

# OVERHEAD IRRIGATION



## **SOLID SET & NURSERY/GREENHOUSE**

Application guide for container stock

# Rating Performance Irrigation System



Irrigation systems should be evaluated to establish uniformity of water application to identify run times that minimize dry areas. Uniformity is determined by developing a sprinkler's specific application pattern on the ground by collecting and measuring water depth in catch cans at regular intervals out from the sprinkler. This "profile" is established and then overlapped based on lateral and sprinkler spacing in order to develop the Coefficient of Uniformity and water Scheduling Coefficient ratings as described below. These values are referred to in this guide as CU and SC respectively.

## Average Application Rate

Average application rate is the average depth of water applied over a given interval of time under an irrigation system. This is usually indicated as inches per hour (in/hr) or millimeters per hour (mm/hr).

## Coefficient of Uniformity (CU)

Christiansen's CU identifies the evenness of an irrigation system's water distribution by comparing the average difference in the amount of water collected in each catch can to the mean amount of water collected by all catch cans.

## Scheduling Coefficient (SC)

SC calculates the ratio of the driest area's application rate divided into the average application rate. The result is always greater than or equal to one (a value of one would be perfect) and indicates the total amount of irrigation time required to bring the application rate in the driest area up to the average application rate. For example: if a system has an SC of 1.5 and an average application rate of 0.5 inch (12.7 mm) of water per one hour, it would take 1.5 x one hour or 1.5 hours for the driest area to receive the average application depth of 0.5 inch (12.7 mm) of water.

## Pressure Regulation

Variations in system pressure can result in erratic application rates. Optimum performance of a well-designed overhead container irrigation system can be achieved by using pressure regulators. The Senninger Pressure-Master Regulator® maintains a constant preset outlet pressure while handling inlet pressure up to 150 psi (10.35 bar).



*Senninger Irrigation's WinSIPP2 software utilizes your specific criteria to optimize system design and installation.*



# How To Design a System



One important goal of a well-designed container irrigation system is to achieve the highest uniformity while considering spacing restrictions, operating pressure and application rate to best meet the needs of your crop.

This guide includes examples of each of the Senninger products recommended for an Overhead Container Irrigation System. The products shown in Chart A target an application rate of 0.5 inch (12.7 mm) per hour while considering the best

spacing, operating pressure and nozzle combination to achieve optimum uniformity.

You can use this information to choose the product that best fits your situation. Refer to the corresponding page numbers for additional design information for the product selected. For additional options regarding specific applications not addressed in this chart please contact Senninger Irrigation.

## CHART A- Product Selection for Overhead Container

Data based on a riser height of 18 inches (0.457 mm)

PRODUCT	CU %	SC	SQUARE SPACING Feet Meters	OPERATING PRESSURE (psi) (bar)	NOZZLE #	APPLICATION RATE (in/h) (mm/h)	PAGE #
mini-Wobbler®	92.4	1.17	20 x 20 6.10 x 6.10	20 1.38	8	0.47 11.94	3
Xcel-Wobbler® HA	86.7	1.30	25 x 25 7.62 x 7.62	25 1.72	10	0.54 13.72	5
Smooth Drive	89.3	1.17	25 x 25 7.62 x 7.62	30 2.07	8	0.37 9.40	7
Smooth Drive	89.3	1.35	30 x 30 9.14 x 9.14	30 2.07	8	0.26 6.60	7
2023-1 Impact	96.0	1.19	25 x 25 7.62 x 7.62	45 3.10	8 SQ*	0.46 11.68	9
2023-1 Impact	89.3	1.25	30 x 30 9.14 x 9.14	45 3.10	9 WV**	0.40 10.16	9
3023-2 Impact	90.4	1.17	35 x 35 10.7 x 10.7	45 3.10	10 RV*** x 5 RV	0.48 12.19	9
4023-2 Impact	91.2	1.16	40 x 40 12.2 x 12.2	45 3.10	12 WV x 6 RV	0.51 12.95	9
5023-2 Impact	87.3	1.22	45 x 45 13.7 x 13.7	50 3.45	13 WV x 8 RV	0.51 12.95	9

\*SQ = Square orifice nozzle for better stream break-up, improves uniformity.

\*\*WV = White Vane, stream straightening vane, maximizes throw.

\*\*\*RV = Red Vane, spiral vane for better stream break-up, improves uniformity.

# mini-Wobbler® Irrigating

## Advantages of a low pressure 15-20 psi or (1.03 - 1.38 bar) mini-Wobbler Irrigation System



- Outstanding Uniformity
- Large diameter of coverage at low pressures
- Rain-like pattern for gentle application
- Ideal for PVC or Poly Pipe systems



*The unique off-center rotary action of the mini-Wobbler provides outstanding uniformity over a large diameter.*

## Follow these 4 Steps to design a mini-Wobbler irrigation system...

### 1 Determine Application Rate & Maximum Length of Laterals

Based on the selection of the mini-Wobbler from Chart A on page 2, use Table 1 to help determine the application rate and the maximum length of laterals using PVC (maximum allowable velocity of 5 ft or 1.52 m per second as recommended by PVC manufacturers) or Poly Pipe for 3/4" or 1" sizes.

**TABLE 1. mini-Wobbler**

Maximum Length of Lateral on 20 ft (6.1 m); Spacing at 20 psi (1.38 bar)

NOZZLE #	APPLICATION RATE		3/4" PVC (0.930 I.D.) Class 200		1" PVC (1.195 I.D.) Class 160		3/4" POLY (0.817 I.D.) Poly		1" POLY (1.05 I.D.) Poly	
	(in/h)	(mm/h)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)
6	0.26	6.60	180	54.9	300	91.4	140	42.7	220	73.2
7	0.36	9.14	140	42.7	220	73.2	120	36.6	180	54.9
8	0.47	11.9	120	36.6	200	61.0	100	30.5	160	48.8

Data based on <4 psi (0.276 bar) lateral friction loss.

### 2 Determine Zone Flow

Table 2 will determine the number of mini-Wobblers based on system flow rate at 20 psi (1.38 bar).

**TABLE 2.**

Quantity of Units Based on System Flow Rate

Flow Rate	Nozzle #6	Nozzle #7	Nozzle #8
10 gpm (37.84 L/m)	9	6	5
20 gpm (75.69 L/m)	18	13	10
30 gpm (113.53 L/m)	27	19	15
40 gpm (151.37 L/m)	36	26	20
50 gpm (189.21 L/m)	72	52	41



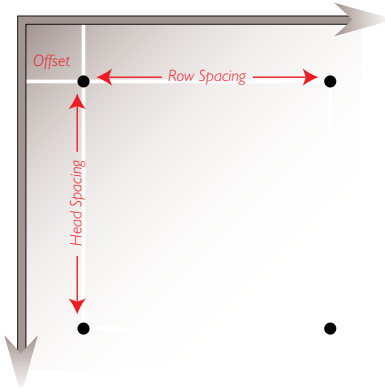
# Irrigating mini-Wobblers®

## 3

### Determine Spacing

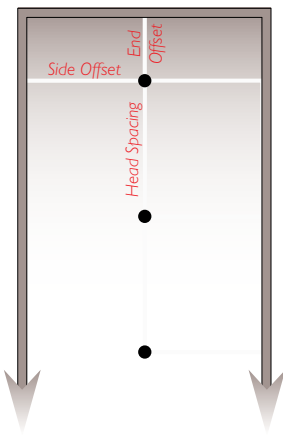
#### Square Spacing

Head Spacing: 20 ft (6.10 m)  
 Row Spacing: 20 ft (6.10 m)  
 Offset from sides: 5 ft (1.52 m)  
 Offset from ends: 5 ft (1.52 m)



#### Single Row Spacing

Head Spacing: 10 ft (3.05 m)  
 Offset from sides: 7.5 ft (2.87 m)  
 Offset from ends: 5 ft (1.52 m)



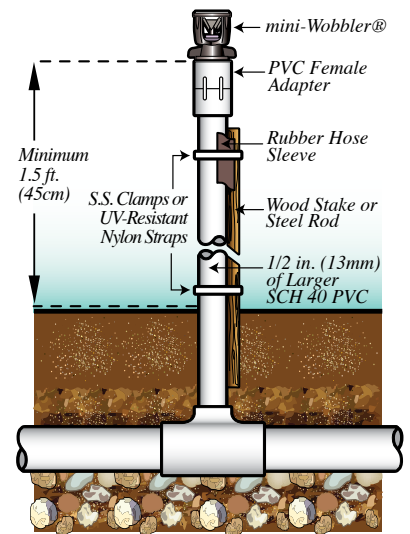
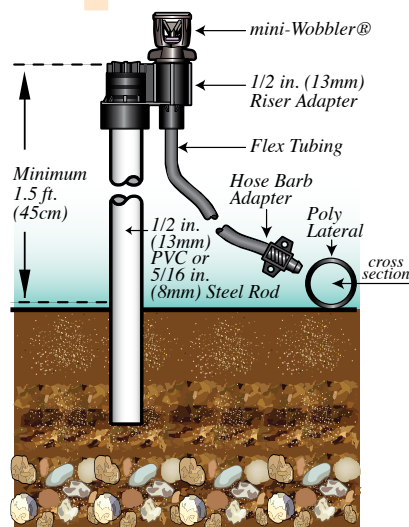
Recommended spacings based on maximum uniformities from Chart A, page 2.

**TABLE 3. mini-Wobblers®** Additional Design Options at 20 psi (1.38 bar) (not shown on Chart A, page 2)

NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
4	10 X 10	3.05 X 3.05	94.8	1.13	18	45	0.48	12.2
5	10 X 10	3.05 X 3.05	95.6	1.08	18	45	1.72	18.3
6	10 X 10	3.05 X 3.05	96.3	1.08	18	45	1.06	29.9
7	10 X 10	3.05 X 3.05	97.4	1.05	18	45	1.45	36.8
8	10 X 10	3.05 X 3.05	96.8	1.06	18	45	1.88	47.8
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4	15 X 15	4.57 X 4.57	88.6	1.29	18	45	0.21	5.33
5	15 X 15	4.57 X 4.57	89.6	1.29	18	45	1.32	8.23
6	15 X 15	4.57 X 4.57	93.4	1.30	18	45	1.47	11.9
7	15 X 15	4.57 X 4.57	95.5	1.15	18	45	1.65	16.5
8	15 X 15	4.57 X 4.57	93.8	1.10	18	45	1.83	21.1
<hr/>								
4	15 X 15	4.57 X 4.57	94.1	1.10	36	90	0.48	12.2
5	15 X 15	4.57 X 4.57	97.6	1.04	36	90	0.72	18.3
6	15 X 15	4.57 X 4.57	96.2	1.08	36	90	1.06	29.9
7	15 X 15	4.57 X 4.57	97.3	1.05	36	90	1.45	36.8
8	15 X 15	4.57 X 4.57	96.7	1.06	36	90	1.88	47.5
<hr/>								
5	20 X 20	6.10 X 6.10	90.2	1.12	18	45	0.18	4.57
6	20 X 20	6.10 X 6.10	94.7	1.13	18	45	0.26	6.6
7	20 X 20	6.10 X 6.10	93.7	1.17	18	45	0.36	9.14
8	20 X 20	6.10 X 6.10	92.4	1.17	18	45	0.47	11.9

## 4

### Installation Options



# Xcel-Wobbler® Irrigating



## Advantages of a low pressure (20 psi or 1.38 bar) Xcel-Wobbler Irrigation System

- New balanced design for smooth, stable operation
- Outstanding uniformity
- Large diameter of coverage at low pressures
- Low wind-drift and evaporative loss
- High-angle model approximately 24° trajectory (18° trajectory Mid-Angle model also available)



*Xcel-Wobblers provide outstanding uniformity and a large diameter of coverage. The design is balanced for a smooth, stable operation.*

## Follow these 4 Steps to design a Xcel-Wobbler irrigation system...

### 1 Determine Application Rate & Maximum Length of Laterals

Based on the selection of the Xcel-Wobbler HA from Chart A on page 2, use Table 1 to help determine the application rate and the maximum length of laterals using PVC (maximum allowable velocity of 5 ft or 1.52 m per second as recommended by PVC manufacturers).

**TABLE 1. Xcel-Wobbler - HA (high Angle)**

Maximum Length of Lateral on 25 ft (7.6 m); Spacing at 20 psi (1.38 bar)

NOZZLE #	APPLICATION RATE		1.5" PVC (1.754 I.D.) Class 160		2" PVC (2.193 I.D.) Class 160	
	(in/h)	(mm/h)	(ft)	(m)	(ft)	(m)
9	0.39	9.91	375	91.4	525	160.0
10	0.48	12.2	325	99.1	450	137.2
11	0.59	15.0	250	76.2	375	114.3
12	0.70	17.8	200	61.0	325	99.1

Data based on <4 psi (0.276 bar) lateral friction loss.

### 2 Determine Zone Flow

Table 2 will determine the number of High Angle Xcel-Wobblers based on system flow rate of 20 psi (1.38 bar).

**TABLE 2.**

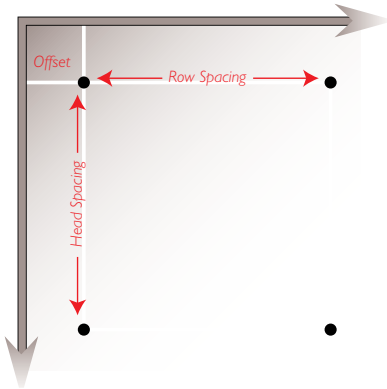
Quantity of units based on System Flow Rate

Flow Rate	Nozzle #6	Nozzle #7	Nozzle #8
30 gpm (113.5 L/m)	11	9	7
40 gpm (151.4 L/m)	15	12	10
50 gpm (189.2 L/m)	19	15	13
60 gpm (227.1 L/m)	23	19	15
80 gpm (305.7 L/m)	31	25	20

## 3 Determine Spacing

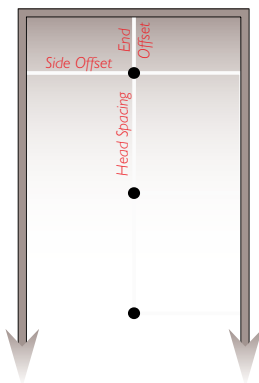
### Square Spacing-

Head Spacing: 25 ft (7.62 m)  
 Row Spacing: 25 ft (7.62 m)  
 Offset from sides: 5 ft (1.52 m)  
 Offset from ends: 5 ft (1.52 m)



### Single Row Spacing-

Head Spacing: 20 ft (6.10 m)  
 Offset from sides: 10 ft (3.05 m)  
 Offset from ends: 5 ft (1.52 m)



Recommended spacings based on maximum uniformities from Chart A, page 2.

**TABLE 3. Xcel-Wobbler - HA (high Angle)**

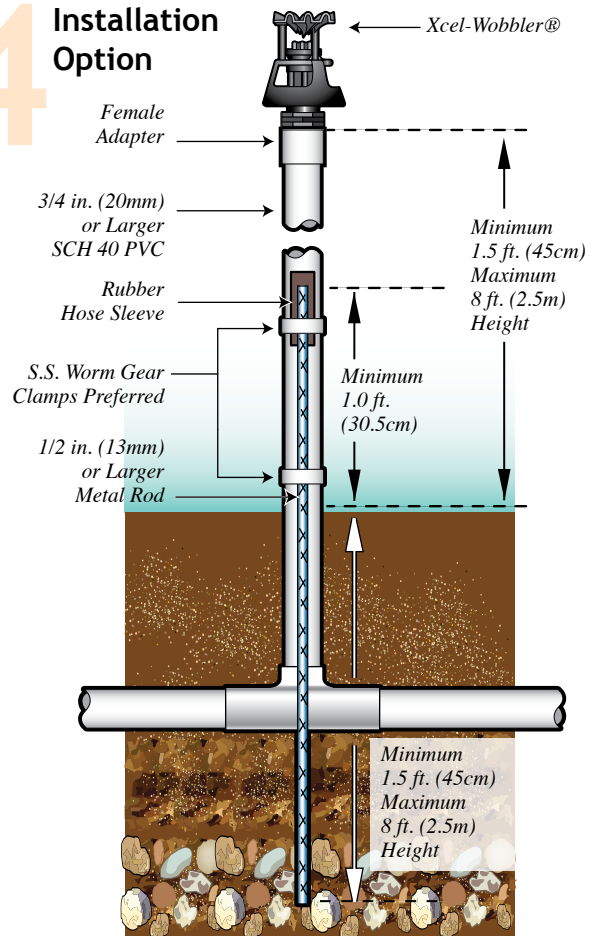
Additional Design Options at 20 psi (1.38 bar) (not shown on Chart A, page 2)

NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
6	20 x 20	6.10 x 6.10	84.6	1.44	18	45	0.26	6.60
7	20 x 20	6.10 x 6.10	90.7	1.17	18	45	0.36	9.14
8	20 x 20	6.10 x 6.10	8.5	1.19	18	45	0.48	12.2
9	20 x 20	6.10 x 6.10	90.6	1.13	18	45	0.61	15.5
10	20 x 20	6.10 x 6.10	89.1	1.14	18	45	0.76	19.3

Additional Design Options at 25 psi (1.72 bar) (not shown on Chart A, page 2)

NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
6	25 x 25	7.62 x 7.62	86.9	1.30	18	45	0.19	4.83
7	25 x 25	7.62 x 7.62	86.8	1.30	18	45	0.26	6.60
8	25 x 25	7.62 x 7.62	87.6	1.30	18	45	0.34	8.64
9	25 x 25	7.62 x 7.62	86.1	1.45	18	45	0.44	11.2
10	25 x 25	7.62 x 7.62	86.7	1.30	18	45	0.54	13.7

## 4 Installation Option



# Smooth Drive™ Irrigating



## Advantages of a Smooth Drive Irrigation System

- Walking diffuser for outstanding uniformity, no leg shadows and gentle application
- Precision-radiused deflector provides greater throw and enhanced distribution
- Advanced breaking mechanism for smooth, consistent rotation speed through a wide range of pressures and flow rates
- Rugged design stands up to harsh field conditions



*The Smooth Drive has a smooth, consistent rotation speed through a wide range of pressures and flows.*

## Follow these 4 Steps to design a Smooth Drive irrigation system...

### 1 Determine Application Rate & Maximum Length of Laterals

Based on the selection of the Smooth Drive from Chart A on page 2, use Table 1 to help determine the application rate and the maximum length of laterals using PVC (maximum allowable velocity of 5 ft or (1.52 m per second) as recommended by PVC manufacturers) or Poly Pipe for 3/4" or 1" sizes.

**TABLE 1. Smooth Drive™**

Maximum Length of Lateral on 30 ft (9.1 m); Spacing at 30 psi (2.07 bar)

NOZZLE #	APPLICATION RATE		3/4" PVC (0.930 I.D.) Class 200		1" PVC (1.195 I.D.) Class 160		3/4" POLY (0.817 I.D.) Poly		1" POLY (1.05 I.D.) Poly		1" PVC (1.754 I.D.) Class 160		2" PVC (2.193 I.D.) Class 160	
	(in/h)	(mm/h)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)
6	0.14	3.56	210	64.0	330	100.6	180	54.9	270	82.3	660	201.2	1590	484.6
7	0.20	5.08	180	54.9	270	82.3	120	36.6	210	64.0	510	155.5	1290	393.2
8	0.26	6.60	120	36.6	210	64.0	90	27.4	180	54.9	420	128.0	1080	329.2

Data based on <4 psi (0.276 bar) lateral friction loss.

### 2 Determine Zone Flow

Table 2 will determine the number of Smooth Drives based on system flow rate of 30 psi (2.07 bar).

**TABLE 2.**  
Quantity of units based on System Flow Rate

Flow Rate	Nozzle #6	Nozzle #7	Nozzle #8
20 gpm (75.69 L/m)	14	10	8
30 gpm (113.5 L/m)	22	16	12
40 gpm (151.4 L/m)	29	21	16
50 gpm (189.2 L/m)	37	27	20
60 gpm (227.1 L/m)	44	32	24
70 gpm (264.9 L/m)	52	38	28



*The Smooth Drive unique "walking diffuser" eliminates leg shadows in the distribution pattern.*



## 3

### Determine Spacing

#### Square Spacing

Head Spacing: 30 ft (9.14 m)

Row Spacing: 30 ft (9.14 m)

Offset from sides: 10 ft (3.05 m)

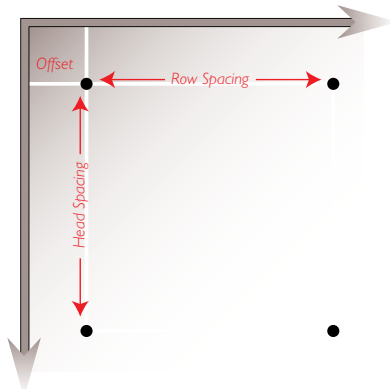
Offset from ends: 10 ft (3.05 m)

Head Spacing: 25 ft (7.62 m)

Row Spacing: 25 ft (7.62 m)

Offset from sides: 8 ft (2.44 m)

Offset from ends: 8 ft (2.44 m)



Recommended spacings based on maximum uniformities from Chart A, page 2.

**TABLE 3. Smooth Drive**

Additional Design Options at 25 psi (1.72 bar) (not shown on Chart A, page 2)

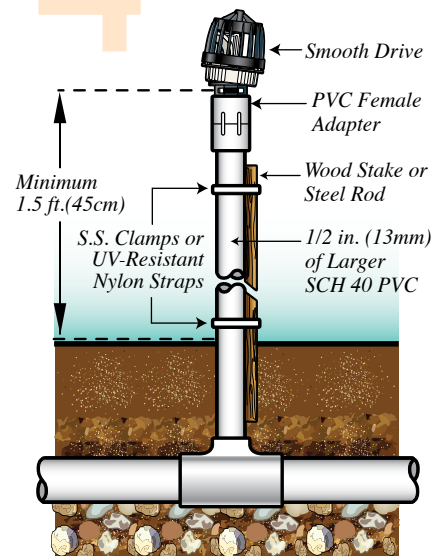
NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
6	25 × 25	7.62 × 7.62	91.8	1.23	18	45	0.19	4.83
7	25 × 25	7.62 × 7.62	95.1	1.10	18	45	0.26	6.60
8	25 × 25	7.62 × 7.62	94.8	1.09	18	45	0.34	8.64
6	30 × 30	9.14 × 9.14	89.6	1.20	18	45	0.13	3.30
7	30 × 30	9.14 × 9.14	89.6	1.23	18	45	0.18	4.57
8	30 × 30	9.14 × 9.14	87.7	1.27	18	45	0.24	6.10

Additional Design Options at 30 psi (2.07 bar) (not shown on Chart A, page 2)

NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
6	25 × 25	7.62 × 7.62	89.3	1.15	18	45	0.21	5.33
7	25 × 25	7.62 × 7.62	90.6	1.14	18	45	0.28	7.11
8	25 × 25	7.62 × 7.62	89.3	1.17	18	45	0.37	9.40
6	30 × 30	9.14 × 9.14	84.1	1.38	18	45	0.14	3.56
7	30 × 30	9.14 × 9.14	88.0	1.30	18	45	0.20	5.10
8	30 × 30	9.14 × 9.14	89.3	1.35	18	45	0.26	6.60

## 4

### Installation Options



# Impact Sprinklers Irrigating



*Senninger offers a wide variety of impact sprinklers with varying trajectories and configurations to meet many installation needs.*

## Advantages of an Impact Sprinkler Irrigation System

- Double-nozzle models for enhanced distribution
- Single-nozzle models for maximum throw
- Nozzle-vane combinations for outstanding uniformity
- Various degree trajectory models available
- Wide spacing



## Follow these 4 Steps to design an Impact Sprinkler irrigation system...

### 1 Determine Application Rate & Maximum Length of Laterals

Based on the selection of an Impact Sprinkler from Chart A on page 2, use Table 1 to help determine the application rate and the maximum length of laterals using PVC (maximum allowable velocity of 5 ft or (1.52 mm per second) as recommended by PVC manufacturers).

**TABLE 1. IMPACT SPRINKLERS**

Maximum Length of Lateral on 45 ft (3.10 bar)

EMITTER	NOZZLE #	SPACING		APPLICATION RATE		1.5" PVC (1.754 I.D.) Class 160		2" POLY (2.193 I.D.) Class 160	
		(ft)	(m)	(in/h)	(mm/h)	(ft)	(m)	(ft)	(m)
2023-1	8SQ	25	7.62	0.46	11.7	350	106.7	500	152.4
3023-2	9RV x 6RV	35	10.7	0.43	10.9	300	91.4	450	137.2
4023-2	12VV x 6RV	40	12.2	0.51	13.0	200	61.0	320	97.5
5023-2	14VV x 8RV	45	13.7	0.54	13.7	180	54.9	300	91.4

Data based on <4 psi (0.276 bar) lateral friction loss.

### 2 Determine Zone Flow

Table 2 will determine the number of impacts based on system flow rate.

**TABLE 2.**

Quantity of units based on System Flow Rate

Flow Rate	Impact 2023-1	Impact 3023-2	Impact 4023-2	Impact 5023-2
30 gpm (113.5 L/m)	10	4	-	-
40 gpm (151.4 L/m)	13	6	4	-
50 gpm (189.2 L/m)	16	8	5	4
60 gpm (227.1 L/m)	20	9	7	5
80 gpm (302.7 L/m)	26	13	9	7



*Double-nozzle impacts provide enhanced distribution.*



# Irrigating Impact Sprinklers

# 3

## Determine Spacing

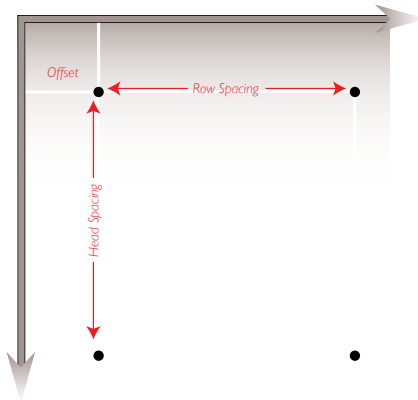
### 3023-2 Square-

Head Spacing: 35 ft (10.7 m)

Row Spacing: 35 ft (10.7 m)

Offset from sides: 10 ft (3.05 m)

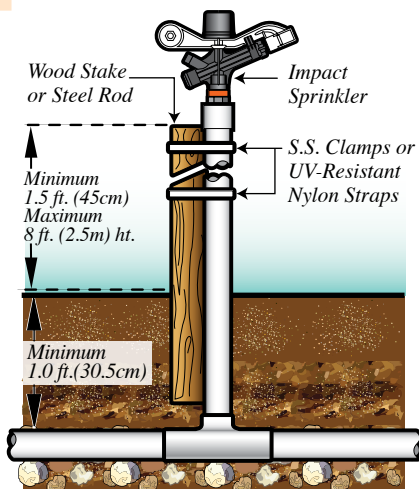
Offset from ends: 10 ft (3.05 m)



Recommended spacings based on maximum uniformities from Chart A, page 2.

# 4

## Installation Option



**TABLE 3. Impact Sprinklers**

Additional Design Options (not shown on Chart A, page 2)

2023-1 Impacts at 45 psi (3.10 bar)

NOZZLE #	SQUARE SPACING		CU (%)	SC	RISER HEIGHT		APPLICATION RATE	
	(ft)	(m)			(in)	(cm)	(ft)	(m)
6SQ	30 × 30	9.14 × 9.14	91.3	1.20	18	45	0.18	4.57
7SQ	30 × 30	9.14 × 9.14	92.3	1.14	18	45	0.24	6.10
8SQ	30 × 30	9.14 × 9.14	92.9	1.13	18	45	0.32	8.13
9WV	30 × 30	9.14 × 9.14	89.3	1.25	18	45	0.40	10.2

3023-2 Impacts at 40 psi (2.76 bar)

7RV × 4RV	40 × 40	12.2 × 12.2	88.7	1.35	18	45	0.21	5.33
8RV × 4RV	40 × 40	12.2 × 12.2	91.8	1.19	18	45	0.27	6.86
9RV × 4RV	40 × 40	12.2 × 12.2	94.8	1.14	18	45	0.31	7.87
10RV × 4RV	40 × 40	12.2 × 12.2	92.3	1.25	18	45	0.27	6.86

4023-2 Impacts at 45 psi (3.10 bar)

10WV × 6RV	55 × 55	16.8 × 16.8	88.2	1.24	18	45	0.20	5.08
11WV × 6RV	55 × 55	16.8 × 16.8	89.5	1.18	18	45	0.24	6.10
12WV × 6RV	55 × 55	16.8 × 16.8	87.5	1.22	18	45	0.29	7.37
13WV × 6RV	55 × 55	16.8 × 16.8	88.2	1.17	18	45	0.31	7.87
14WV × 6RV	55 × 55	16.8 × 16.8	87.4	1.19	18	45	0.35	8.89

5023-2 Impacts at 50 psi (3.45 bar)

13WV × 8RV	65 × 65	19.8 × 19.8	86.9	1.45	18	45	0.24	6.10
14WV × 8RV	65 × 65	19.8 × 19.8	86.9	1.24	18	45	0.28	7.11
15WV × 8RV	65 × 65	19.8 × 19.8	88.0	1.32	18	45	0.30	7.62
16WV × 8RV	65 × 65	19.8 × 19.8	86.3	1.27	18	45	0.34	8.64
17WV × 8RV	65 × 65	19.8 × 19.8	85.7	1.20	18	45	0.37	9.40

# Pressure Regulators & Components

Pressure Regulators



## Other nursery products:

- i-mini-Wobbler
- Mister
- Part-Circle Impact Sprinklers
- Spray Stakes
- Super Spray
- T-Spray
- Wobblers

Contact Senninger Irrigation for more information about these quality products or the name of your nearest Senninger dealer.

Riser Adapters



Riser Adapter Assemblies

(See our Quick Connect Riser Adapter Brochure)



Barb Fittings



Bushing Fittings



Punch Tools



0.125" Tubing



**Senninger**<sup>®</sup>  
Irrigation Inc.

Made in U.S.A.

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