivel by FPT
US	Union Swivel by Stip
UU	Union Swivel by Union Swivel
UX	Union Swivel
UB	Union Swivel by Blu-Lock
TS	Thread Adapter
Type	
BD	Body
BA	Buttress Thread Adapter
1X	1"
CP	Coupling
CA	Cap
04	4th Generation
75	3/4"

#### Models (SKU)

- HRM-100-01-BD (03100)
- HRM-100-02-BD (03108)
- HRM-100-03-BD (03101)
- HRM-100-UM-BA (03105)
- HRM-100-UF-BA (03107)
- HRM-100-US-1X (03109)
- HRM-100-UU-CP (03110)
- HRM-100-UX-CA (03102)
- HRM-100-UM-04 (03104)
- HRM-100-UB-1X (03133)
- HRM-100-UB-75 (03134)
- HRM-100-TS-1X (03111)



HRM-100-02-BD

HRM-100-03-BD



HRM-100-01-BD

HRM-100-UM-BA

HRM-100-UF-BA



HRM-100-US-1X

HRM-100-UU-CP

HRM-100-UX-CA



HRM-100-UM-04

HRM-100-UB-1X

HRM-100-UB-75

HRM-100-TS-1X

## VALVE BOXES AND BASE

Strong and Durable

### VB-Pro Features

- Pre-molded 3" pipe slots
- 3/8"-16 UNC nut is insert molded into box body
- "T" top lid provides extra strength
- Snap-latch keeps lid in place
- Skid-resistant lid
- Made from 100% recycled material (black boxes only)

### Dimensions

- 20.5" x 15.5" x 12.25"



### VB-Base Features

- Formed with high strength, high density polyethylene material
- Includes covers for 3" pipe slots
- 6 pre-molded slots for 1.5" OD pipe
- Fits NDS 14" x 19" box (113)
- Fits Carson/Oldcastle (1419)

### Dimensions

- 22.75" x 16.75" x 3.75"

### How to Specify

	Model
VB	Valve Box
BASE	Base
STND	15" x 20"
12	12" Height
BG	Black Base with Green Lid

### Models (SKU)

- VB-STND-12-BG (03306)
- VB-BASE (03230)

### HRN SERIES

Outstanding Distribution Uniformity and Low Precipitation Rates

#### Features

- Body and top are color-coded according to spray radius
- Thick, ridged edges around top of nozzle gives excellent grip no matter the conditions
- Exclusive color-coded arc edge indicator lets you set a precise pattern fast
- Adjustment slot allows use of a screwdriver to give fine arc adjustment during operation
- Matched precipitation on fixed and adjustable nozzles allow for outstanding distribution uniformity
- Strip nozzles have the most uniform precipitation rate vs. leading competitors

#### Fixed Pattern Spray Nozzles



#### Adjustable Pattern Spray Nozzles



#### Specifications

- Pressure range: 15-70 psi (1.03-4.83 bar)
- Optimized for 30 psi (2.1 bar)
- Filtration: 500 micron filter















#### How to Specify


Model	
HRN	Nozzle
Series	
100	Fixed
200	Adjustable
Radius	
04	3'-4' with Filter Screen
08	6'-8' with Filter Screen
10	8'-10' with Filter Screen
12	10'-12' with Filter Screen
15	12'-15' with Filter Screen
18	15'-18' with Filter Screen
Pattern	
ADJ	Adjustable
Q	Quarter
H	Half
F	Full
SST	Side Strip
CST	Center Strip
EST	End Strip


#### Models (SKU)

- HRN-100-08-Q (04203)
- HRN-100-08-H (04204)
- HRN-100-08-F (04205)
- HRN-100-10-Q (04206)
- HRN-100-10-H (04207)
- HRN-100-10-F (04208)
- HRN-100-12-Q (04209)
- HRN-100-12-H (04210)
- HRN-100-12-F (04211)
- HRN-100-15-Q (04212)
- HRN-100-15-H (04213)
- HRN-100-15-F (04214)
- HRN-100-15-SST (04215)
- HRN-100-15-CST (04216)
- HRN-100-15-EST (04217)
- HRN-200-04-ADJ (04100)
- HRN-200-08-ADJ (04101)
- HRN-200-10-ADJ (04102)
- HRN-200-12-ADJ (04103)
- HRN-200-15-ADJ (04104)
- HRN-200-18-ADJ (04105)











PATTERN	PRESSURE PSI	RADIUS FT.	FLOW GPM	PRECIP. IN./H ■	PRECIP. IN./H ▲	PRESSURE BARS	RADIUS M	FLOW M <sup>3</sup> /H	FLOW L/S	PRECIP. MM/H ■	PRECIP. MM/H ▲
<b>HRN-100-08-Q (04203)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 90° Arc	15	5	0.18	2.07	2.39	1.0	1.5	0.04	2.85	53	61
	20	6	0.21	2.01	2.32	1.4	1.8	0.05	3.33	51	59
	25	7	0.24	1.62	1.87	1.7	2.1	0.05	3.80	41	47
	30	8	0.26	1.58	1.83	2.1	2.4	0.06	4.12	40	46
<b>HRN-100-08-H (04204)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 180° Arc	15	5	0.37	2.07	2.39	1.0	1.5	0.08	5.86	53	61
	20	6	0.42	2.01	2.32	1.4	1.8	0.10	6.66	51	59
	25	7	0.47	1.62	1.87	1.7	2.1	0.11	7.45	41	47
	30	8	0.52	1.58	1.83	2.1	2.4	0.12	8.24	40	46
<b>HRN-100-08-F (04205)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 360° Arc	15	5	0.74	2.07	2.39	1.0	1.5	0.17	11.73	53	61
	20	6	0.86	2.01	2.32	1.4	1.8	0.20	13.63	51	59
	25	7	0.96	1.62	1.87	1.7	2.1	0.22	15.22	41	47
	30	8	1.05	1.58	1.83	2.1	2.4	0.24	16.64	40	46
<b>HRN-100-10-Q (04206)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 90° Arc	15	7	0.29	2.28	2.63	1.0	2.1	0.07	4.60	58	67
	20	8	0.33	1.96	2.26	1.4	2.4	0.07	5.23	50	57
	25	9	0.36	1.71	1.98	1.7	2.7	0.08	5.71	43	50
	30	10	0.39	1.52	1.75	2.1	3.0	0.09	6.18	39	44
<b>HRN-100-10-H (04207)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 180° Arc	15	7	0.58	2.28	2.63	1.0	2.1	0.13	9.19	58	67
	20	8	0.65	1.96	2.26	1.4	2.4	0.15	10.30	50	57
	25	9	0.72	1.71	1.98	1.7	2.7	0.16	11.41	43	50
	30	10	0.79	1.52	1.75	2.1	3.0	0.18	12.52	39	44
<b>HRN-100-10-F (04208)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 360° Arc	15	7	1.58	2.28	2.63	1.0	2.1	0.36	25.04	58	67
	20	8	1.68	1.96	2.26	1.4	2.4	0.38	26.63	50	57
	25	9	1.82	1.71	1.98	1.7	2.7	0.41	28.85	43	50
	30	10	1.92	1.52	1.75	2.1	3.0	0.44	30.43	39	44
<b>HRN-100-12-Q (04209)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 90° Arc	15	9	0.45	2.14	2.47	1.0	2.7	0.10	7.13	54	63
	20	10	0.53	2.02	2.34	1.4	3.0	0.12	8.40	51	59
	25	11	0.60	1.91	2.21	1.7	3.4	0.14	9.51	49	56
	30	12	0.65	1.74	2.01	2.1	3.7	0.15	10.30	44	51
<b>HRN-100-12-H (04210)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 180° Arc	15	9	0.90	2.14	2.47	1.0	2.7	0.20	14.27	54	63
	20	10	1.05	2.02	2.34	1.4	3.0	0.24	16.64	51	59
	25	11	1.20	1.91	2.21	1.7	3.4	0.27	19.02	49	56
	30	12	1.30	1.74	2.01	2.1	3.7	0.30	20.61	44	51
<b>HRN-100-12-F (04211)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 360° Arc	15	9	1.80	2.14	2.47	1.0	2.7	0.41	28.53	54	63
	20	10	2.10	2.02	2.34	1.4	3.0	0.48	33.29	51	59
	25	11	2.40	1.91	2.21	1.7	3.4	0.55	38.04	49	56
	30	12	2.60	1.74	2.01	2.1	3.7	0.59	41.21	44	51
<b>HRN-100-15-Q (04212)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 90° Arc	15	11	0.65	2.07	2.39	1.0	3.4	0.15	10.30	53	61
	20	12	0.75	2.01	2.32	1.4	3.7	0.17	11.89	51	59
	25	14	0.82	1.62	1.87	1.7	4.3	0.19	13.00	41	47
	30	15	0.92	1.58	1.83	2.1	4.6	0.21	14.58	40	46
<b>HRN-100-15-H (04213)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 180° Arc	15	11	1.30	2.07	2.39	1.0	3.4	0.30	20.61	53	61
	20	12	1.50	2.01	2.32	1.4	3.7	0.34	23.78	51	59
	25	14	1.65	1.62	1.87	1.7	4.3	0.37	26.15	41	47
	30	15	1.85	1.58	1.83	2.1	4.6	0.42	29.32	40	46
<b>HRN-100-15-F (04214)</b>						<b>30° Trajectory</b>		<b>SI (Metric)</b>			
 360° Arc	15	11	2.60	2.07	2.39	1.0	3.4	0.59	41.21	53	61
	20	12	3.00	2.01	2.32	1.4	3.7	0.68	47.55	51	59
	25	14	3.30	1.62	1.87	1.7	4.3	0.75	52.31	41	47
	30	15	3.70	1.58	1.83	2.1	4.6	0.84	58.65	40	46



PATTERN	PRESSURE PSI	W x L FT.	FLOW GPM	PRESSURE BARS	RADIUS M Width	RADIUS M Length	FLOW M <sup>3</sup> /H	FLOW L/S		
<b>HRN-100-15-SST (04215)</b>			<b>30° Trajectory</b>		<b>SI (Metric)</b>					
	15	4 x 26	0.89	1.0	1.2	7.9	0.20	14.11		
	20	4 x 28	1.00	1.4	1.2	8.5	0.23	15.85		
	25	4 x 28	1.11	1.7	1.2	8.5	0.25	17.59		
	30	4 x 30	1.21	2.1	1.2	9.1	0.27	19.18		















<b>HRN-100-15-CST (04216)</b>			<b>30° Trajectory</b>		<b>SI (Metric)</b>					
	15	4 x 26	0.89	1.0	1.2	7.9	0.20	14.11		
	20	4 x 28	1.00	1.4	1.2	8.5	0.23	15.85		
	25	4 x 28	1.11	1.7	1.2	8.5	0.25	17.59		
	30	4 x 30	1.21	2.1	1.2	9.1	0.27	19.18		

<b>HRN-100-15-EST (04217)</b>			<b>30° Trajectory</b>		<b>SI (Metric)</b>					
	15	4 x 13	0.45	1.0	1.2	4.0	0.10	7.13		
	20	4 x 14	0.50	1.4	1.2	4.3	0.11	7.93		
	25	4 x 14	0.56	1.7	1.2	4.3	0.13	8.88		
	30	4 x 15	0.61	2.0	1.2	4.6	0.14	9.67		

PATTERN	PRESSURE PSI	RADIUS FT.	FLOW GPM	PRECIP. IN./H ■	PRECIP. IN./H ▲	PRESSURE BARS	RADIUS M	FLOW M <sup>3</sup> /H	FLOW L/S	PRECIP. MM/H ■	PRECIP. MM/H ▲
<b>HRN-200-04-ADJ (04100)</b>			<b>0° Trajectory</b>		<b>SI (Metric)</b>						
	15	4	0.40	9.50	10.98	1.0	1.2	0.09	0.02	241	279
	20	4	0.42	10.11	11.68	1.4	1.2	0.10	0.03	257	297
	25	4	0.46	10.95	12.65	1.7	1.2	0.10	0.03	278	321
	30	4	0.48	11.55	13.34	2.1	1.2	0.11	0.03	293	339
	15	4	0.79	9.50	10.98	1.0	1.2	0.18	0.05	241	279
	20	4	0.74	10.11	11.68	1.4	1.2	0.19	0.05	257	297
	25	4	0.91	10.95	12.65	1.7	1.2	0.21	0.06	278	321
	30	4	0.96	11.55	13.34	2.1	1.2	0.22	0.06	293	339
	15	4	1.19	9.50	10.98	1.0	1.2	0.27	0.07	241	279
	20	4	1.26	10.11	12.65	1.4	1.2	0.29	0.08	257	297
	25	4	1.37	10.95	12.65	1.7	1.2	0.31	0.09	278	321
	30	4	1.44	11.55	13.34	2.1	1.2	0.33	0.09	293	339
	15	4	1.58	9.50	10.98	1.0	1.2	0.36	0.10	241	279
	20	4	1.68	10.11	12.65	1.4	1.2	0.38	0.11	257	297
	25	4	1.82	10.95	12.65	1.7	1.2	0.41	0.11	278	321
	30	4	1.92	11.55	13.34	2.1	1.2	0.44	0.12	293	339

<b>HRN-200-08-ADJ (04101)</b>			<b>5° Trajectory</b>		<b>SI (Metric)</b>						
	15	7	0.53	4.16	4.81	1.0	2.1	0.12	0.03	106	122
	20	7	0.58	4.52	5.22	1.4	2.1	0.13	0.04	115	133
	25	8	0.62	3.70	4.27	1.7	2.4	0.14	0.04	94	109
	30	9	0.65	3.09	3.57	2.1	2.7	0.15	0.04	78	91
	15	7	1.06	4.16	4.81	1.0	2.1	0.24	0.07	106	122
	20	7	1.15	4.52	5.22	1.4	2.1	0.26	0.07	115	133
	25	8	1.23	3.70	4.27	1.7	2.4	0.28	0.08	94	109
	30	9	1.30	3.09	3.57	2.1	2.7	0.30	0.08	78	91
	15	7	1.59	4.16	4.81	1.0	2.1	0.36	0.10	106	122
	20	7	1.73	4.52	5.22	1.4	2.1	0.39	0.11	115	133
	25	8	1.85	3.70	4.27	1.7	2.4	0.42	0.12	94	109
	30	9	1.95	3.09	3.57	2.1	2.7	0.44	0.12	78	91
	15	7	2.12	4.16	4.81	1.0	2.1	0.48	0.13	106	122
	20	7	2.30	4.52	5.22	1.4	2.1	0.52	0.15	115	133
	25	8	2.46	3.70	4.27	1.7	2.4	0.56	0.16	94	109
	30	9	2.60	3.09	3.57	2.1	2.7	0.59	0.16	78	91

<b>HRN-200-10-ADJ (04102)</b>			<b>10° Trajectory</b>		<b>SI (Metric)</b>						
	15	8	0.51	3.04	3.51	1.0	2.4	0.11	0.02	77	89
	20	8	0.57	3.43	3.96	1.4	2.4	0.13	0.04	87	101
	25	9	0.59	2.82	3.25	1.7	2.7	0.13	0.04	72	83
	30	10	0.67	2.56	2.96	2.1	3.0	0.15	0.04	65	75
	15	8	1.01	3.04	3.51	1.0	2.4	0.23	0.06	77	89
	20	8	1.14	3.43	3.96	1.4	2.4	0.26	0.07	87	101
	25	9	1.19	2.82	3.25	1.7	2.7	0.27	0.07	72	83
	30	10	1.33	2.56	2.96	2.1	3.0	0.30	0.08	65	75

PATTERN	PRESSURE PSI	RADIUS FT.	FLOW GPM	PRECIP. IN./H ■	PRECIP. IN./H ▲	PRESSURE BARS	RADIUS M	FLOW M <sup>3</sup> /H	FLOW L/S	PRECIP. MM/H ■	PRECIP. MM/H ▲		
<b>HRN-200-10-ADJ (04102)</b>						<b>10° Trajectory</b>						<b>SI (Metric)</b>	
 270° Arc	15	8	1.52	3.04	3.51	1.0	2.4	0.34	0.10	77	89		
	20	8	1.71	3.43	3.96	1.4	2.4	0.39	0.11	87	101		
	25	9	1.78	2.82	3.25	1.7	2.7	0.40	0.11	72	83		
	30	10	2.00	2.56	2.96	2.1	3.0	0.45	0.13	65	75		
 360° Arc	15	8	2.02	3.04	3.51	1.0	2.4	0.46	0.13	77	89		
	20	8	2.28	3.43	3.96	1.4	2.4	0.52	0.14	87	101		
	25	9	2.37	2.82	3.25	1.7	2.7	0.54	0.15	72	83		
	30	10	2.66	2.56	2.96	2.1	3.0	0.60	0.17	65	75		
<b>HRN-200-12-ADJ (04103)</b>						<b>15° Trajectory</b>						<b>SI (Metric)</b>	
 90° Arc	15	11	0.52	1.65	1.91	1.0	3.4	0.12	0.03	42	49		
	20	11	0.61	1.94	2.24	1.4	3.4	0.14	0.04	49	57		
	25	12	0.70	1.86	2.15	1.7	3.7	0.16	0.04	47	55		
	30	13	0.71	1.61	1.86	2.1	4.0	0.16	0.04	41	47		
 180° Arc	15	11	1.04	1.65	1.91	1.0	3.4	0.24	0.07	42	49		
	20	11	1.22	1.94	2.24	1.4	3.4	0.28	0.08	49	57		
	25	12	1.40	1.86	2.15	1.7	3.7	0.32	0.09	47	55		
	30	13	1.41	1.61	1.86	2.1	4.0	0.32	0.09	41	47		
 270° Arc	15	11	1.56	1.65	1.91	1.0	3.4	0.35	0.10	42	49		
	20	11	1.83	1.94	2.24	1.4	3.4	0.42	0.12	49	57		
	25	12	2.09	1.86	2.15	1.7	3.7	0.48	0.13	47	55		
	30	13	2.12	1.61	1.86	2.1	4.0	0.48	0.13	41	47		
 360° Arc	15	11	2.08	1.65	1.91	1.0	3.4	0.47	0.13	42	49		
	20	11	2.44	1.94	2.24	1.4	3.4	0.55	0.15	49	57		
	25	12	2.79	1.86	2.15	1.7	3.7	0.63	0.18	47	55		
	30	13	2.82	1.61	1.86	2.1	4.0	0.64	0.18	41	47		
<b>HRN-200-15-ADJ (04104)</b>						<b>23° Trajectory</b>						<b>SI (Metric)</b>	
 90° Arc	15	14	0.69	1.35	1.56	1.0	4.3	0.16	0.04	34	40		
	20	14	0.72	1.41	1.63	1.4	4.3	0.16	0.05	36	41		
	25	15	0.75	1.29	1.49	1.7	4.6	0.17	0.05	33	38		
	30	16	0.78	1.17	1.36	2.1	4.9	0.18	0.05	30	34		
 180° Arc	15	14	1.38	1.35	1.56	1.0	4.3	0.31	0.09	34	40		
	20	14	1.44	1.41	1.63	1.4	4.3	0.33	0.09	36	41		
	25	15	1.51	1.29	1.49	1.7	4.6	0.34	0.09	33	38		
	30	16	1.56	1.17	1.36	2.1	4.9	0.35	0.10	30	34		
 270° Arc	15	14	2.06	1.35	1.56	1.0	4.3	0.47	0.13	34	40		
	20	14	2.15	1.41	1.63	1.4	4.3	0.49	0.14	36	41		
	25	15	2.26	1.29	1.49	1.7	4.6	0.51	0.14	33	38		
	30	16	2.34	1.17	1.36	2.1	4.9	0.53	0.15	30	34		
 360° Arc	15	14	2.75	1.35	1.56	1.0	4.3	0.62	0.17	34	40		
	20	14	2.87	1.41	1.63	1.4	4.3	0.65	0.18	36	41		
	25	15	3.01	1.29	1.49	1.7	4.6	0.68	0.19	33	38		
	30	16	3.12	1.17	1.36	2.1	4.9	0.71	0.20	30	34		
<b>HRN-200-18-ADJ (04105)</b>						<b>26° Trajectory</b>						<b>SI (Metric)</b>	
 90° Arc	15	15	0.71	1.22	1.41	1.0	4.6	0.16	0.04	31	36		
	20	16	0.74	1.11	1.29	1.4	4.9	0.17	0.05	28	33		
	25	17	0.78	1.04	1.20	1.7	5.2	0.18	0.05	26	30		
	30	18	0.83	0.98	1.13	2.1	5.5	0.19	0.05	25	29		
 180° Arc	15	15	1.43	1.22	1.41	1.0	4.6	0.32	0.09	31	36		
	20	16	1.48	1.11	1.29	1.4	4.9	0.34	0.09	28	33		
	25	17	1.56	1.04	1.20	1.7	5.2	0.35	0.10	26	30		
	30	18	1.65	0.98	1.13	2.1	5.5	0.37	0.10	25	29		
 270° Arc	15	15	2.14	1.22	1.41	1.0	4.6	0.49	0.13	31	36		
	20	16	2.22	1.11	1.29	1.4	4.9	0.50	0.14	28	33		
	25	17	2.34	1.04	1.20	1.7	5.2	0.53	0.15	26	30		
	30	18	2.48	0.98	1.13	2.1	5.5	0.56	0.16	25	29		
 360° Arc	15	15	2.85	1.22	1.41	1.0	4.6	0.65	0.18	31	36		
	20	16	2.96	1.11	1.29	1.4	4.9	0.67	0.19	28	33		
	25	17	3.12	1.04	1.20	1.7	5.2	0.71	0.20	26	30		
	30	18	3.30	0.98	1.13	2.1	5.5	0.75	0.21	25	29		

### HRS 200

Rugged and Durable

#### Features

- Pre-installed "quick rip" flush cap makes nozzle installation trouble-free. Just pull the tab, rip it off the stem, and install the filter and nozzle
- HRS-200-04-BL allows for an instant transition to Blu-Lock's "Built for Green" pipe and fittings system
- PRHS models provide 30 psi (2 bar) or 40 psi (2.75 bar) to the nozzle, effectively preventing water wasting misting caused by unregulated high pressure
- PRHS models are equipped with a factory-installed check valve that prevents low head drainage
- Co-molded TPR pressure activated wiper seal effectively reduces water waste by minimizing flow-by at system start-up

#### Dimensions

- HRS-200-04-FC (03012): 6" (15.2 cm) body height; 4" pop-up height (10.2 cm)
- HRS-200-04-FB (03015): 6" (15.2 cm) body height; 4" pop-up height (10.2 cm)
- HRS-200-04-PC (03001): 6" (15.2 cm) body height; 4" pop-up height (10.2 cm)
- HRS-200-06-FC (03013): 9 3/8" (23.8 cm) body height; 6" pop-up height (15.2 cm)
- HRS-200-12-FC (03014): 16" (40.6 cm) body height; 12" pop-up height (30.5 cm)
- Exposed surface diameter: 2 1/4" (5.7 cm)



#### Specifications

- Pressure: 15-70 psi (1.0-6.2 bar)
- Spacing: 3-20' (0.9-6.1 meters)

#### How to Specify

Model	
HRS	Spray Head
Height	
200	Commercial
04	4"
06	6"
12	12"
Options	
FC	Flush Cap
FB	Flush Cap & 1/2" Blu-Lock Elbow
PC	Flush Cap & PRHS
30	30 psi
40	40 psi

#### Models (SKU)

- HRS-200-04-FC (03012)
- HRS-200-04-FB (03015)
- HRS-200-04-PC30 (03001)
- HRS-200-04-PC40 (03011)
- HRS-200-06-FC (03013)
- HRS-200-12-FC (03014)

# HRS 100

Slim Head

## Features

- Pre-installed "quick rip" flush cap makes nozzle installation trouble-free. Just pull the tab, rip it off the stem, and install the filter and nozzle
- Pressure activated wiper seal minimizes flow-by and resists abrasion from debris
- Compatible with high efficiency HRN 200 nozzles
- Heavy-duty material stands up to the elements and delivers years of dependable performance
- Heat-treated, stainless steel retractor spring provides years of precision operation
- Two-piece stem ratchet makes nozzle and body alignment effortless
- Duty cycle, life, environmental, and field beta tests ensure quality and dependability
- Compatible with Hydro-Rain®, Hunter®, Irritrol®, K-Rain®, Orbit®, Rain Bird®, RainPro®, and Weathermatic® nozzles



sprinklers

## How to Specify

	Model
HRS	Spray Head
100	Slim Profile
	Height
04	4"
	Options
FC	Flush Cap

## Models (SKU)

- HRS-100-04-FC (94497)

## Dimensions

- HRS-100-04-FC (94497) 6¼" (15.8 cm) body height; 4" pop-up height (10.1 cm)
- Exposed surface diameter: 1½" (3.8 cm)

## Specifications

- Pressure: 15-70 psi (1.0-6.2 bar)
- Spacing: 3-20' (0.9-6.1 meters)



### HRX 075

Industry-Leading Distribution Uniformity

#### Features

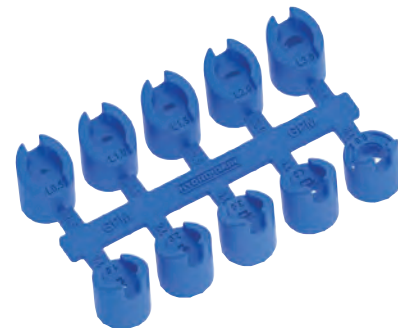
- Uniform coverage with matched precipitation across nozzles #1 through #4 and low angle nozzles
- Easy-to-match precipitation nozzle system. Use nozzle #1 for 90°, #2 for 180°, #3 for 270°, and #4 for 360°
- Rubber cover keeps the dirt out of adjustment components
- Lubricated gear assembly provides years of reliable use
- Precision reversing mechanism enables smooth non-delayed forward and reverse rotation
- Adjustment key changes arc from 40-360°
- Radius can be adjusted from 100-50%

#### Dimensions

- Overall height: 7 3/8" (19 cm)
- Exposed surface diameter: 1 3/4" (4 cm)
- Pop-up height: 4" (10 cm)

#### Specifications

- Precipitation rate: 0.10-1.03 inches per hour
- Radius: 22'-52'
- Operating pressure: 30-70 psi
- Flow rate: 0.3-9.6 GPM
- Inlet: 3/4" FPT
- Nozzle outlet trajectory: 25 degree standard or 13 degrees low angle
- Nozzle installed: Number 2



#### How to Specify

	Model
HRX	Rotor
	Inlet
075	3/4" FPT
ADJ	Adjustable

#### Models (SKU)

- HRX-075-ADJ (01010)

NOZZLE	PRESSURE PSI	RADIUS FT.	FLOW GPM	PRECIP. IN./H ■	PRECIP. IN./H ▲
<b>1</b>	25	28	0.7	0.18	0.20
	35	30	0.9	0.18	0.21
	45	31	1.0	0.20	0.23
	55	31	1.1	0.22	0.26
	65	31	1.3	0.26	0.30
<b>2</b>	25	31	1.4	0.28	0.32
	35	34	1.7	0.29	0.34
	45	35	2.0	0.32	0.37
	55	36	2.3	0.35	0.41
	65	37	2.5	0.36	0.42
<b>3</b>	25	31	2.1	0.43	0.49
	35	35	2.6	0.41	0.48
	45	38	3.0	0.41	0.47
	55	39	3.3	0.41	0.48
	65	40	3.6	0.43	0.49
<b>4</b>	25	33	2.8	0.50	0.57
	35	38	3.4	0.46	0.53
	45	40	4.0	0.49	0.56
	55	42	4.5	0.50	0.58
	65	43	5.0	0.51	0.59
<b>8</b>	25	36	6.0	0.89	1.03
	35	45	7.1	0.68	0.79
	45	50	8.0	0.63	0.73
	55	51	8.8	0.66	0.76
	65	52	9.6	0.68	0.79
<b>L 0.5</b>	25	24	0.3	0.10	0.12
	35	26	0.4	0.11	0.13
	45	28	0.5	0.12	0.14
	55	29	0.6	0.14	0.16
	65	31	0.7	0.14	0.16
<b>L 1</b>	25	23	0.7	0.26	0.30
	35	26	0.9	0.25	0.29
	45	29	1.0	0.23	0.26
	55	31	1.2	0.25	0.29
	65	32	1.4	0.27	0.31
<b>L 1.5</b>	25	23	1.2	0.44	0.50
	35	27	1.3	0.35	0.40
	45	29	1.5	0.34	0.40
	55	31	1.7	0.35	0.40
	65	32	1.9	0.36	0.42
<b>L 2</b>	25	23	1.6	0.58	0.67
	35	27	1.8	0.49	0.57
	45	29	2.0	0.45	0.52
	55	32	2.2	0.43	0.49
	65	33	2.4	0.42	0.49
<b>L 3</b>	25	30	2.6	0.57	0.65
	35	36	2.8	0.42	0.48
	45	40	3.0	0.37	0.43
	55	41	3.3	0.37	0.43
	65	42	3.5	0.38	0.44



\*All Precipitation rates were calculated using 180° operation. The precipitation rate for 360° of operation would be half of the value in the table. 8.0 nozzle is designed for single-head field and pasture applications

\*For optimal matched precipitation use the suggested nozzle when the indicated pattern is set.

	PATTERN	Suggested Nozzle	Suggested L Nozzle
	<b>90°</b>	1	L 0.5
	<b>180°</b>	2	L 1
	<b>270°</b>	3	L 1.5
	<b>360°</b>	4	L 2



# MICRO-IRRIGATION

The Most Efficient Method of Watering

### Manifold Features

- Flow control on adjustable manifolds
- ¼" barbed ports with threaded caps
- Easy to remove filter-prevents clogged nozzles
- Connects to ½" MPT
- Ports rotate up to 270°
- UV resistant

### Manifold Specifications

- Operating pressure: 0-50 psi (0-3.4 bar)
- Flow: .01-20 GPH at 50 psi
- Minimum filtration: 12 mesh (707 microns)

### Pipe & Tubing Features

- Designed for vineyards, orchards, row crops, and landscape
- Use with Drip-Lock® or barbed fittings
- Commercial grade
- UV resistant

### Pipe & Tubing Specifications

- Operating pressure: 0-50 psi (0-3.4 bar)
- ½" tubing material: polyethylene
- ¼" tubing material: vinyl

### Emitter & Spray Features

- Self-piercing barb on pressure compensating emitters
- Color coded by flow
- UV and chemical resistant
- Insect baffle to deter insect entry
- Removable cap for inspection and cleaning
- Designed for vineyards, orchards, row crops, and landscape

### Emitter & Spray Specifications

- Operating pressure: 5-25 psi (0.34-1.7 bar)
- Flow rate: .5-2 GPH



### Accessory Features

- UV resistant materials
- No clamps required
- Industry exclusive double barb


### Accessory Specifications



- Maximum pressure: 50 psi (3.4 bar)
- Material: UV resistant nylon and/or aluminum





micro

MANIFOLDS		Part Number	Ports	Description	SKU
	Adjustable Flow	HRZ-AFM-4	4	½" FPT	07005
		HRZ-AFM-8	8	½" FPT	07000
	Full Flow	HRZ-FFSA-1	1	Shrub Head Adapter	07050
		HRZ-FFM-1	1	½" FPT	07056
		HRZ-FFM-2M	2	½" MPT	07035
		HRZ-FFM-2	2	½" FPT	07030
		HRZ-FFM-4	4	½" FPT	07025



PIPE & TUBING		Part Number	Size	Description	SKU
	Distribution	DLT-250-50	1/4"	1/4" x 50'	07300
		DLT-250-100	1/4"	1/4" x 100'	07301
		DLT-660-100	1/2"	.660 x 100'	07336
		DLT-700-100	1/2"	.700 x 100'	07346
		DLT-700-500	1/2"	.700 x 500'	07347
	1 GPH Emitter	DLT-10-12-100	1/2"	.700 x 100'	07376
	Soaker	DLT-250S-100	1/4"	1/4" x 100'	07331

SPRAYS & EMITTERS		Part Number	Description	SKU
	Sprays	HRZ-BUB360-STK	Micro-Bubbler on 6" Stake	07110
		HRZ-MS360-STK	Multi-Stream Emitter on 6" Stake	07105
	Emitters	HRZ-PCD-05	PC Emitter - 1/2 GPH	07214
		HRZ-PCD-10	PC Emitter - 1 GPH	07225
		HRZ-PCD-20	PC Emitter - 2 GPH	07226

ACCESSORIES		Part Number	Size	Description	SKU
	Stakes	HRZ-CS-7-6	1/4"	Clip Stake	05721
		HRZ-LS-7	1/4"	Loop Stake	05730
		HRZ-LS-18	1/2"	Loop Stake	05731
	Clamps	HRZ-PCN-7	1/4"	Pipe Clamp w/Nail	05715
		HRZ-PCN-18	1/2"	Pipe Clamp w/Nail	05716
	Double Barb Fittings	1401-002	1/4"	Tee	07401
		1406-002	1/4"	Elbow	07400
		1429-002	1/4"	Coupling	07402
	Fittings	1VLV-002	1/4"	Shut-off Valve	07404
		HRZ-FIG-8	1/2"	Figure 8 End Fitting	05443

micro

### DLM 050

Drip-Lock®  
In-line Manifolds

#### Features

- All 1/2" fittings are releasable and reusable with the Drip-Lock® release collar
- Patented design is 100% tool and chemical free
- Low insertion force makes installation quick and easy
- 1/2" Drip-Lock® works with tubing from 16 mm to .710"
- 1/4" Drip-Lock® works with tubing from 0.245" to 0.250"
- Total compatibility of fittings, pipe, manifolds, valves, saddles, and heads
- Drip-Lock® technology ensures lower friction loss for better water efficiency
- Built tough fittings made from UV-resistant ABS, stainless steel and EPDM seals

#### Specifications

- Compatibility range: 16mm (about .630") to .710" (about 17.8 mm) outside diameter
- Burst pressure exceeds 100 psi (6.9 bar)
- Operating pressure: 0-50 psi (0-3.4 bar)



**DLM-050-DD-25**



**DLM-050-DS-25**

fittings

DRIP MANIFOLDS	Part Number	Nom. Size	Description	SKU
Push x Push x Dual 1/4" Manifold	DLM-050-DD-25	1/2"	1/2" x 1/2" x dual 1/4"	07046
Push x Street x Dual 1/4" Manifold	DLM-050-DS-25	1/2"	1/2" x 1/2" x dual 1/4"	07047

# DRIP-LOCK®

For 1/2" Micro Irrigation Pipe

## Features

- All 1/2" fittings are releasable and reusable with the Drip-Lock® release collar
- Patented design requires no glue or tools for installation
- Low insertion force makes installation quick and easy
- 1/2" Drip-Lock® works with tubing from 16 mm to 18mm
- Drip-Lock® technology ensures lower friction loss for better water efficiency
- Built tough fittings made from UV-resistant ABS, stainless steel and EPDM seals

## Specifications

- Compatibility range: 16mm (about .630") to .710" (about 17.8 mm) outside diameter
- Burst pressure exceeds 100 psi (6.9 bar)
- Operating pressure: 0-50 psi (0-3.4 bar)



DL-401-005



DL-406-005



DL-429-005



DL-VLV-005



DL-436-101



DL-436-005



DL-MHT-101



DL-447-005

FITTINGS		Part Number	Nom. Size	Description	SKU
Tee	Push x Push x Push	DL-401-005	1/2"	1/2" x 1/2" x 1/2"	07492
Elbow	Push x Push	DL-406-005	1/2"	1/2" x 1/2"	07490
Coupling	Push x Push	DL-429-005	1/2"	1/2" x 1/2"	07491
Adapter	Push x MPT	DL-436-101	1/2"	1/2" x 3/4"	07493
		DL-436-005	1/2"	1/2" x 1/2"	07494
	Push x FHT	DL-MHT-101	1/2"	1/2" x 5/8"	07495
Shut-off Valve	Shut-off Valve	DL-VLV-005	1/2"	1/2" x 1/2"	07497
End Cap	End Cap	DL-447-005	1/2"	1/2" x MHT	07498

### PVC-LOCK® MANIFOLD TEES

For PVC Pipe

#### Features

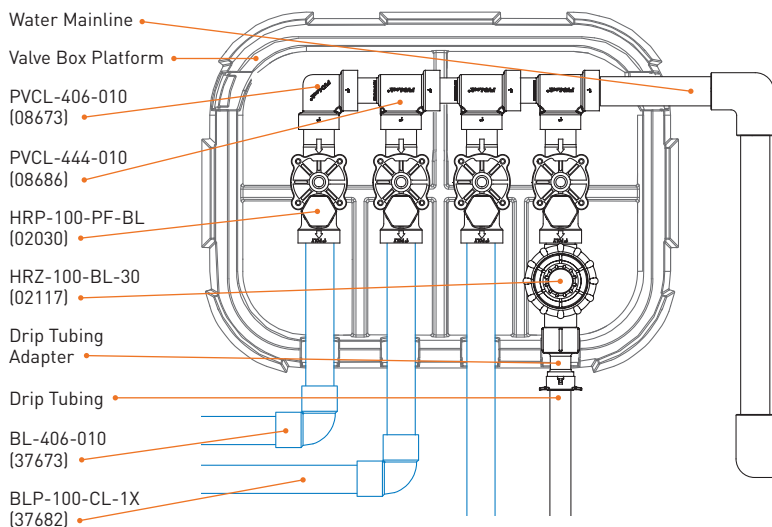
- Patent pending design is 100% tool and glue free
- PVC-Lock® fittings cut installation time in half or more
- Patent pending retaining system with stainless steel teeth grip pipe tight for a strong, leak-proof connection
- PVC-Lock® fittings can swivel 360° around the pipe for easy sprinkler head orientation and adjustment
- For use with all brands and classes of Schedule 40 and 80 PVC pipe
- Removable and reusable using the PVC-Lock® removal tool
- Pressure rated for use on either side of the irrigation valve

#### Specifications

- Burst pressure: 600 psi (41.4 bar)
- Working pressure: 0-150 psi (10.5 bar) at 68°F (20°C)
- Certifications: IAPMO IGC 300-2013



#### Installation Specification Detail



MANIFOLD TEES	Part Number	Nom. Size	Description	SKU
Push x Spigot x MPT	PVCL-476-010	1"	1" x 1" x 1"	08685
Push x Spigot x Push	PVCL-444-010	1"	1" x 1" x 1"	08686
Push x Spigot x FPT	PVCL-477-101	1"	1" x 1" x 1"	08688

# PVC-LOCK®

For PVC Pipe



## Features

- Patent pending design is 100% tool and glue free
- PVC-Lock® fittings cut installation time in half or more
- Patent pending retaining system with stainless steel teeth grip pipe tight for a strong, leak-proof connection
- PVC-Lock® fittings can swivel 360° around the pipe for easy sprinkler head orientation and adjustment
- For use with all brands and classes of Schedule 40 and 80 PVC pipe
- Removable and reusable using the PVC-Lock® removal tool
- Pressure rated for use on either side of the irrigation valve

## Specifications

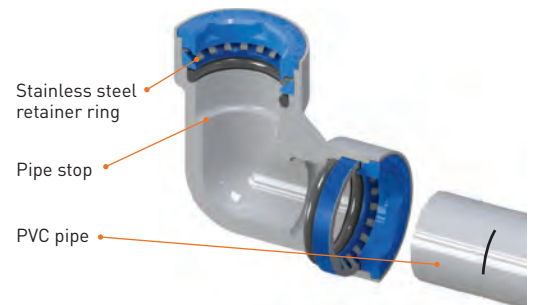
- Burst pressure: 600 psi (41.4 bar)
- Working pressure: 0-150 psi (10.5 bar) at 68°F (20°C)
- Certifications: IAPMO IGC 300-2013



fittings






## How Does PVC-Lock® Work?







When PVC pipe is inserted to the pipe stop, the O-ring seals around the pipe and the stainless steel ring "locks" the pipe in place.

The fitting with a fully inserted pipe creates a permanent, leak-free connection.

<b>TEES</b>		Part Number	Nom. Size	Description	SKU
	Push x Push x Push	PVCL-401-010	1"	1" x 1" x 1"	08672
		PVCL-401-007	¾"	¾" x ¾" x ¾"	07752
		PVCL-401-005	½"	½" x ½" x ½"	06503
	Bullhead	PVCL-401-102	1"	¾" x ¾" x 1"	08684
		PVCL-402-130	1"	1" x 1" x ½"	08671
	Push x Push x FPT	PVCL-402-101	¾"	¾" x ¾" x ½"	07772
		PVCL-402-005	½"	½" x ½" x ½"	06544

<b>MANIFOLD TEES</b>		Part Number	Nom. Size	Description	SKU
	Push x Spigot x MIPT	PVCL-476-010	1"	1" x 1" x 1"	08685
	Push x Spigot x Push	PVCL-444-010	1"	1" x 1" x 1"	08686
	Push x Spigot x FPT	PVCL-477-101	1"	1" x 1" x 1"	08688

<b>ELBOWS</b>		Part Number	Nom. Size	Description	SKU
	Push x Push	PVCL-406-010	1"	1" x 1"	08673
		PVCL-406-007	¾"	¾" x ¾"	07774
		PVCL-406-005	½"	½" x ½"	06516
	Push x FPT	PVCL-407-130	1"	1" x ½"	08675
		PVCL-407-010	1"	1" x 1"	08681
		PVCL-407-101	¾"	¾" x ½"	07775
	Push x MPT	PVCL-410-010	1"	1" x 1"	08679
		PVCL-410-005	½"	½" x ½"	06548

<b>COUPLINGS</b>		Part Number	Nom. Size	Description	SKU
	Push x Push	PVCL-429-010	1"	1" x 1"	08676
		PVCL-429-131	1"	1" x ¾"	08677
		PVCL-429-007	¾"	¾" x ¾"	07776
		PVCL-429-101	¾"	¾" x ½"	06619
		PVCL-429-005	½"	½" x ½"	06542

**SLIDE REPAIR COUPLINGS**



Push x Spigot

Part Number	Nom. Size	Description	SKU
PVCL-SFX-100	1"	1" x 1"	08646
PVCL-SFX-075	¾"	¾" x ¾"	07884
PVCL-SFX-050	½"	½" x ½"	06556

**FLEXIBLE COUPLINGS**



Push x Push

Part Number	Nom. Size	Description	SKU
PVCL-FPC-100	1"	1" x 1"	08002
PVCL-FPC-075	¾"	¾" x ¾"	07002
PVCL-FPC-050	½"	½" x ½"	06002

**ADAPTERS**



Push x MPT

Push x Spigot

Insert x Spigot

Part Number	Nom. Size	Description	SKU
PVCL-436-010	1"	1" x 1"	08678
PVCL-436-007	¾"	¾" x ¾"	07778
PVCL-437-131	1"	¾" x 1"	08690
1460-010	1"	1" x 1"	37905

**END CAPS**



Push

Part Number	Nom. Size	Description	SKU
PVCL-447-010	1"	1"	08680
PVCL-447-007	¾"	¾"	07780
PVCL-447-005	½"	½"	06546

**TOOLS**



Release

Bevel

Part Number	Nom. Size	Description	SKU
PVCL-RTL-100	1"	1"	08195
PVCL-RTL-075	¾"	¾"	07015
PVCL-RTL-050	½"	½"	06016
PVCL-BVL-T00L			02022

**BLU-LOCK®**

For HDPE Pipe

**Features**

- Low insertion force makes installation fast
- Works with all HDPE pipe ASTM D2239 listed SIDR 15 100 psi and SIDR 19 80 psi pipe
- All 1/2", 3/4", and 1" fittings are releasable and reusable with the Blu-Lock® release tool or collar
- Patented design is 100% tool and chemical free
- Coil and straight length pipe options provide unrivaled flexibility
- Blu-Lock® pipe is environmentally friendly, and recyclable, HDPE pipe that provides a superior alternative to PVC
- Blu-Lock® technology will ensure lower friction loss for better water efficiency
- Built tough fittings made from UV-resistant ABS, stainless steel and EPDM seals are designed and tested to ensure toughness
- For use on the downstream side of the station valves, not rated for mainline use



fittings

**Specifications****Blu-Lock® 1/2" (1.3 cm) Swing Pipe Fittings:**

- Burst pressure: exceeds 220 psi (15.2 bar)
- Working pressure: 10-80 psi (0.69-5.5 bar)

**Blu-Lock® 3/4" (1.9 cm) Lateral Pipe Fittings:**

- Burst pressure: exceeds 250 psi (17.2 bar)
- Working pressure: 10-125 psi (0.69-8.6 bar)

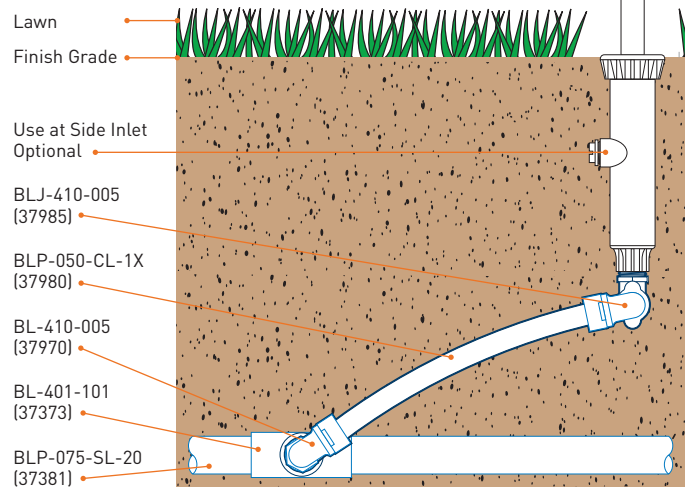
**Blu-Lock® 1" (2.5 cm) Lateral Pipe Fittings:**

- Burst pressure: exceeds 350 psi (24.1 bar)
- Working pressure: 10-150 psi (0.69-10.3 bar)





Installation Specification Detail



**FAST**



**SIMPLE  
PUSH ON**



**ROTATE  
360°**



**HOT OR  
COLD**



**WET OR  
DRY**



**NO  
WAITING**



**RELEAS-  
ABLE**



**FULL  
FLOW**

PSI vs. Flow Rate

PSI	1" GPM	¾" GPM
40	11	8
50	13	9
60	14	10
70	16	11

1" (2.5 cm) Pipe Pressure Loss\*





FLOW GPM	VELOCITY FPS	PRESSURE LOSS PSI
1		
2		
3		
4	1.48	0.46
5	1.86	0.76
6	2.23	1.06
7	2.60	1.37
8	2.97	1.80
9	3.34	2.23
10	3.71	2.76
11	4.08	3.07
12	4.45	3.85
13	4.83	4.45
14	5.2	5.10
15	5.57	5.76
20	7.42	9.90
25	9.98	14.90





¾" (1.9 cm) Pipe Pressure Loss\*


FLOW GPM	VELOCITY FPS	PRESSURE LOSS PSI
1	0.60	0.15
2	1.20	0.48
3	1.80	1.00
4	2.41	1.64
5	3.01	2.46
6	3.61	3.45
7	4.21	4.59
8	4.81	5.85
9	5.41	7.29
10	6.02	8.85
11	6.62	10.60
12	7.22	12.40
13	7.82	14.40
14	8.42	16.50
15	9.02	18.70

\*Measured in 100' lengths

\*Measured in 100' lengths

<b>TEES</b>		Part Number	Nom. Size	Description	SKU
	Push x Push x Push	BL-401-010	1"	1" x 1" x 1"	37670
		BL-401-131	1"	1" x 1" x 3/4"	37683
		BL-401-130	1"	1" x 1" x 1/2"	37672
		BL-401-007	3/4"	3/4" x 3/4" x 3/4"	37370
		BL-401-101	3/4"	3/4" x 3/4" x 1/2"	37373
	Bullhead	BL-401-005	1/2"	1/2" x 1/2" x 1/2"	37977
		BL-401-102	1"	3/4" x 3/4" x 1"	37684
		BL-401-075	1"	1/2" x 1/2" x 1"	37687
	Push x Push x FPT	BL-401-074	3/4"	1/2" x 1/2" x 3/4"	37387
		BL-402-130	1"	1" x 1" x 1/2"	37671
	Barb x Barb x Push	BL-402-101	3/4"	3/4" x 3/4" x 1/2"	37372
		BL-1401-130	1"	1" x 1" x 1/2"	37904
		BL-1401-101	3/4"	3/4" x 3/4" x 1/2"	37903

<b>ELBOWS</b>		Part Number	Nom. Size	Description	SKU
	Push x Push	BL-406-010	1"	1" x 1"	37673
		BL-406-007	3/4"	3/4" x 3/4"	37374
		BL-406-005	1/2"	1/2" x 1/2"	37987
	Push x FPT	BL-407-130	1"	1" x 1/2"	37675
		BL-407-101	3/4"	3/4" x 1/2"	37375
		BL-407-005	1/2"	1/2" x 1/2"	37972
	Push x MPT	BL-407-074	1/2"	1/2" x 3/4"	37973
		BL-410-005	1/2"	1/2" x 1/2"	37970
	Push x Street	BL-410-007	1/2"	1/2" x 3/4"	37971
		BL-409-005	1/2"	1/2" x Street	37979

<b>SWING ASSEMBLIES</b>		Part Number	Nom. Size	Description	SKU
	Street x Street	BLJ-050-SS-6X	1/2"	6" Swing Assembly	37604
		BLJ-050-SS-12	1/2"	12" Swing Assembly	37605

**SWING JOINTS**



Push x MPT

Part Number	Nom. Size	Description	SKU
BLJ-410-005	1/2"	1/2" x 1/2"	37985
BLJ-410-101	1/2"	1/2" x 3/4"	37986

**COUPLINGS**



Push x Push

Part Number	Nom. Size	Description	SKU
BL-429-010	1"	1" x 1"	37676
BL-429-131	1"	1" x 3/4"	37677
BL-429-130	1"	1" x 1/2"	37685
BL-429-007	3/4"	3/4" x 3/4"	37376
BL-429-101	3/4"	3/4" x 1/2"	37377
BL-429-005	1/2"	1/2" x 1/2"	37976

**ADAPTERS**



Push x MPT



Push x Soc



Push x MPT



Barb x Push



Push x Buttress

Part Number	Nom. Size	Description	SKU
BL-436-010	1"	1" x 1"	37678
BL-436-131	3/4"	3/4" x 1"	37383
BL-436-007	3/4"	3/4" x 3/4"	37378
BLA-075-BF-75	3/4"	3/4" x 3/4"	37379
BL-474-010	1"	1" x 1"	37689
BL-474-131	3/4"	3/4" x 1"	37385
BL-474-007	3/4"	3/4" x 3/4"	37384
BL-436-101	1/2"	1/2" x 3/4"	37975
BL-436-005	1/2"	1/2" x 1/2"	37974
BL-1474-130	1"	1" x 1/2"	37902
BL-1474-101	3/4"	3/4" x 1/2"	37901
BL-FPA-050	1/2"	1/2" x 1/2"	37990
HRM-100-UB-1x	1"	1" x 1"	03133
HRM-075-UB-1x	3/4"	3/4" x 3/4"	03134

### END CAPS



Push

Part Number	Nom. Size	Description	SKU
BL-447-010	1"	1"	37680
BL-447-007	¾"	¾"	37380

### TOOLS/ACCESSORIES



Release

Part Number	Nom. Size	Description	SKU
BL-RTL-100	1"	1"	37908
BL-RTL-075	¾"	¾"	37909
BLD-050-BX-50	½"	½" Blu-Lock Spigot	02602
BLB-CUT-25-1x	1"	1"	26113

### 100 Psi SIDR 15 PIPE



Straight

Part Number	Nom. Size	Description	SKU
BLP-100-SL-20	1"	1" x 20'	37681
BLP-075-SL-20	¾"	¾" x 20'	37381



Coil

BLP-100-CL-1x	1"	1" x 100'	37682
BLP-100-CL-3x	1"	1" x 300'	37692
BLP-075-CL-1x	¾"	¾" x 100'	37382
BLP-075-CL-3x	¾"	¾" x 300'	37388



Coil-Reclaimed

BLP-100-CR-1x	1"	1" x 100'	37698
BLP-100-CR-1x	¾"	¾" x 100'	37396

### SWING PIPE



Coil

Part Number	Nom. Size	Description	SKU
BLP-050-CL-1x	½"	½" x 100'	37980

# BLS NITRO SADDLES™

The Fastest Irrigation Saddle

### Features

- Installs in less than 5 seconds
- Push lock design, no tools required
- Designed for a chemical free, glue free, tool-free installation
- Swiss-engineered Schenkel clamp provides a fast, one-hand installation
- Ergonomic grip is comfortable and fast under any condition
- High-impact ABS guarantees durability
- Best in class flow with up to 14 GPM at 40 psi
- Compatible with ASTM D2239 listed SIDR 19 80 psi

### Specifications

- Flow: up to 14 GPM (53 LPM) at 40 psi (2.75 bar)
- Operating pressure: 120 psi (8.2 bar) max
- Burst pressure: 220 psi (15.17 bar)

### Dimensions

- Saddle height: 3" (7.6 cm)
- Saddle width: 2" (5.0 cm)
- Tap height: 3" (7.6 cm)
- Tap width: 2.5" (6.3 cm)
- Installed height: 3" (7.6 cm)



BLS-125-BD-LT



BLS-100-BD-LT



BLS-075-BD-LT



BLS-TAP-FP-75



BLS-TAP-FP-50



BLS-TAP-BL-50



BLS-TAP-SB-50

SADDLE BODY		Part Number	Nom. Size	SKU
-------------	--	-------------	-----------	-----



Body

BLS-125-BD-LT	1 1/4"	02911
BLS-100-BD-LT	1"	02917
BLS-075-BD-LT	3/4"	02916

SADDLE TEES		Part Number	Nom. Size	SKU
-------------	--	-------------	-----------	-----



FPT Tap

BLS-TAP-FP-75	3/4"	02920
BLS-TAP-FP-50	1/2"	02919
BL Swing Pipe Tap	1/2"	02918
SB Adapter Tap	1/2"	02019

# HYDRO-RAIN®

The Hydro-Rain® professional line of energy efficient LED landscape lights provides complete lighting control, straightforward selection, no-hassle installation, elegant design, and breathtaking accents for homes and plants alike. The brilliant warm light generated by our professional-quality, long-lasting lights enriches the natural beauty of any landscape.



Lighting

# HRL 100 SERIES

Independent Stations Allows Better Management of Landscape Lighting

### Transformer Features

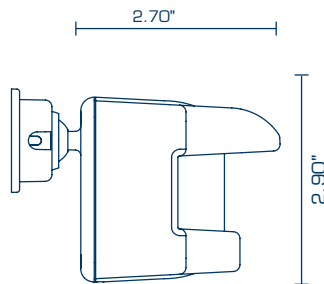
- Optimized for LED landscape lights
- Digital display
- 3 fully programmable stations
- 2 start times per station
- 60W built-in electronic transformer 12V AC/DC
- Photocell with 10' cable
- Motion sensor capable
- Indoor/outdoor mount

### Transformer Specifications

- 18 watts per station

### Motion Sensor Specifications

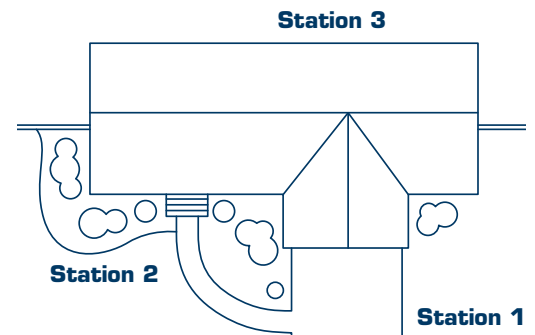
- Designed for the HRL-100 landscape lighting controllers
- DC pulse
- Passive infrared sensor
- 120° field of view
- 40' range



lighting

How to Specify	
	Model
HRL	Hydro-Rain Lighting
	Series
100	Basic
	Type
60W	Transformer Size in Watts
MS	Motion Sensor

- ### Models (SKU)
- HRL-100-60W (06700)
  - HRL-100-MS (06730)



# HRL PATH LIGHTING

## Area Lighting

### Features

- PWM dimming
- Warm light output
- 3 high efficiency LED lights
- Aluminum housing
- Weather resistant
- Classic design for path or area lighting

### Specifications

- Material: aluminum
- Finish: black or textured bronze
- Light source: USA 12V LED & driver
- Power usage: 3 watts
- Operation range: 7V-15V AC or DC
- Lumens: 210
- 8" mounting stake included
- Wire lead: #18-2 @ 30"
- Expected life: 50,000 hrs



**HRL-BKP1-LED-3W**

**HRL-BRP1-LED-3W**

## Color Temperature



### How to Specify

Model	
HRL	Hydro-Rain Lighting
Series	
BK	Black
BR	Bronze
Bulb Type	
LED	LED Lighting
Power Usage	
3W	Power Input

### Models (SKU)

- HRL-BKP1-LED-3W (06701)
- HRL-BRP1-LED-3W (06703)



# HRL SPOT LIGHTING

Directional Lighting

### Features

- PWM dimming
- Warm light output
- 3 high efficiency LED lights
- Aluminum housing
- Weather resistant
- Directional lighting

### Specifications

- Material: aluminum
- Finish: black or textured bronze
- Light source: USA 12V LED & driver
- Power usage: 3 watts
- Operation range: 7V-15V AC or DC
- Lumens: 210
- 8" mounting stake included
- Wire lead: #18-2 @ 30"
- Expected life: 50,000 hrs



HRL-BRS2-LED-3W



HRL-BKS1-LED-3W



HRL-BRS1-LED-3W

### Color Temperature



### How to Specify

	<b>Model</b>
HRL	Hydro-Rain Lighting
	<b>Series</b>
BK	Black
BR	Bronze
1	Traditional
2	Bullet
	<b>Bulb Type</b>
LED	LED Lighting
	<b>Power Usage</b>
3W	Power Input

### Models (SKU)

- HRL-BKS1-LED-3W (06721)
- HRL-BRS1-LED-3W (06723)
- HRL-BRS2-LED-3W (06722)

lighting

# CONTRACTOR ADVANTAGE REWARDS

Travel,  
Merchandise,  
Gift Cards,  
Distributor  
Credit

## Built for Speed

Time is money. Faster installs mean lower labor costs—and more money in your pocket. With Hydro-Rain patented Blu-Lock® piping system and professional irrigation products, there's no glue, no twisting, no pounding, no headache—just 80% faster installation.

Installation speed:  
It's the Hydro-Rain® advantage.

## Built for Rewards

To help you enjoy the time you save, you can now earn points towards merchandise, travel, and account credit every time you purchase any Hydro-Rain® product including Blu-Lock® pipe and fittings, valves, controllers, valve boxes, manifolds, sprinklers, nozzles etc. As a Hydro-Rain® contractor, you'll earn up to 5 points for every dollar you spend. You work hard. Rewards points are our way of saying "thanks!"

## Built for You

The Contractor Advantage program is designed for top landscaping and irrigation professionals. As a participating contractor, you'll receive training, resources, and special benefits to help you grow your business.

**It pays to install Hydro-Rain®.  
Join the Hydro-Rain Contractor  
Advantage™ Program today!**

To learn more or sign up, go to:  
[www.hydrorain.com](http://www.hydrorain.com) and click on "CONTRACTOR," or ask your authorized Hydro-Rain® distributor for details.

## High Payout

- Up to 5 points per dollar spent

## Easy Enrollment

- Automatic for contractors already using Hydro-Rain® products
- Automatic for new customers when: Hydro-Rain® products are purchased on an account at an authorized distributor. For a list of distributors, click on "Where to Buy" at [www.hydrorain.com](http://www.hydrorain.com)

## Simple Process

- No invoices to mail or fax in
- No product mixes to balance
- No additional fees to redeem merchandise (not even shipping and handling)
- Check point totals at any time on-line
- No need for a 1099

## Up-to-Date Information

- Log into the website at any time to check your points totals
- Points are updated at least once a month (within 30-40 days of purchase)
- No additional lag time for processing paper invoices
- Points can be used as soon as they post to your account on the website

## Great Customer Service

- Redeem points on-line
- All reward redemptions include shipping tracking numbers

### RESTRICTIONS

- Product must be purchased at authorized distributors to earn points.
- Points earned from pre-tax invoice price, not from delivery charges.
- Points expire 24 months after they post to the website.
- Must have an account # at an authorized distributor to enter the website.
- Points will become inactive if distribution houses notify Hydro-Rain® of delinquent accounts.
- Minimum purchase of at least \$50 before web account is created.

rewards



**COMMON CONVERSIONS**

To Convert	From	To	Multiply By	To Convert	From	To	Multiply By
<b>Area</b>	acres	foot <sup>2</sup>	43560	<b>Length</b>	foot	inch	12
	acres	meter <sup>2</sup>	4046.8		inch	centimeter	2.54
	meter <sup>2</sup>	foot <sup>2</sup>	10.764		foot	meter	0.30481
	foot <sup>2</sup>	inch <sup>2</sup>	144		kilometer	miles	0.6214
	inch <sup>2</sup>	centimeter <sup>2</sup>	6.452		miles	foot	5280
	hecters	meter <sup>2</sup>	10000		miles	meter	1609.34
<b>Power</b>	hecters	acres	2.471	<b>Pressure</b>	millimeter	inch	0.03937
	kilowatts	horsepower	1.341		Psi	kilopascals	6.89476
<b>Flow</b>	foot <sup>3</sup> /minute	meter <sup>3</sup> /second	0.0004719		Psi	bar	0.068948
	foot <sup>3</sup> /second	meter <sup>3</sup> /second	0.02832		bar	kilopascals	100
	yards <sup>3</sup> /minute	meter <sup>3</sup> /second	0.01274	Psi	feet of head	2.31	
	gallon/minute	meter <sup>3</sup> /hour	0.22716	<b>Velocity</b>	feet/second	meter/second	0.3048
	gallon/minute	liter/minute	3.7854		feet <sup>3</sup>	gallon	7.481
	gallon/minute	liter/second	0.06309		feet <sup>3</sup>	liter	28.32
	meter <sup>3</sup> /hour	liter/minute	16.645		meter <sup>3</sup>	feet <sup>3</sup>	35.31
	meter <sup>3</sup> /hour	liter/second	0.2774		meter <sup>3</sup>	yard <sup>3</sup>	1.3087
liter/minute	liter/second	60	yard <sup>3</sup>		feet <sup>3</sup>	27	
			yard <sup>3</sup>		gallon	202	
			acres/feet		foot <sup>3</sup>	43560	
			gallon		meter <sup>3</sup>	0.003785	
			gallon		liter	3.785	
			imperial gallon	gallon	1.833		

**COMMON FORMULAS**

**Precipitation Rates**

<b>Equilateral Triangular Spacing</b>	P.R. = (in/hr) $\frac{(\text{gpm of } 360) \times 96.25}{(\text{Head Spacing})^2 \times .866}$	P.R. = (mm/hr) $\frac{\text{m}^3/\text{hr of } 360 \times 1000}{(\text{Head Spacing})^2 \times .866}$
<b>Square/Rectangular Spacing</b>	P.R. = (in/hr) $\frac{(\text{gpm of } 360) \times 96.25}{\text{Head Spacing} \times \text{Row Spacing}}$	P.R. = (mm/hr) $\frac{\text{m}^3/\text{hr of } 360 \times 1000}{\text{Head Spacing} \times \text{Row Spacing}}$
<b>Square/Rectangular Spacing for Specific Arc</b>	P.R. = (in/hr) $\frac{34650 \times \text{gpm (for any arc)}}{\text{Degrees of Arc} \times \text{Head Spacing} \times \text{Row Spacing}}$	P.R. = (mm/hr) $\frac{\text{m}^3/\text{hr (for any arc)} \times 1000}{\text{Degrees of Arc} \times \text{Head Spacing} \times \text{Row Spacing}}$

**Horsepower**

H.P. = $\frac{\text{gpm} \times \text{ft of Head}}{3,960 \times \text{Pump Efficiency (expressed as a decimal)}}$	H.P. = $\frac{\text{lpm} \times \text{Meters of Head}}{3,433 \times \text{Pump Efficiency (expressed as a decimal)}}$
---	---

**Station Run Time**

S.R.T. = (min/wk) $\frac{\text{Total Weekly Req'd (in/wk)} \times 60 \text{ (min/hr)}}{\text{Precipitation Rate (in/hr)}}$	S.R.T. = (min/wk) $\frac{\text{Total Weekly Req'd (mm/wk)} \times 60 \text{ (min/hr)}}{\text{Precipitation Rate (mm/hr)}}$
--	--

**Pipe Velocity**

V. = (ft/sec) $\frac{0.4085 \times \text{Flow (gpm)}}{(\text{Inside Pipe Diameter in Inches})^2}$	V. = (m/sec) $\frac{1273.24 \times \text{Flow (l/sec)}}{(\text{Inside Pipe Diameter in Millimeters})^2}$
---	--

**Slope**

S. =  $\frac{\text{Rise (Measure of Length)}}{\text{Run (Measure of Length)}}$

### WATER METER PRESSURE LOSS CHART: Typical Pressure Loss (psi)

Flow (gpm)	5/8"	3/4"	1"	1½"	2"	3"	4"	Flow (gpm)
1	0.2	0.1						1
2	0.3	0.2						2
3	0.4	0.3						3
4	0.6	0.5	0.1					4
5	0.9	0.6	0.2					5
6	1.3	0.7	0.3					6
7	1.8	0.8	0.4					7
8	2.3	1.0	0.5					8
9	3.0	1.3	0.6					9
10	3.7	1.6	0.7					10
11	4.4	1.9	0.8					11
12	5.1	2.2	0.9					12
13	6.1	2.6	1.0					13
14	7.2	3.1	1.1					14
15	8.3	3.6	1.2					15
16	9.4	4.1	1.4	0.4				16
17	10.7	4.6	1.6	0.5				17
18	12.0	5.2	1.8	0.6				18
19	13.4	5.8	2.0	0.7				19
20	15.0	2.0	2.2	0.8				20
22		7.9	2.8	1.0				22
24		9.5	3.4	1.2				24
26		11.2	4.0	1.4				26
28		13.0	4.6	1.6				28
30		15.0	5.3	1.8	0.7			30
32			6.0	2.1	0.8			32
34			6.9	2.4	0.9			34
36			7.8	2.7	1.0			36
38			8.7	3.0	1.2			38
40			9.6	3.3	1.3			40
42			10.6	3.6	1.4			42
44			11.7	3.9	1.5			44
46			12.8	4.2	1.6			46
48			13.9	4.5	1.7			48
50			15.0	4.9	1.9			50
52				5.3	2.1			52
54				5.7	2.2			54
56				6.2	2.3			56
58				6.7	2.5			58
60				7.2	2.7	1.0		60
65				8.3	3.2	1.1		65
70				9.8	3.7	1.3		70
75				11.3	4.3	1.5		75
80				12.8	4.9	1.6	0.7	80
90				16.1	6.2	2.0	0.8	90
100				20.0	7.8	2.5	0.9	100
110					9.5	2.9	1.0	110
120					11.3	3.4	1.2	120
130					13.0	3.9	1.4	130
140					15.1	4.5	1.6	140
150					17.3	5.1	1.8	150
160					20.0	5.8	2.1	160
170						6.5	2.4	170
180						7.2	2.7	180
190						8.0	3.0	190
200						9.0	3.2	200
220						11.0	3.9	220
240						13.0	4.7	240
260						15.0	5.5	260
280						17.3	6.3	280
300						20.0	7.2	300
350							10.0	350
400							13.0	400
450							16.2	450
500							20.0	500
<b>75% of max meter capacity</b>	<b>15 gpm</b>	<b>22.5 gpm</b>	<b>37.5 gpm</b>	<b>75 gpm</b>	<b>120 gpm</b>	<b>225 gpm</b>	<b>375 gpm</b>	<b>75% of max meter capacity</b>

Reference

**POLYETHYLENE PLASTIC PIPE ID CONTROLLED**

PE 3408 ASTM D2239 C=140 • psi loss per 100 ft. of pipe

Nominal Size Avg. ID  flow (gpm)	½" 0.622		¾" 0.824		1" 1.049		1¼" 1.380		1½" 1.610		2" 2.067		2½" 2.469		3" 3.068		4" 4.026	
	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

\*Note: Shaded areas represent velocities over 5 fps. Use with caution where water hammer is a concern.

reference

### CLASS 160 PVC IPS PLASTIC PIPE

ASTM D2241 (1120, 1220) SDR 26 C=150 • psi loss per 100 ft. of pipe

Nominal Size Avg. ID Pipe OD Avg. Wall Min. Wall	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
	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	0.18	0.01	0.14	0.00								
2	1.68	0.90	0.99	0.24	0.59	0.07	0.36	0.02	0.27	0.01	0.17	0.00						
3	2.53	1.90	1.48	0.52	0.89	0.15	0.54	0.04	0.41	0.02	0.26	0.01						
4	3.37	3.24	1.97	0.88	1.18	0.25	0.71	0.07	0.54	0.04	0.35	0.01	0.24	0.00				
5	4.21	4.89	2.46	1.33	1.48	0.38	0.89	0.11	0.68	0.06	0.43	0.02	0.29	0.01				
6	5.05	6.86	2.96	1.86	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	5.90	9.12	3.45	2.47	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	6.74	11.68	3.94	3.17	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	7.58	14.53	4.43	3.94	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	8.42	17.66	4.93	4.79	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	10.11	24.75	5.91	6.71	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	11.79	32.93	6.90	8.93	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	13.48	42.16	7.88	11.44	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	15.16	52.44	8.87	14.23	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			9.85	17.29	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			10.84	20.63	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			11.82	24.24	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			12.81	28.11	7.68	8.11	4.64	2.38	3.58	1.22	2.25	0.41	1.53	0.16	1.03	0.06	0.62	0.02
28			13.80	32.25	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			14.78	36.64	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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
85									11.53	10.94	7.34	3.65	4.99	1.43	3.37	0.55	2.03	0.16
90									12.21	12.16	7.78	4.06	5.29	1.59	3.56	0.61	2.15	0.18
95									12.89	13.45	8.21	4.48	5.58	1.76	3.76	0.67	2.27	0.20
100									13.57	14.79	8.64	4.93	5.88	1.93	3.96	0.74	2.39	0.22
110									14.93	17.64	9.50	5.88	6.46	2.30	4.36	0.88	2.63	0.26
120											10.37	6.91	7.05	2.71	4.75	1.04	2.86	0.30
130											11.23	8.02	7.64	3.14	5.15	1.20	3.10	0.35
140											12.10	9.20	8.23	3.60	5.54	1.38	3.34	0.40
150											12.96	10.45	8.81	4.09	5.94	1.57	3.58	0.46
160											13.82	11.77	9.40	4.61	6.34	1.76	3.82	0.52
170											14.69	13.17	9.99	5.16	6.73	1.97	4.06	0.58
180													10.58	5.73	7.13	2.19	4.30	0.64
190													11.16	6.34	7.52	2.42	4.54	0.71
200													11.75	6.97	7.92	2.67	4.77	0.78
220													12.93	8.31	8.71	3.18	5.25	0.93
240													14.10	9.77	9.50	3.74	5.73	1.09
260															10.29	4.33	6.21	1.27
280															11.09	4.97	6.68	1.45
300															11.88	5.65	7.16	1.65
320															12.67	6.37	7.64	1.86
340															13.46	7.12	8.12	2.08
360															14.25	7.92	8.59	2.31
380																	9.07	2.56
400																	9.55	2.81
420																	10.03	3.08
440																	10.50	3.35
460																	10.98	3.64
480																	11.46	3.94
500																	11.94	4.25

\*Note: Shaded areas represent velocities over 5 fps. Use with caution where water hammer is a concern.

**CLASS 200 PVC IPS PLASTIC PIPE**

ASTM D2241 (1120, 1220) SDR 21 C=150 • psi loss per 100 ft. of pipe

Nominal Size Avg. ID Pipe OD Avg. Wall Min. Wall	Class 315: ½"		¾"		1"		1½"		1½"		2"		2½"		3"		4"		6"	
	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	0.100	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	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	0.34	1.38	0.05
130									11.70	8.85	7.96	3.47	5.36	1.32	3.24	0.39	1.50	0.39	1.50	0.06
140									12.60	10.16	8.57	3.98	5.77	1.52	3.49	0.45	1.61	0.45	1.61	0.07
150									13.50	11.54	9.19	4.52	6.18	1.73	3.74	0.51	1.73	0.51	1.73	0.08
160									14.40	13.01	9.80	5.10	6.60	1.95	3.99	0.57	1.84	0.57	1.84	0.09
170											10.41	5.70	7.01	2.18	4.24	0.64	1.96	0.64	1.96	0.10
180											11.02	6.34	7.42	2.42	4.49	0.71	2.07	0.71	2.07	0.11
190											11.64	7.01	7.83	2.67	4.74	0.79	2.19	0.79	2.19	0.12
200											12.25	7.71	8.24	2.94	4.98	0.86	2.30	0.86	2.30	0.13
220											13.47	9.19	9.07	3.51	5.48	1.03	2.53	1.03	2.53	0.16
240											14.70	10.80	9.89	4.12	5.98	1.21	2.76	1.21	2.76	0.18
260													10.72	4.78	6.48	1.41	2.99	1.41	2.99	0.21
280													11.54	5.48	6.98	1.61	3.22	1.61	3.22	0.25
300													12.37	6.23	7.48	1.83	3.45	1.83	3.45	0.28
320													13.19	7.02	7.98	2.06	3.68	2.06	3.68	0.31
340													14.02	7.86	8.47	2.31	3.91	2.31	3.91	0.35
360													14.84	8.73	8.97	2.57	4.14	2.57	4.14	0.39
380															9.97	3.12	4.60	3.12	4.60	0.48
400															10.47	3.42	4.83	3.42	4.83	0.52
420															10.97	3.72	5.06	3.72	5.06	0.57
440															11.46	4.04	5.29	4.04	5.29	0.62
460															11.96	4.37	5.52	4.37	5.52	0.67
480															12.46	4.72	5.75	4.72	5.75	0.72
500																				

\*Note: Shaded areas represent velocities over 5 fps. Use with caution where water hammer is a concern.

reference

## CLASS 315 PVC IPS PLASTIC PIPE

ASTM D2241 (1120, 1220) SDR 13.5 C=150 • psi loss per 100 ft. of pipe

Nominal Size Avg. ID Pipe OD Avg. Wall Min. Wall	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
	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

\*Note: Shaded areas represent velocities over 5 fps. Use with caution where water hammer is a concern.



**SCHEDULE 40 PVC IPS PLASTIC PIPE**

ASTM D1785 (1120, 1220) SDR 21 C=150 • psi loss per 100 ft. of pipe

Nominal Size Avg. ID Pipe OD Avg. Wall Min. Wall	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		5"	
	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	2.90	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	106.24	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	4.87	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	6.48	2.53	4.19	0.87	2.42	0.23	1.07	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		

\*Note: Shaded areas represent velocities over 5 fps. Use with caution where water hammer is a concern.

reference

### SCHEDULE 40 STEEL

ASTM B53 C=100 • psi loss per 100 ft. of pipe

Nominal Size Pipe ID Pipe OD Avg. Wall flow (gpm)	½"		¾"		1"		1¼"		1½"		2"		2½"		3"		4"	
	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	0.91	0.60	0.23	0.37	0.07	0.21	0.02	0.16	0.01								
2	2.11	3.28	1.20	0.84	0.74	0.26	0.43	0.07	0.31	0.03								
3	3.16	6.95	1.80	1.77	1.11	0.55	0.64	0.14	0.47	0.07								
4	4.22	11.85	2.40	3.02	1.48	0.93	0.86	0.25	0.63	0.12								
5	5.27	17.91	3.00	4.56	1.85	1.41	1.07	0.37	0.79	0.18								
6	6.33	25.10	3.61	6.39	2.22	1.97	1.29	0.52	0.94	0.25	0.57	0.07						
7	7.38	33.40	4.21	8.50	2.60	2.63	1.50	0.69	1.10	0.33	0.67	0.10						
8	8.44	42.77	4.81	10.88	2.97	3.36	1.71	0.89	1.26	0.42	0.76	0.12						
9	9.49	53.19	5.41	13.54	3.34	4.18	1.93	1.10	1.42	0.52	0.86	0.15						
10	10.55	64.65	6.01	16.45	3.71	5.08	2.14	1.34	1.57	0.63	0.95	0.19						
12	12.65	90.62	7.21	23.06	4.45	7.12	2.57	1.88	1.89	0.89	1.15	0.26	0.80	0.11				
14			8.41	30.68	5.19	9.48	3.00	2.50	2.20	1.18	1.34	0.35	0.94	0.15				
16			9.61	39.29	5.93	12.14	3.43	3.20	2.52	1.51	1.53	0.45	1.07	0.19				
18			10.82	48.87	6.67	15.10	3.86	3.97	2.83	1.88	1.72	0.56	1.20	0.23				
20			12.02	59.40	7.42	18.35	4.28	4.83	3.15	2.28	1.91	0.68	1.34	0.28				
22			13.22	70.87	8.16	21.89	4.71	5.76	3.46	2.72	2.10	0.81	1.47	0.34	0.95	0.12	0.55	0.03
24					8.90	25.72	5.14	6.77	3.78	3.20	2.29	0.95	1.61	0.40	1.04	0.14	0.60	0.04
26					9.64	29.83	5.57	7.85	4.09	3.71	2.48	1.10	1.74	0.46	1.13	0.16	0.65	0.04
28					10.38	34.22	6.00	9.01	4.41	4.25	2.67	1.26	1.87	0.53	1.21	0.18	0.70	0.05
30					11.12	38.88	6.43	10.24	4.72	4.83	2.86	1.43	2.01	0.60	1.30	0.21	0.76	0.06
32					11.86	43.81	6.86	11.54	5.04	5.45	3.06	1.62	2.14	0.68	1.39	0.24	0.81	0.06
34					12.61	49.02	7.28	12.91	5.35	6.10	3.25	1.81	2.28	0.76	1.47	0.26	0.86	0.07
36					13.35	54.49	7.71	14.35	5.67	6.78	3.44	2.01	2.41	0.85	1.56	0.29	0.91	0.08
38							8.14	15.86	5.98	7.49	3.63	2.22	2.54	0.94	1.65	0.33	0.96	0.09
40							8.57	17.44	6.30	8.24	3.82	2.44	2.68	1.03	1.73	0.36	1.01	0.10
42							9.00	19.09	6.61	9.02	4.01	2.67	2.81	1.13	1.82	0.39	1.06	0.10
44							9.43	20.81	6.93	9.83	4.20	2.91	2.94	1.23	1.91	0.43	1.11	0.11
46							9.86	22.59	7.24	10.67	4.39	3.16	3.08	1.33	1.99	0.46	1.16	0.12
48							10.28	24.44	7.56	11.55	4.58	3.42	3.21	1.44	2.08	0.50	1.21	0.13
50							10.71	26.36	7.87	12.45	4.77	3.69	3.35	1.55	2.17	0.54	1.26	0.14
55							11.78	31.45	8.66	14.86	5.25	4.40	3.68	1.85	2.38	0.64	1.38	0.17
60							12.85	36.95	9.44	17.45	5.73	5.17	4.02	2.18	2.60	0.76	1.51	0.20
65							13.93	42.86	10.23	20.24	6.21	6.00	4.35	2.53	2.82	0.88	1.64	0.23
70									11.02	23.22	6.68	6.88	4.69	2.90	3.03	1.01	1.76	0.27
75									11.81	26.39	7.16	7.82	5.02	3.29	3.25	1.14	1.89	0.31
80									12.59	29.74	7.64	8.82	5.35	3.71	3.47	1.29	2.01	0.34
85									13.38	33.27	8.12	9.86	5.69	4.15	3.68	1.44	2.14	0.38
90											8.59	10.96	6.02	4.62	3.90	1.60	2.27	0.43
95											9.07	12.12	6.36	5.10	4.12	1.77	2.39	0.47
100											9.55	13.33	6.69	5.61	4.33	1.95	2.52	0.52
110											10.50	15.90	7.36	6.70	4.77	2.33	2.77	0.62
120											11.46	18.68	8.03	7.87	5.20	2.73	3.02	0.73
130											12.41	21.66	8.70	9.12	5.63	3.17	3.27	0.85
140											13.37	24.85	9.37	10.47	6.07	3.64	3.52	0.97
150													10.04	11.89	6.50	4.13	3.78	1.10
160													10.71	13.40	6.94	4.66	4.03	1.24
170													11.38	15.00	7.37	5.21	4.28	1.39
180													12.05	16.67	7.80	5.79	4.53	1.54
190													12.72	18.43	8.24	6.40	4.78	1.71
200													13.39	20.26	8.67	7.04	5.03	1.88
220													9.54	8.40	5.54	5.54	5.54	2.24
240													10.40	9.87	6.04	6.04	6.04	2.63
260													11.27	11.45	6.54	6.54	6.54	3.05
280													12.14	13.13	7.05	7.05	7.05	3.50
300													13.00	14.92	7.55	7.55	7.55	3.98
320													13.87	16.81	8.05	8.05	8.05	4.48
340															8.56	8.56	8.56	5.01
360															9.06	9.06	9.06	5.57
380															9.57	9.57	9.57	6.16
400															10.07	10.07	10.07	6.77
420															10.57	10.57	10.57	7.42
440															11.08	11.08	11.08	8.08
460															11.58	11.58	11.58	8.78
480															12.08	12.08	12.08	9.50
500															12.59	12.59	12.59	10.24

\*Note: Shaded areas represent velocities over 7 fps. Use with caution where water hammer is a concern.

**TYPE K COPPER TUBING**

ASTM B88 C=140 • psi loss per 100 ft. of pipe

Nominal Size Pipe ID Pipe OD Avg. Wall  flow (gpm)	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
	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																		

\*Note: Shaded areas represent velocities over 7 fps. Use with caution where water hammer is a concern.

reference

### TYPE L COPPER TUBING

ASTM B88 C=140 • psi loss per 100 ft. of pipe

Nominal Size Pipe ID Pipe OD Avg. Wall flow (gpm)	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
	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																		

\*Note: Shaded areas represent velocities over 7 fps. Use with caution where water hammer is a concern.

### FRICITION LOSS FORMULAS

#### Hazen-Williams Equation

$$H_f = (0.2083) (100/C)^{1.852} (Q^{1.852}/D^{4.864})$$

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°F above (below) the reference temperature of 73.4°F

### APPROXIMATE PRESSURE LOSSES FOR PIPE FITTINGS

To use this chart, multiply the approximate "equivalent feet of pipe" value by the proper pipe pressure loss per 100 ft. rating, then divide by 100. The result is the fitting loss in psi. **Notes:** It is recommended that this chart be used only when the manufacturers recommended pressure loss values are not available.

Steel Fitting Type	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"
Coupling	0.6	0.8	1	1.2	1.5	2	2.5	3	4	6	8
Run of St. Tee	1	1	1.5	2	2	2.5	3	4	5	7	10
Tee, Side Outlet	3	4.5	5	7	9	11	13	16	20	31	42
Tee, Run Reduced ½"	1.5	2.5	3	4	5	6	7	8	12	16	20
Elbow, 90°	1.5	2.5	3	4	5	6	7	8	12	16	20
Elbow, 45°	0.75	1	1.3	1.7	2	2.5	3	3.5	5	7.5	10
Corporation Stop	9	9	9	9	9	9					
Curb Stop	6	6	7	7	8	8					
Plastic IPS or Copper Fitting Type	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"
Coupling	1.5	2.5	3.0	3.0	4.0	6.0	7.0	8.0	11.0	18.0	24.0
Run of St. Tee	2.5	3.0	4.0	5.0	6.0	8.0	9.0	11.0	15.0	21.0	28.0
Tee, Side Outlet	7.0	9.0	12.0	15.0	18.0	24.0	30.0	36.0	45.0	70.0	90.0
Tee, Run Reduced ½"	3.5	4.5	6.0	8.0	9.0	11.0	14.0	17.0	24.0	34.0	45.0
Elbow, 90°	3.5	4.5	6.0	8.0	9.0	11.0	14.0	17.0	24.0	34.0	45.0
Elbow, 34°	1.5	2.0	3.0	3.5	4.0	5.0	7.0	8.0	10.0	16.0	20.0

### ESTIMATING PIPE SIZE

To determine the nominal size of a pipe, wrap a string around the pipe and compare its length to this chart

Nominal Pipe Size	Approximate String Length in Inches		
	Copper Pipe	Galvanized	PVC Pipe
½"	2"	2 5/8"	2 5/8"
5/8"	2 3/8"		
¾"	2 3/4"	3 5/16"	3 5/16"
1"	3 1/2"	4 1/8"	4 1/8"
1 ¼"	4 5/16"	5 3/16"	5 3/16"
1 ½"	5 1/8"	6"	6"
2"	6 3/4"	7 7/16"	7 7/16"

### VALVE WIRE SIZING\*

Maximum one-way distance (ft.) between controller and valve [standard 24 VAC solenoid]†

Wire Size	Maximum Run Length						
	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 VAC, Pressure: 150 psi, Voltage Drop: 4V, Min. Op. Voltage: 20V, Amperage (peak): 0.3A  
 \*This assumes control wire and ground wire are the same size.

### DRIP FORMULAS

#### Number of Emitters per Plant

$$\text{Emitters per Plant} = \frac{\text{Canopy Area (sq.ft.)} \times 0.75}{\text{Wetted Area per Emitter (sq. ft.)}}$$

Soil Type	Wetted Area	
	Diameter (ft.)	Area (sq. ft.)
Sand	2-3	3-7
Sandy-Loam	3-4.5	7-16
Loam	3-5	7-20
Clay-Loam	4-6	13-28
Clay	5-7	20-38

#### Flow per Zone

$$\text{Flow per Zone} = \frac{\text{Total Number of Drippers} \times \text{Dripper Flow Rate (gph)}}{\text{GPM}}$$

#### Precipitation Rate Formula for Multiple Rows

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

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

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

\*Lateral Spacing—the distance between rows of emitter tubing

\*Emitter Spacing—the distance between emitters in tubing

#### Precipitation Rate Formula for a Single Row.

$$\text{Precipitation Rate (in. per hr.)} = \frac{231.1 \times \text{Emitter Flow (gph)}}{\text{Width of Area (in.)} \times \text{Emitter Spacing (in.)}}$$

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



**HYDRO-RAIN®**

915 Overland Street  
North Salt Lake, UT 84054

Telephone: 888-493-7672

Fax: 801-203-1179

