Volume V: AquaRise CPVC Hot & Cold Water Systems

Mechanical Technical Manual Series

THIRD EDITION

AquaRISE®

Tough solvent weld system for commercial, industrial and high-rise buildings.

IPEX

We build tough products for tough environments®

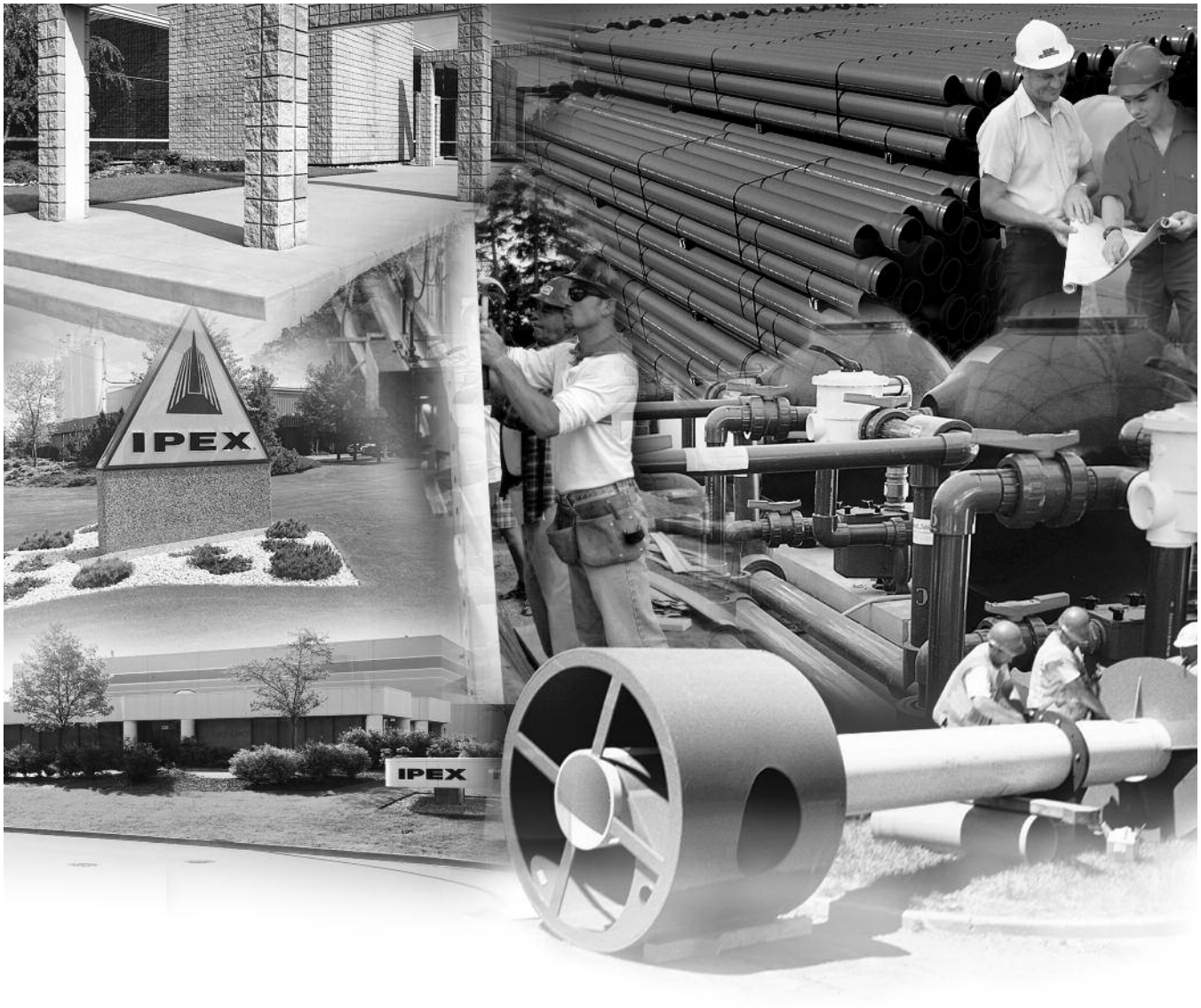
AquaRise® CPVC Hot & Cold Water Systems

Mechanical Technical Manual Series

Vol. V, 3rd Edition

LITERATURE & WEBSITE DISCLAIMER

The information contained here within is based on current information and product design at the time of publication and is subject to change without notification. IPEX does not guarantee or warranty the accuracy, suitability for particular applications, or results to be obtained therefrom.



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We and are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

Safety Alerts

Engineered thermoplastics are safe inert materials that do not pose any significant safety or environmental hazards during handling or installation. However, improper installation or use can result in personal injury and/or property damage. It is important to be aware of and recognize safety alert messages as they appear in this manual.

The types of safety alert messages are described below.

This safety alert symbol indicates important safety messages in this manual. When you see this symbol be alert to the possibility of personal injury and carefully read and fully understand the message that follows.

Note: The use of the word "NOTE" signifies special instructions which are important but are not related to hazards.

WARNING

"WARNING" identifies hazards or unsafe practices that can result in severe personal injury or death if instructions, including recommended precautions, are not followed.

CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.

WARNING

- **NEVER** use compressed air or gas in CPVC pipe and fittings.
- **NEVER** test CPVC pipe and fittings with compressed air or gas, or air-over-water boosters.
- **ONLY** use CPVC pipe for water and approved chemicals.

Use of compressed air or gas in CPVC pipe and fittings can result in explosive failures and cause severe injury or death.

WARNING

Duratec is only suitable for compressed air and inert gases.

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

CONTENTS

NOTES

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

Section One: General

Overview

AquaRise is a thermoplastic piping system designed for potable (drinking) water applications in combustible or non-combustible buildings. Pipe and fittings are manufactured in sizes ½" through 6" diameter using a specially formulated TempRite®* Chlorinated Polyvinyl Chloride (CPVC) compound.

This manual provides both installers and designers with guidance to help ensure the proper usage of AquaRise. Readers are encouraged to contact their nearest IPEX Sales Office, or local representative for any further consultation or clarification before using AquaRise to ensure a successful installation.

Features

MATERIAL - made from Chlorinated Polyvinyl Chloride (CPVC) to SDR11 dimension ratio

COMPLETE LINE – pipe, fittings, valves and solvent cements are all offered within the AquaRise product line thus creating a complete, one-source piping system

FULLY CERTIFIED – AquaRise pipe, fittings valves and solvent cements are certified to CSA B137.6 and applicable ASTM standards. All components are listed to NSF 61 for potable water applications.

PRESSURE CAPACITY – the SDR wall thickness provides pressure ratings of 400psi at 73oF (2,758kPa at 23oC) and 100psi at 180oF (690kPa at 82oC).

FLOW CAPACITY – AquaRise pipe and fittings have a Hazen-Williams Flow Coefficient, C = 150, and larger inside diameters than most plastic water pipe systems

SIZE RANGE – offered in nominal sizes ½" through 6"

COLOR CODED – with an Aqua-blue color code for pipe, fittings and valves, AquaRise can be easily identified as a potable water piping system within buildings

LIGHTWEIGHT – AquaRise is a relatively light weight piping system offering the potential for efficiency in transport, handling and installation

CORROSION RESISTANCE – AquaRise CPVC is generally resistant to most common external corrosion sources. For complete information see … … … …

*TempRite is a registered trademark of Lubrizol Advanced Materials, Inc.
AquaRise® is a trademark of IPEX Branding Inc.
The colour of the AquaRise® pipes and fittings is a trademark of IPEX Branding Inc.

BURNING CHARACTERISTICS – AquaRise pipe, fittings and solvent cements are listed to ULC S102.2 with Flame Spread and Smoke Developed ratings of 25/50. This makes AquaRise acceptable for use in High Rises and Plenums in Canada. For the current status of approvals throughout the United States, please contact IPEX. Always check local authorities for approval.

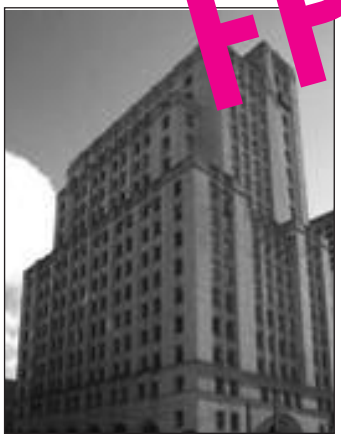
DOMESTIC PRODUCTION – AquaRise pipe and fittings are made in the USA and Canada.

Applications

AquaRise is approved for use in domestic, hot and cold potable water applications only. It may not be used for any other piping applications. Using AquaRise for any application other than hot and cold potable water will void the AquaRise Limited Warranty.

Common types of buildings where AquaRise may be used include:

- Apartments / condos / townhouses
- Hotels
- Long-Term care facilities
- Retail stores
- Office buildings
- Schools
- Health Care facilities
- Industrial plants
- Restaurants
- Indoor sports facilities



Section Two: Design Considerations

Material Description

AquaRise pipe, fittings and valves are manufactured from TempRite® Chlorinated Polyvinyl Chloride (CPVC). CPVC is similar to PVC in its physical properties and benefits but provides an advantage by maintaining tensile strength and thus pressure capacity at temperatures as high as 180oF (82oC). The use of any non-AquaRise components within an AquaRise system is generally prohibited and must be evaluated and approved by IPEX prior to installation.

AquaRise Pipe

AquaRise pipe is manufactured to Iron Pipe Size Outside Diameter (IPS OD) SDR11 dimensions. This provides a robust pipe designed to withstand the challenges of installation in a wide variety of buildings. All diameters have the same pressure rating while providing larger inside diameters than most potable water systems.

A. Imperial Units

Nominal Size (Inches)	Average OD (Inches)	Average ID (Inches)	Average Wall Thickness (inches)	Wt Pipe - Empty lb/ft	Wt Pipe - Full of Water lb/ft
1/2	0.840	0.679	0.081	0.13	0.76
3/4	1.050	0.847	0.101	0.20	1.18
1	1.315	1.061	0.127	0.32	1.85
1-1/4	1.660	1.340	0.160	0.51	2.95
1-1/2	1.900	1.534	0.183	0.66	3.86
2	2.375	1.917	0.229	1.04	6.04
2-1/2	2.875	2.321	0.277	1.52	8.29
3	3.500	2.826	0.337	2.25	13.12
4	4.500	3.633	0.434	3.87	21.83
6	6.625	5.348	0.639	8.41	47.33

B. Metric Units

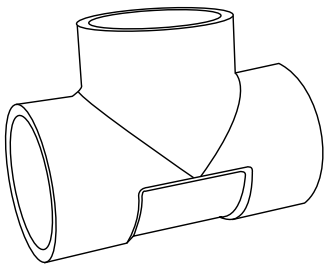
Nominal Size (mm)	Average OD (mm)	Average ID (mm)	Average Wall Thickness (mm)	Wt Pipe - Empty Kg/m	Wt Pipe - Full of Water Kg/m
12	21.3	17.2	2.06	0.19	1.13
19	26.7	21.5	2.57	0.30	1.76
25	33.4	26.9	3.23	0.48	2.76
32	42.2	34.0	4.06	0.76	4.40
38	48.3	39.0	4.65	0.99	5.76
50	60.3	48.7	5.82	1.55	9.00
63	73.0	56.7	7.04	2.27	12.36
75	88.9	71.8	8.56	3.36	19.56
100	114.3	92.3	11.02	5.77	32.55
150	168.2	135.8	16.23	12.54	70.58

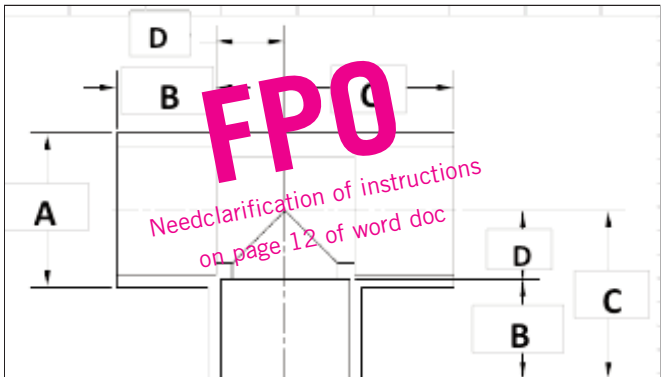
AquaRise Fittings

The AquaRise system offers a wide variety of Fittings including Tees, Reducer Tees, 90's, 45's, Couplings, Reducer Bushings, Threaded Transition Fittings and Flanges. All AquaRise fittings are manufactured to strict IPEX tolerances meant to ensure proper interference fits between pipes and fittings each time.

The following AquaRise fittings are offered. Check with IPEX representatives for updates and new fittings.

Tees





TEE Soc x Soc x Soc

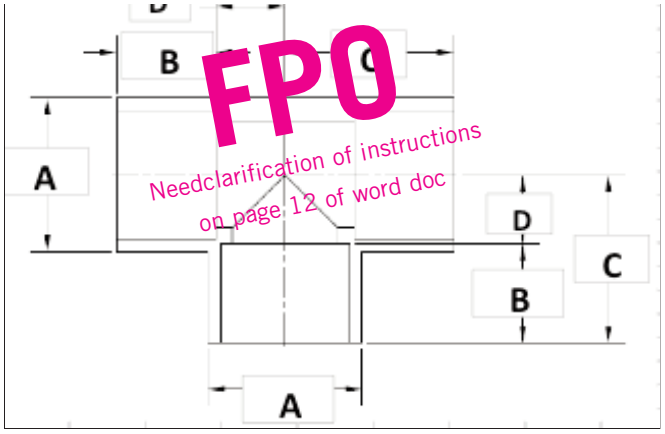
Imperial (in)

Size	A	B	C	D
1/2	1.200	0.890	1.367	0.477
3/4	1.426	1.020	1.581	0.561
1	1.745	1.141	1.850	0.709
1-1/4	2.122	1.265	2.140	0.875
1-1/2	2.373	1.395	2.377	0.982
2	2.896	1.520	2.794	1.265
2-1/2	3.533	1.772	3.292	1.520
3	4.215	1.895	3.728	1.833
4	5.350	2.270	4.662	2.392
6	7.875	3.020	6.563	3.543

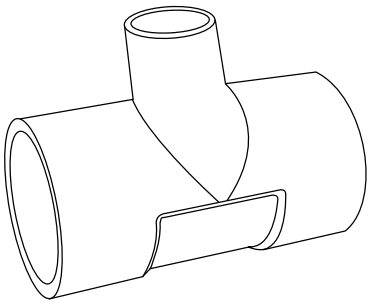
Metric (mm)

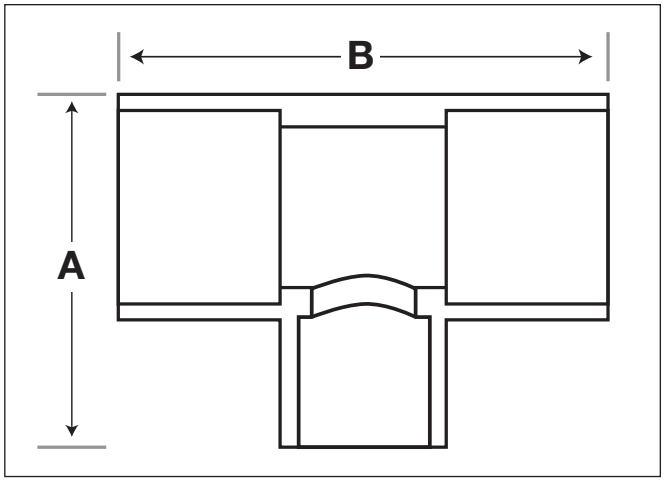
Size	A	B	C	D
12	30.5	22.6	34.7	12.1
19	36.2	25.9	40.2	14.2
25	44.3	29.0	47.0	18.0
32	53.9	32.1	54.4	22.2
38	60.3	35.4	60.4	24.9
50	73.6	38.6	71.0	32.1
63	89.7	45.0	83.6	38.6
75	107.1	48.1	94.7	46.6
100	135.9	57.7	118.4	60.8
150	200.0	76.7	166.7	90.0

Need to add two drawings that will cover all sizes – one to show standard socket dimensions and the other to show a standard fitting spigot. Dimensions to be shown are the depth of socket, length of spigot and outside diameter of the socket and spigot. Thus, there should be two dimensions per drawing.



Reducing Tees





REDUCING TEE Soc x Soc x Soc

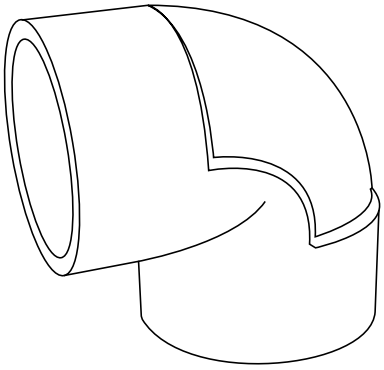
Imperial (in)

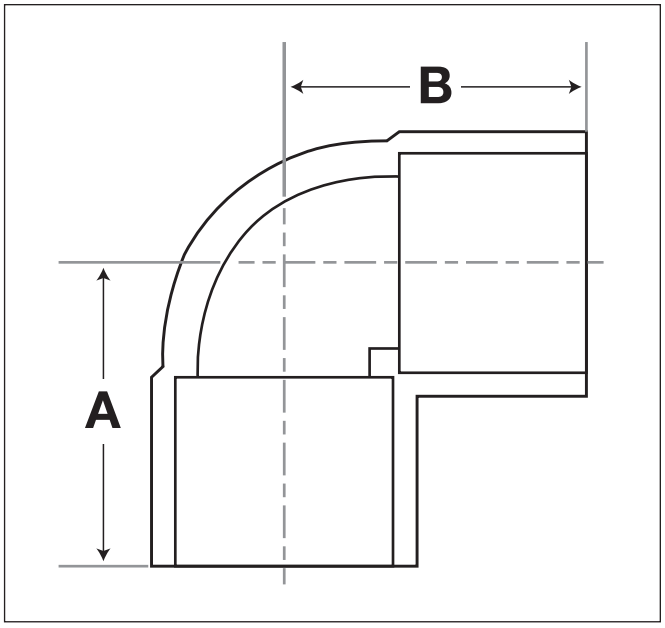
Nominal Size	A	B
3/4 x 3/4 x 1/2		
3/4 x 1/2 x 3/4		
3/4 x 1/2 x 1/2		
1 x 1 x 1/2		
1 x 1 x 3/4		
1-1/4 x 1-1/4 x 1		
1-1/2 x 1-1/2 x 1/2		
1-1/2 x 1-1/2 x 3/4		
1-1/2 x 1-1/2 x 1		
2 x 2 x 1/2		
2 x 2 x 3/4		
2 x 2 x 1		
2 x 2 x 1-1/2		
2-1/2 x 2-1/2 x 1/2		
2-1/2 x 2-1/2 x 3/4		
2-1/2 x 2-1/2 x 1		
2-1/2 x 2-1/2 x 1-1/4		
2-1/2 x 2-1/2 x 2		
3 x 3 x 2		
4 x 4 x 2		
4 x 4 x 3		
6 x 6 x 2		
6 x 6 x 3		
6 x 6 x 4		

Metric (mm)

Nominal Size	A	B
19 x 19 x 12		
19 x 12 x 19		
19 x 12 x 12		
25 x 25 x 12		
25 x 25 x 19		
32 x 32 x 25		
38 x 38 x 12		
38 x 38 x 19		
38 x 38 x 25		
50 x 50 x 12		
50 x 50 x 19		
50 x 50 x 25		
50 x 50 x 38		
63 x 63 x 12		
63 x 63 x 19		
63 x 63 x 25		
63 x 63 x 32		
63 x 63 x 50		
75 x 75 x 50		
100 x 100 x 50		
100 x 100 x 75		
150 x 150 x 50		
150 x 150 x 75		
150 x 150 x 100		

90˚ Elbows





90˚ ELBOW Soc x Soc

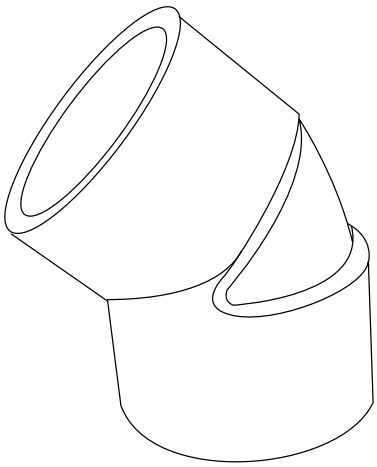
Imperial (in)

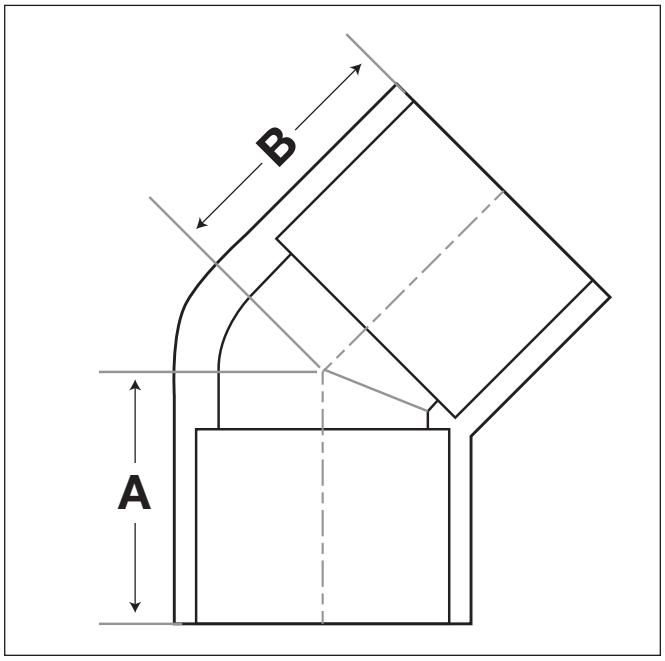
Size	A	B
1/2		
3/4		
1		
1-1/4		
1-1/2		
2		
2-1/2		
3		
4		
6		

Metric (mm)

Size	A	B
12		
19		
25		
32		
38		
50		
63		
75		
100		
150		

45˚ Elbows





45˚ ELBOW Soc x Soc

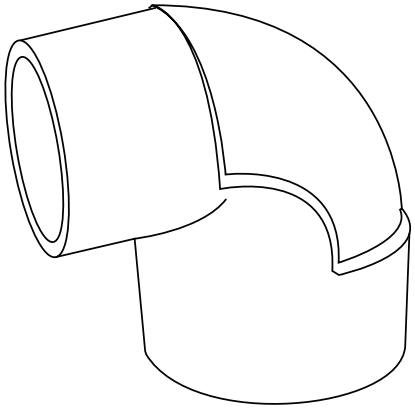
Imperial (in)

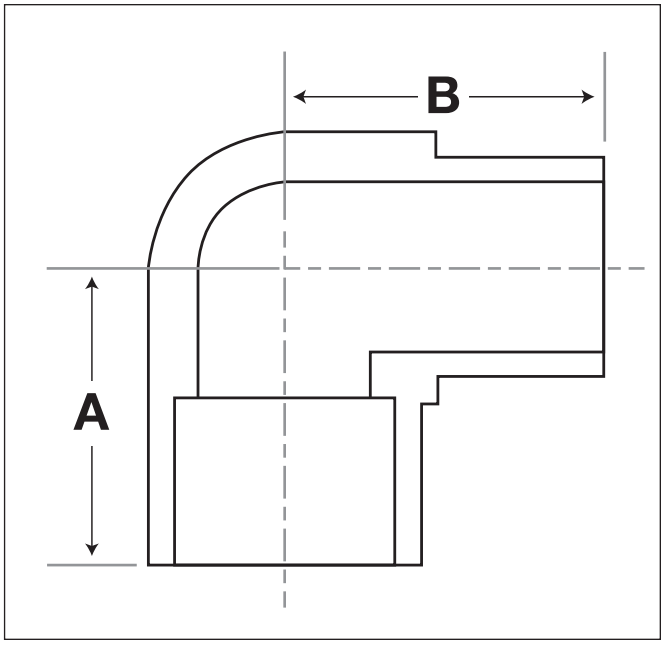
Size	A	B
1/2		
3/4		
1		
1-1/4		
1-1/2		
2		
2-1/2		
3		
4		
6		

Metric (mm)

Size	A	B
12		
19		
25		
32		
38		
50		
63		
75		
100		
150		

90˚ Street Elbows





90˚ STREET ELBOW Soc x Spg

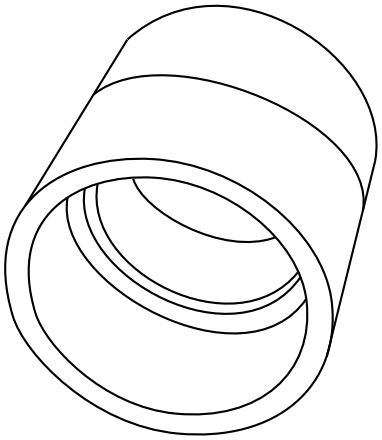
Imperial (in)

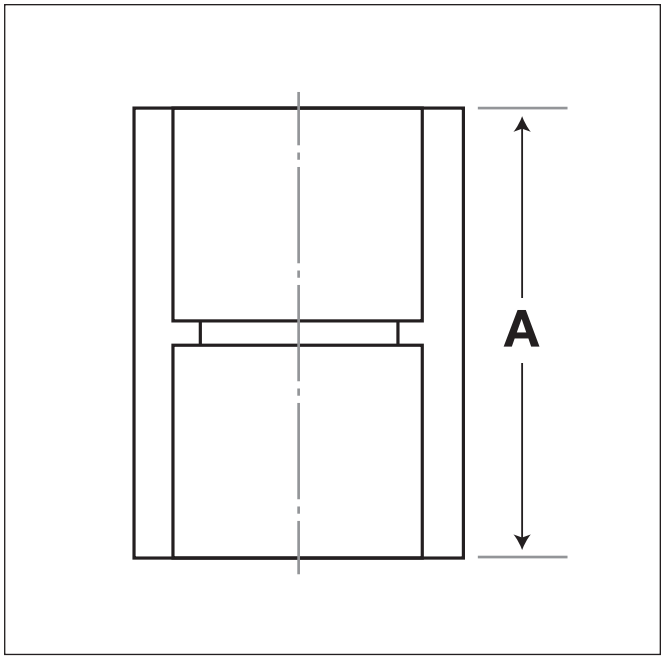
Size	A	B
1/2		
3/4		
1		

Metric (mm)

Size	A	B
12		
19		
25		

Couplings





COUPLING Soc x Soc

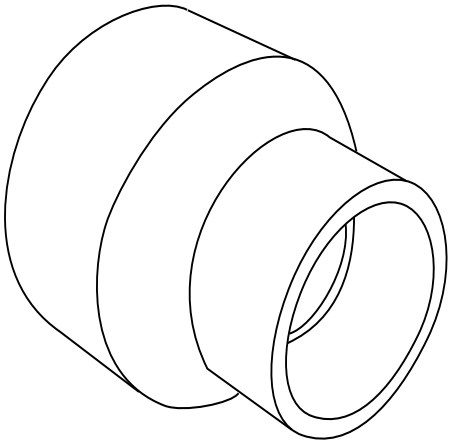
Imperial (in)

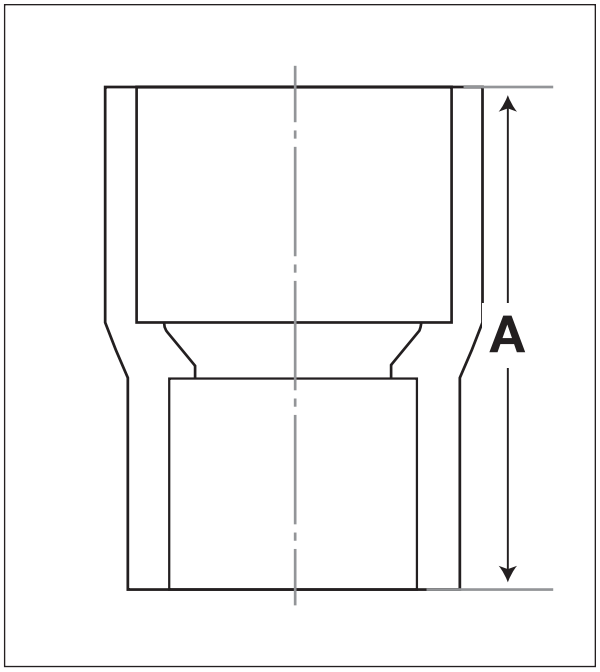
Size	A
1/2	1.910
3/4	2.156
1	2.400
1-1/4	2.654
1-1/2	2.905
2	3.163
2-1/2	3.744
3	4.010
4	4.790
6	6.290

Metric (mm)

Size	A
12	48.5
19	54.8
25	61.0
32	67.4
38	73.8
50	80.3
63	95.1
75	101.9
100	121.7
150	159.8

Reducer Couplings





REDUCING COUPLING Soc x Soc

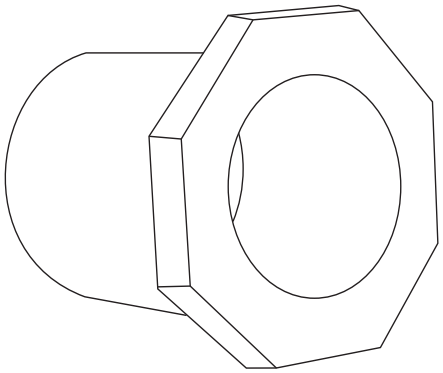
Imperial (in)

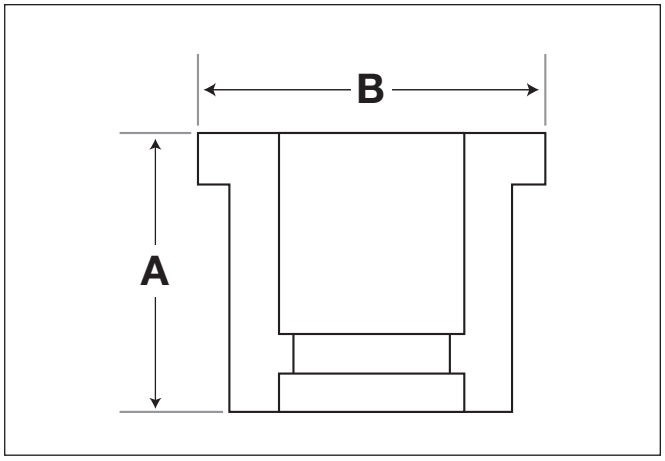
Nominal Size	A
3/4 x 1/2	2.08
1 x 1/2	2.37
1 x 3/4	2.38
1-1/4 x 1	2.66
1-1/2 x 1	3.05
1-1/2 x 1-1/4	3.05
2 x 1	3.54
2 x 2-1/2	3.51
3 x 2	4.13
4 x 2	5.30
4 x 3	5.19

Metric (mm)

Nominal Size	A
19 x 12	52.8
25 x 12	60.3
25 x 19	60.5
32 x 25	67.5
38 x 25	77.4
38 x 32	77.4
50 x 25	89.9
50 x 38	89.2
75 x 50	104.8
100 x 50	134.7
100 x 75	131.8

Reducer Bushings

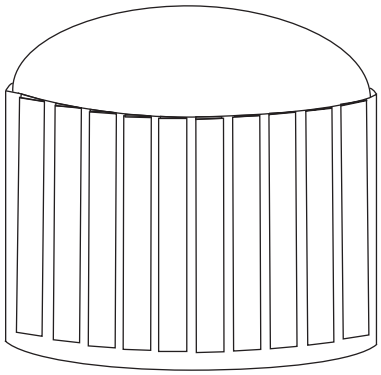


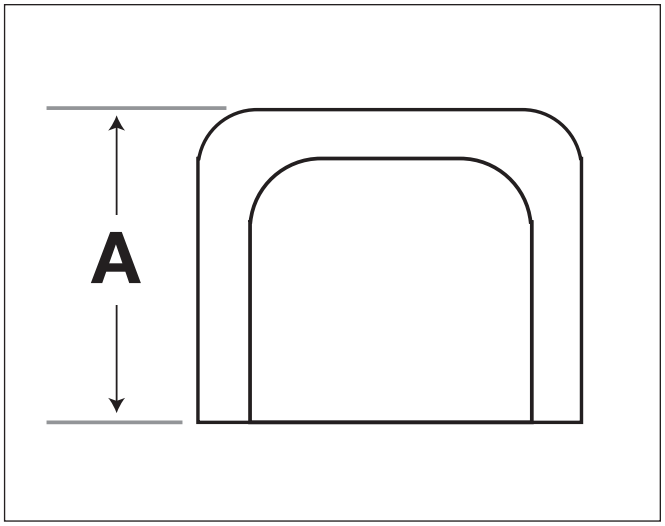


REDUCING BUSHING Soc x Soc

Imperial (in)			Metric (mm)		
Nominal Size	A	B	Nominal Size	A	B
3/4 x 1/2	1.38	1.25	19 x 12	35.0	31.8
1 x 1/2	1.50	1.63	25 x 12	38.1	41.5
1 x 3/4	1.50	1.63	25 x 19	38.1	41.4
1-1/4 x 1/2	1.63	2.06	32 x 12	41.4	52.3
1-1/4 x 3/4	1.63	2.06	32 x 19	41.4	52.3
1-1/4 x 1	1.69	2.06	32 x 25	42.9	52.3
1-1/2 x 1/2	1.75	2.25	38 x 12	44.5	57.2
1-1/2 x 3/4	1.75	2.25	38 x 19	44.5	57.1
1-1/2 x 1	1.75	2.40	38 x 25	44.4	61.0
1-1/2 x 1-1/4	1.55	2.14	38 x 32	39.3	54.4
2 x 1/2	1.89	2.82	50 x 12	48.0	71.6
2 x 3/4	1.89	2.82	50 x 19	48.0	71.6
2 x 1	1.89	2.82	50 x 25	48.0	71.7
2 x 1-1/4	1.89	2.82	50 x 32	48.0	71.7
2 x 1-1/2	1.89	2.82	50 x 38	48.0	71.5
2-1/2 x 3/4	2.12	3.26	63 x 19	53.8	82.8
2-1/2 x 1	2.12	3.26	63 x 25	53.8	82.8
2-1/2 x 2	2.12	3.26	63 x 50	53.9	82.8
3 x 1-1/2	2.26	3.89	75 x 38	57.4	98.8
3 x 2	2.26	3.89	75 x 50	57.4	98.8
3 x 2-1/2	2.26	3.89	75 x 63	57.5	98.7
4 x 1-1/4	2.65	4.90	100 x 32	67.3	124.4
4 x 1-1/2	2.65	4.90	100 x 38	67.3	124.4
4 x 2	2.65	4.90	100 x 50	67.3	124.4
4 x 2-1/2	2.65	4.90	100 x 63	67.3	124.5
4 x 3	2.65	4.90	100 x 75	67.3	124.5
6 x 2	3.65	7.28	150 x 50	92.7	185.0
6 x 3	3.65	7.28	150 x 75	92.7	185.0
6 x 4	3.65	7.28	150 x 100	92.7	185.0

End Caps





CAP Soc

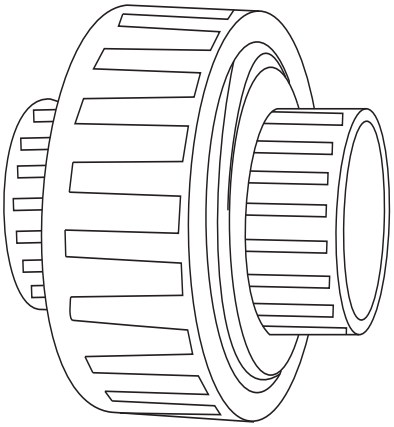
Imperial (in)

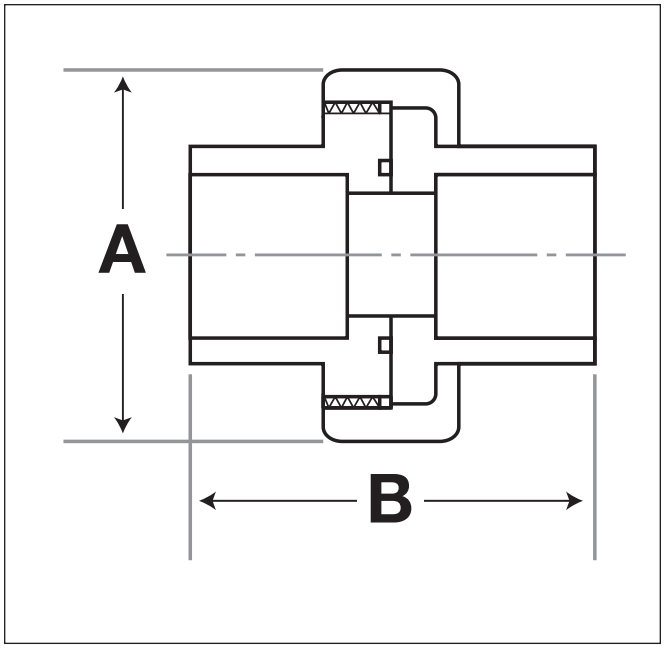
Nominal Size	A
1/2	1.28
3/4	1.34
1	1.56
1-1/4	1.76
1-1/2	1.88
2	2.07
2-1/2	2.65
3	2.96
4	3.27
6	4.39

Metric (mm)

Nominal Size	A
12	32.6
19	34.1
25	39.6
32	44.8
38	47.6
50	52.6
63	67.3
75	75.2
100	83.1
150	111.4

Unions





UNION Soc x Soc

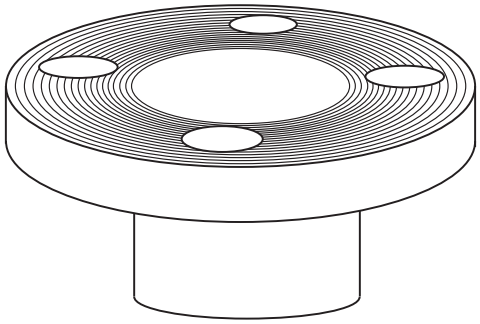
Imperial (in)

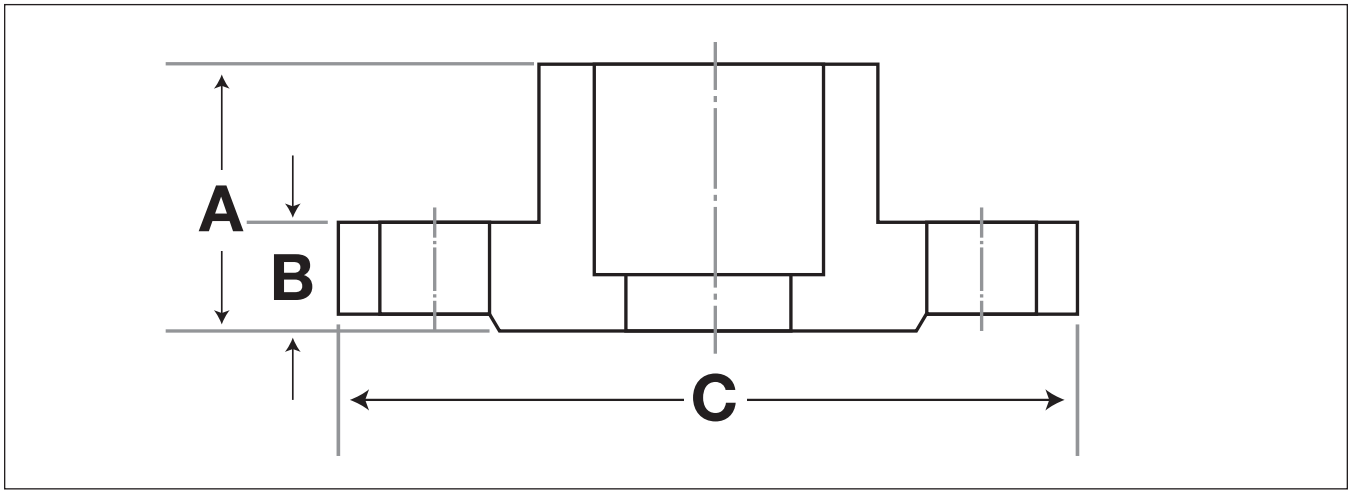
Nominal Size	A	B
1/2	1.98	2.31
3/4	2.34	2.57
1	2.67	2.86
1-1/4	3.09	3.40
1-1/2	3.81	3.82
2	4.81	4.19
3	5.74	5.02
4	7.08	5.82

Metric (mm)

Nominal Size	A	B
12	50.3	58.7
19	59.5	65.3
25	67.7	72.7
32	78.4	86.2
38	96.7	97.1
50	122.0	106.3
75	145.8	127.4
100	179.7	147.8

Flanges

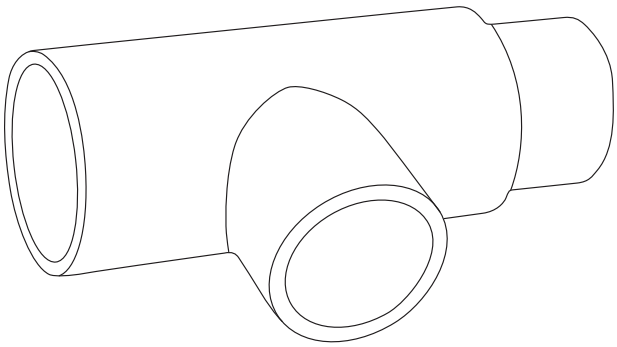


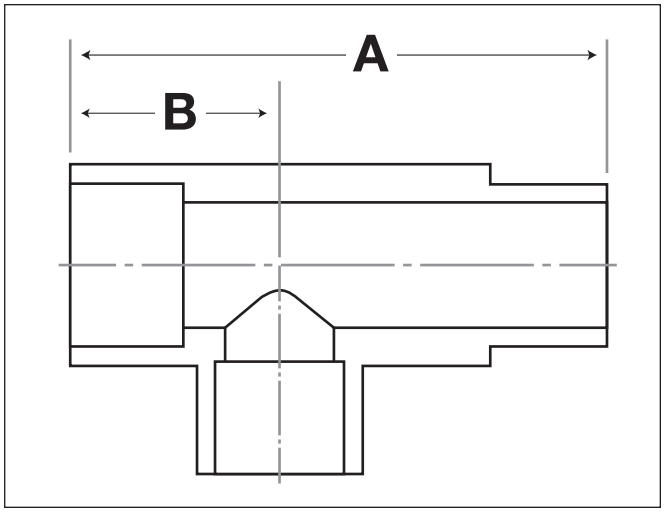


FLANGE Soc

Imperial (in)				Metric (mm)			
Nominal Size	A	B	C	Nominal Size	A	B	C
1/2	1.11	0.47	3.50	12	28.1	11.9	88.9
3/4	1.21	0.52	3.88	19	30.6	13.3	98.6
1	1.34	0.59	4.25	25	34.0	14.9	108.0
1-1/4	1.47	0.65	4.62	32	37.2	16.5	117.3
1-1/2	1.59	0.73	5.00	38	40.4	18.5	127.0
2	1.73	0.80	6.00	50	43.9	20.4	152.4
2-1/2	1.96	0.90	7.00	63	49.7	22.9	177.8
3	2.15	1.10	7.50	75	54.6	27.8	190.5
4	2.50	1.15	9.00	100	63.4	29.1	228.6
6	3.46	1.34	11.00	150	87.8	33.9	279.4

U-Do-It Manifolds





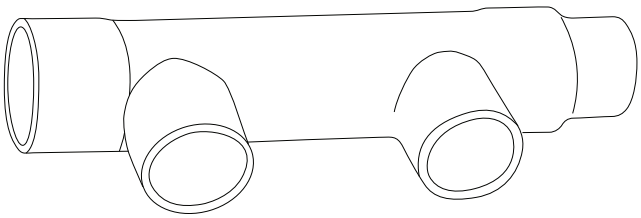
ONE BRANCH U-DO-IT MANIFOLD Soc x Sp x Soc

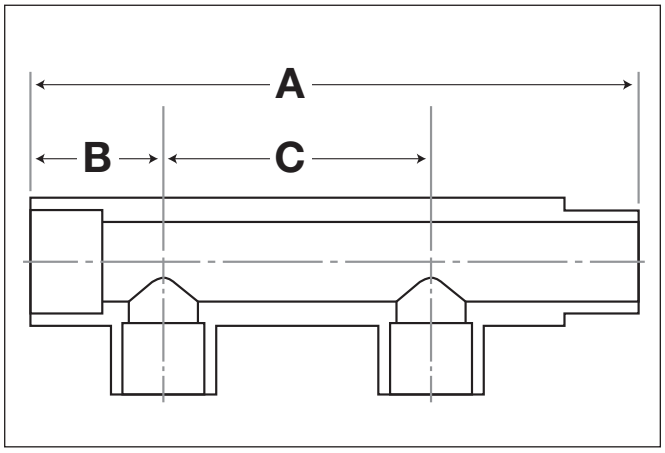
Imperial (in)

Nominal Size	A	B
3/4 x 3/4 x 1/2	3.50	1.38

Metric (mm)

Nominal Size	A	B
19 x 19 x 12	88.9	34.9





TWO BRANCH U-DO-IT MANIFOLD Soc x Sp x Soc x Soc

Imperial (in)

Nominal Size	A	B	C
3/4 x 3/4 x 1/2 x 1/2	6.25	1.38	2.75

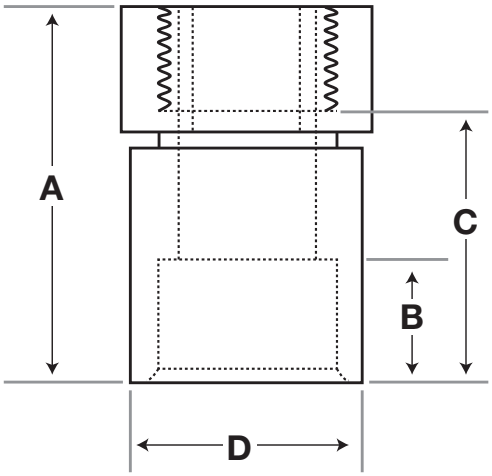
Metric (mm)

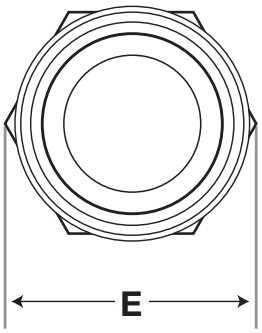
Nominal Size	A	B	C
19 x 19 x 12 x 12	158.8	34.9	69.9

The section below for Transition Fitting dimensions can be removed but needs to be kept on file for when these fittings are available in next 6-12 months.

Transition Fittings

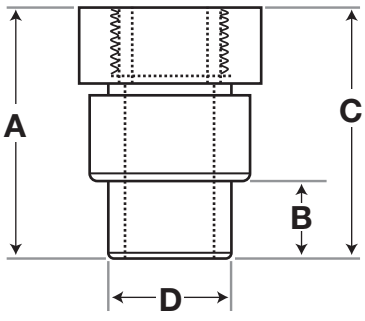
CPVC Socket x Female Thread

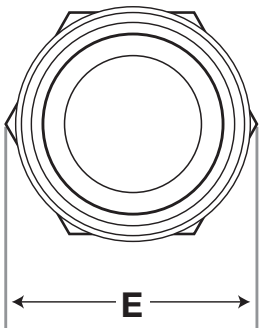




Description	Product Code	A	B	C	D	E
1/2" SOC FEMALE	359800	2.26	0.71	1.63	1.16	1.16
3/4" SOC FEMALE	359801	2.40	0.74	1.77	1.37	1.55
1" SOC FEMALE	359802	2.74	0.90	1.99	1.64	1.84
1-1/4" SOC FEMALE	359803	3.36	1.27	2.57	2.10	2.27
1-1/2" SOC FEMALE	359804	3.48	1.40	2.69	2.35	2.53
2" SOC FEMALE	359805	3.82	1.52	3.03	2.87	3.14

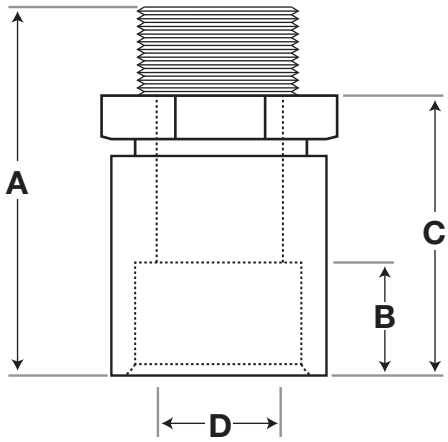
CPVC Spigot x Female Thread

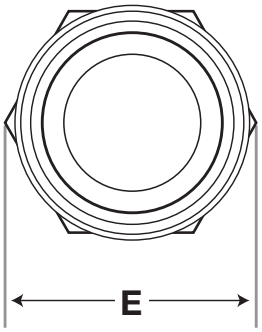




Description	Product Code	A	B	C	D	E
1/2" SP FEMALE	359820	2.24	0.71	1.61	0.84	1.14
3/4" SP FEMALE	359821	2.39	0.74	1.76	1.05	1.55
1" SP FEMALE	359822	2.74	0.90	1.99	1.32	1.84

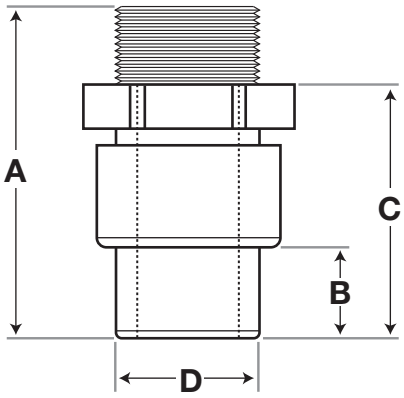
CPVC Socket x Mail Thread

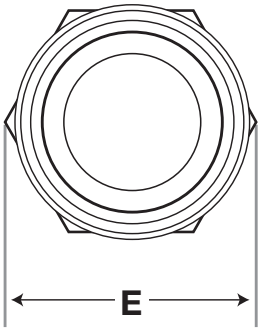




Description	Product Code	A	B	C	D	E
1/2" SOC MALE	359811	2.51	0.71	1.90	1.16	1.16
3/4" SOC MALE	359812	2.65	0.74	2.04	1.37	1.55
1" SOC MALE	359813	2.90	0.90	2.19	1.64	1.84
1-1/4" SOC MALE	359814	3.47	1.27	2.77	2.10	2.27
1-1/2" SOC MALE	359815	3.61	1.40	2.89	2.35	2.53
2" SOC MALE	359816	4.17	1.52	3.23	2.87	2.96

CPVC Spigot x Mail Thread





Description	Product Code	A	B	C	D	E
1/2" SP MALE	359823	2.49	0.71	1.88	0.84	1.14
3/4" SP MALE	359824	2.64	0.74	2.03	1.05	1.55
1" SP MALE	359825	2.90	0.90	2.19	1.32	1.84

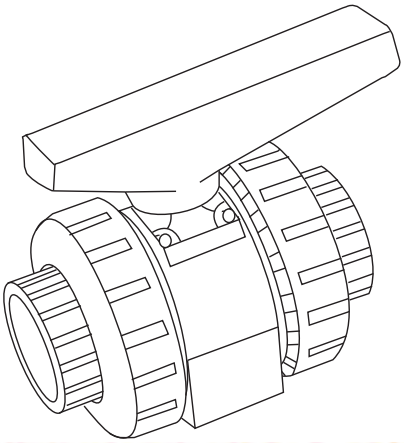
AquaRise Valves

All AquaRise True Union Ball Valves are available in sizes ½″ through 2″ and are made from the same AquaRise CPVC compound used for molded fittings. The Pressure Rating of this size range of ball valves is 232 psi (1600 kPa) at 73°F (23°C). Additional sizes of true union ball valves are soon to be available for 2-1/2″ through 4″.

For larger diameter valve, AquaRise adapter fittings such as flanges allow users to transition to metal valves. Users may also select from a range of industrial plastic valves offered by IPEX such as the FK Butterfly Valve. Contact IPEX for details.

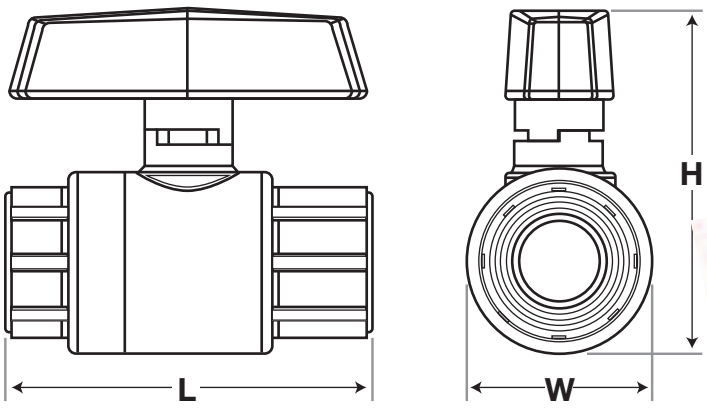
True Union Ball Valves

AquaRise true union ball valves are NSF-61 listed for potable water applications. Union fitting connections allow for easy valve removal and replacement without having to cut the pipe. This valve uses specially selected chloramine resistant O-ring seals for performance in potable water where a variety of treatment chemicals may be used.



Modify existing drawings from current All tech manual to be more simplified as for the socket ball valve and provide basic dimensions of length, height, and widths with handles in open and closed positions...see socket ball valve chart for details.

Entire section and any reference to Socket-End Ball Valves must be removed for now as their availability is now slated for early 2015. Text should be kept on file for when required.



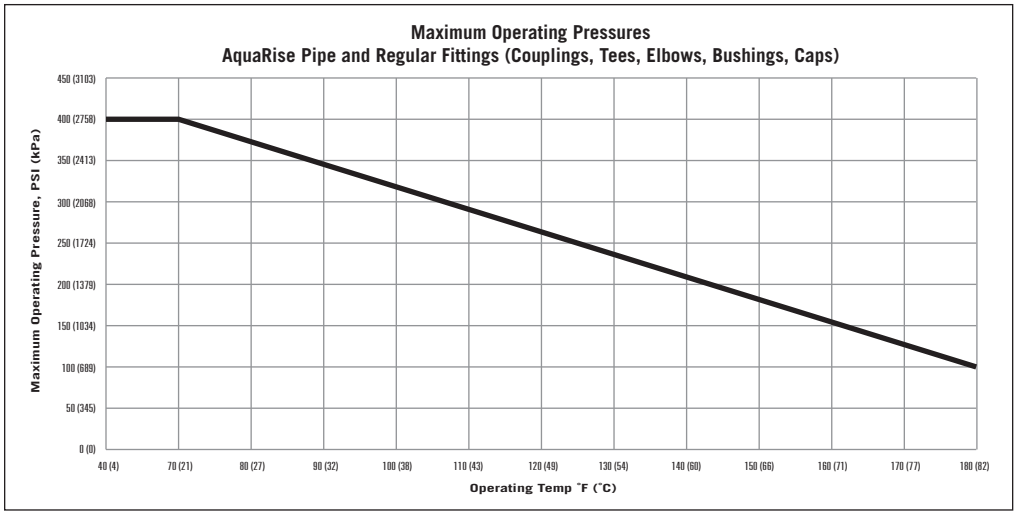
Remove WA clearance from drawing above this column title should be width W, in [mm]

System Pressure Ratings

AquaRise pipe and regular solvent cement fittings (couplings, tees, elbows, bushings, caps, threaded adapters) are rated to a maximum operating pressure of 400 psi at 73oF (2,758 kPa at 23oC) and 100 psi at 180oF (690 kPa at 82oC). The following chart provides a quick reference for pressure ratings of pipe, fittings and valves at various temperatures.

WARNING: Maximum operating temperatures and pressures must not be exceeded. Always design to prevent or accommodate for surge pressures in an AquaRise system.

Pipe and Regular Fittings

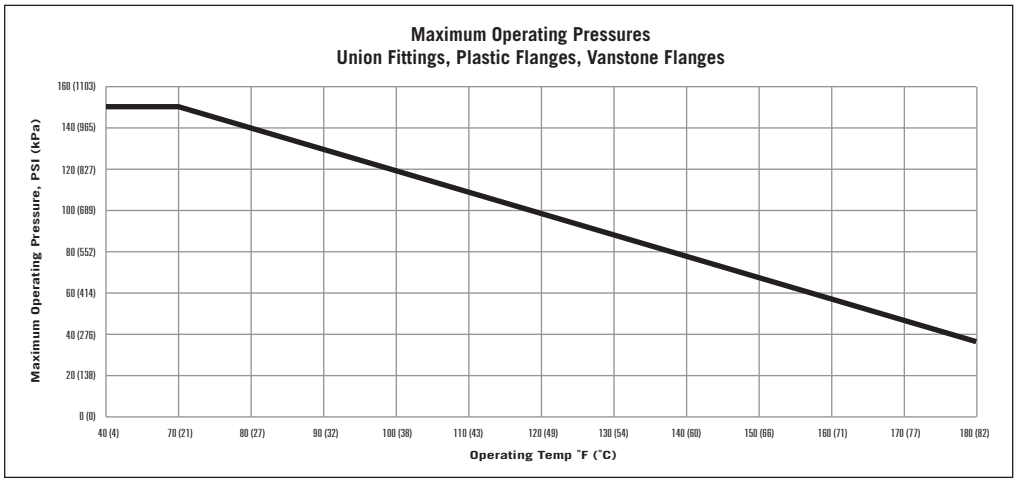


This pressure rating chart applies to all AquaRise pipes, regular molded fittings (tees, elbows, couplings, caps, etc.) as well as all threaded transition fittings.

Suggest to place Valve Pressure Rating info here, followed by Unions and Flanges.

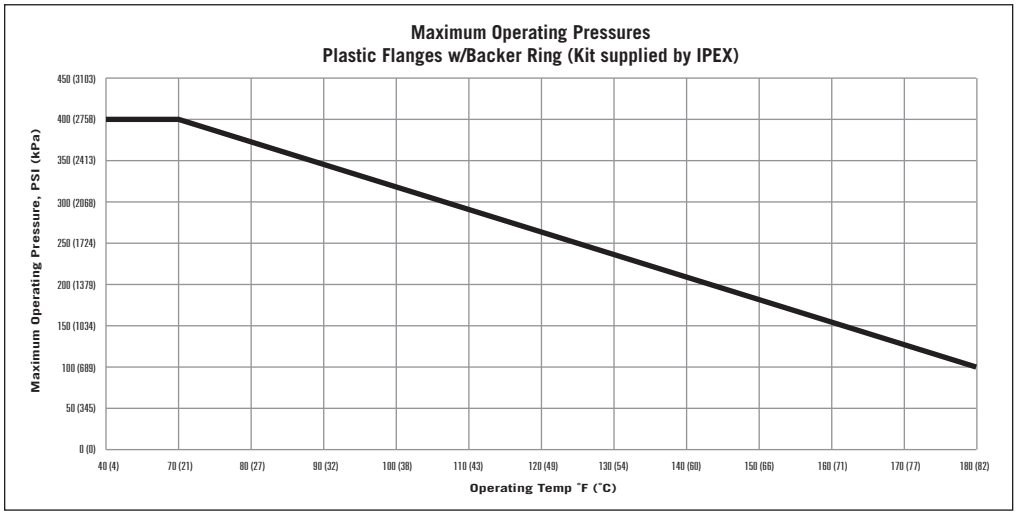
Union Fittings and Plastic Flanges without Backer Rings

Some AquaRise fittings and accessories use O-rings and gaskets as part of the product design or connection method. Such items include union fittings, flanges and valves. These items have unique pressure ratings as shown in the following charts. Care must be taken to understand pressure rating limits of these AquaRise components so as not to exceed the maximum ratings while in service.



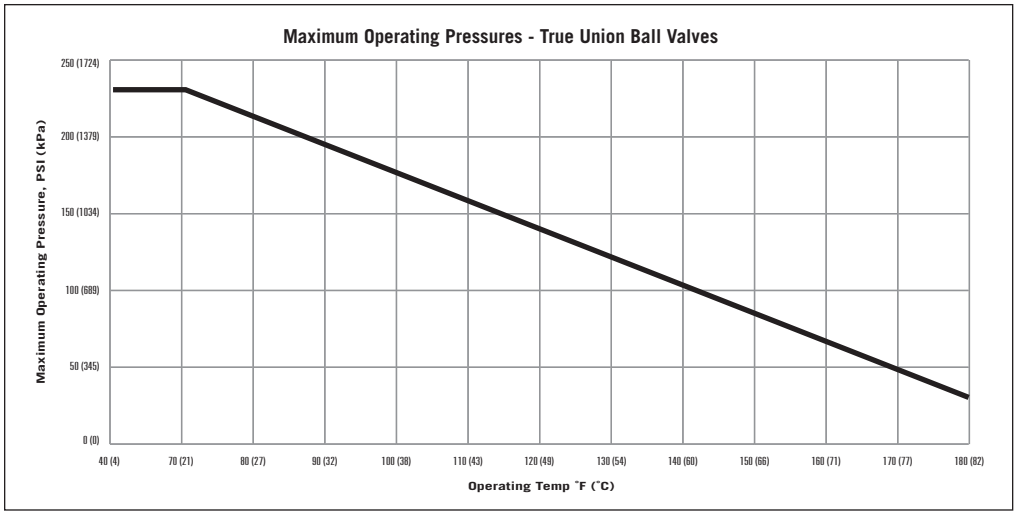
Flanges with Backer Rings (Flange Kit supplied by IPEX)

Note – more information is presented on the Flange Kit later in this Manual.)



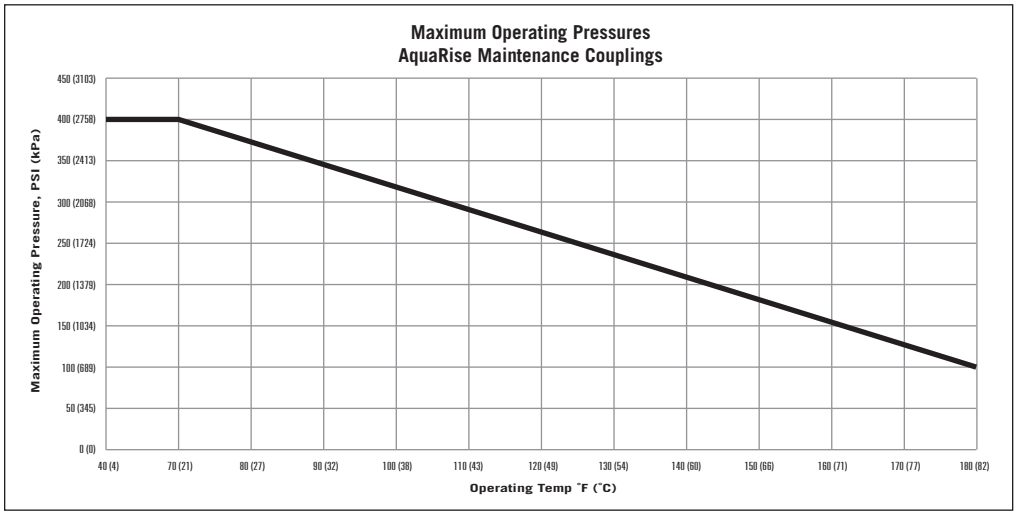
Add a pic
of flange kit

True Union Ball Valves



As requested Socket Ball Valves have been removed until future printing. Gordon to advise.

AquaRise Maintenance Couplings



HYDRAULIC DESIGN

Sizing AquaRise Pipe

Proper sizing design is necessary to create a balance between flow velocity, flow volume and pressure head losses. Due to similar inside diameter dimensions, AquaRise may use design sizes similar to copper. Depending on design velocity considerations AquaRise may even permit designers to use one nominal size smaller than copper.

Inside Diameter Comparison

Nom. Size	AquaRise	Type L Copper	PEX SDR9	CTS CPVC
1/2	0.679	0.545	0.475	0.479
3/4	0.847	0.785	0.670	0.695
1	1.061	1.025	0.861	0.903
1-1/4	1.340	1.265	1.054	1.104
1-1/2	1.526	1.505	1.245	1.310
2	1.917	1.985	1.629	1.717
2-1/2	2.231	2.465	n/a	n/a
3	2.826	2.945	n/a	n/a
4	3.633	3.905	n/a	n/a
6	5.348	5.845	n/a	n/a

AquaRise and Type L copper have similar inside diameters while PEX and CTS CPVC are noticeably smaller. AquaRise most times can be used as a direct substitute for Type L copper for new designs and system replacements while one nominal size larger of PEX or CTS CPVC may be required for equivalent flow.

It is also important to remember that the comparative flow capacities are proportional to the square of the inside diameters. For example, although 1" AquaRise has a 23% larger inside diameter than 1" PEX, this would result in a 52% larger flow area for AquaRise in that size.

Flow Capacity

The flow capacity of an AquaRise pipeline is related to its inside diameter (di), the length of pipe section (L) and the Hazen-Williams flow factor (C). Using the Hazen-Williams formula presented below, designers can calculate the friction losses, also known as Head Loss (HL) for a given pipeline and the flow rate, Q.

First, designers are reminded of the velocity and flow rate relationship for any pipeline that Velocity = Vol. Flow / Pipeline Area, or V = Q /A. Rearranging, the formula can read as, V = [(.4085) x Q] / di2

where, V = flow velocity (ft /s)

Q = volumetric flow (US gpm)

di = pipeline inside diameter (in.)

The Hazen-Williams empirical formula for calculating head loss is as follows,

$$HL = (.2083)\ (110\ /C)^{1.85} \times Q^{1.85} \times di^{(-4.87)}$$

don't understand how these formulas need to be represented

where,

HL = head loss (ft. H20 / 100 ft.)

C = Hazen-Williams flow coefficient (= 150 for AquaRise)

This formula can be simplified for use with AquaRise by substituting C =150 and by converting units for HL to read as,

$$HL = (.0984) \times Q1.85 \times di(-4.87)$$

where HL = head loss (psi /100ft.)

Design Velocity

The maximum design velocity for AquaRise systems is 8 ft/s. This limit is consistent with the recommendations of the American Society of Plumbing Engineers (ASPE) and is considered a good balance between maximizing flow capacity while minimizing frictional head losses and water hammer potential. This velocity limit also lessens concerns for erosion of any metallic system components and fixtures.

Below is a table summarizing the pipeline velocity and head loss of AquaRise pipe for all sizes and for various volumetric flow rates. The upper velocity design limit of 8 ft/s is used for all sizes.

Manual Flow Capacity

AR Manual Flow Capacity Table.xls → Hyperlink to above

LINK DOESN'T WORK

Head Loss Characteristics – Fittings and Valves

In addition to head losses that result from frictional forces in the pipe, losses also occur when water flows through valves, fittings, etc., in the system. These losses are difficult to calculate due

to the complex internal configuration of the various fittings. Generally, loss values are determined for each fitting configuration by experimental tests and are expressed in equivalent length of straight pipe. Typical equivalent length values or pressure drops for valves and fittings can be found below.

Friction Loss through Fittings (Equivilant pipe length in feet)

Size	Tee Run	Tee Branch	90° Elbow	45° Elbow
1/2	1.0	3.8	1.5	0.8
3/4	1.4	4.9	2.0	1.1
1	1.7	6.0	2.5	1.4
1-1/4	2.3	7.3	3.8	1.8
1-1/2	2.7	8.4	4.0	2.1
2	4.0	12.0	5.7	2.6
2-1/2	4.9	14.7	6.9	3.1
3	6.1	16.4	7.9	4.0
4	7.9	22.0	11.4	5.1
6	12.3	32.7	16.7	8.0

Friction Loss through Valves

Pressure drops through valves also contribute to the overall friction loss of fluid through a piping system. Flow rate coefficients (Cv) are defined as the flow rate in gallons per minute (US gpm) through an open valve resulting in a pressure drop of 1 psi. Flow rate coefficients are listed below:

Cv for AquaRise Ball Valves

Size (in)	Cv
1/2	14
3/4	27
1	54
1-1/4	77
1-1/2	123
2	238

The following formula can be used to calculate the pressure loss across a valve under a given flow rate:

$$f = sg\ (Q/Cv)2$$

Where:

f = pressure drop (friction loss) across the valve (psi)

sg = specific gravity (water = 1.0)

Q = flow through the valve (US gpm)

Cv = flow rate coefficient

Example: What is the pressure loss across a 2 (in) ball valve in an AquaRise CPVC system having a flow rate of 50 (US gpm). Calculate the answer in equivalent feet of pipe and psi.

$f = sg\ (Q/Cv)2$

Q = 50 US gpm

Cv = 238

$f = 1 \times (50/238)2 = 0.044$ psi

From the pipe flow chart: 50 US gpm through a 2" pipe generates a loss of 2.51 psi/100ft.

Therefore:

$$= \frac{0.044}{(2.51/100)} = 1.75 \text{ ft of pipe}$$

Surge Pressure Calculations

The following formulae can be used to predict the potential surge pressure in AquaRise for given flow conditions.

Tried doing this one but don't think it's correct >>>

$$a = \frac{4660}{\left[1+\frac{k\,(DR-2)}{E}\right]^{0.5}} \qquad P = \frac{(a \times DV)}{2.31g}$$

where, a = wave velocity (ft/s)

k = fluid bulk modulus (= 300,00 psi for water)

DR = pipe dimensions ratio (= 11 for AquaRise)

E = modulus of elasticity for pipe (see table on page 3)

g = acceleration due to gravity (= 32.2 ft /s^2)

P = pressure surge (psi)

DV = velocity change (ft /s)

don't understand how these formulas need to be represented.

Simplifying the equations for AquaRise with DR = 11 and k = 300,000 psi for water,

$a = 4660 / [1 + 2{,}700{,}000 / E]^{0.5}$ and $P = a\,(DV) / 74.4$

Example: A cold water flow of 35 US gpm in 2" AquaRise is suddenly stopped due to a rapid valve closure. What potential water hammer (surge pressure) could be generated?

Solution: First calculate the system velocity using velocity formula presented earlier,

$$V = (.4085)\,Q / di^2$$

$$= (.4085)\,(35) / (1.917)^2 = 3.89 \text{ ft /s}$$

Next, must determine the value of E for cold water flow. By referring to table on page 3, select the lowest temperature value (T= 73F) where E = 423,000 psi.

Now wave velocity, a, can be calculated:

$$a = 4660 / [1 + 2{,}700{,}000 / 423{,}000]^{0.5} = 1{,}715 \text{ ft /s}$$

Now calculate surge pressure,

$$P = (1714) \times (3.89) / 74.4 = \mathbf{89.7\ psi}$$

Thus, the total potential surge pressure for this pipeline would be 89.7 psi.

It is also interesting to note that a similar calculation for 2" Type L copper at 35 US gpm would yield a potential surge pressure of 185 psi due to the higher rigidity of the copper pipe.

One Ft /s Surge Pressures vs. Temperature

The following table represents the resultant surge pressure for a 1 ft /s instantaneous velocity change (i.e. start-up or shutdown) in AquaRise pipe at varying operating temperatures. The surge pressure values in this table can be multiplied by the actual system velocity to obtain potential surge pressures for that velocity. For example, if V = 3.5 ft /s, then the potential surge for that system would be the table value x 3.5.

Operating Temperature		One Ft /s Surge Pressure	
°F	°C	(psi)	(kPa)
73	23	24.1	166.2
90	32	23.6	162.7
110	43	22.8	157.2
120	49	22.3	153.8
140	60	21.4	147.5
160	71	20.5	141.3
180	82	19.8	136.5

Water Hammer Arrestors

Some code jurisdictions require water hammer arrestors for specific applications. Always verify code requirements prior to installing AquaRise. Always design AquaRise systems to prevent or accommodate for surge pressures. Never exceed maximum pressure ratings for AquaRise components.

Thrust Forces

Thrust forces can occur at any point in a piping system where the directional or cross-sectional area of the waterway changes or where additional structure loads, such as valves, are installed. These forces must be reduced by means of anchors, risers, restraining hangers, thrust blocks or encasement. The method chosen will depend on whether the system is buried or above ground. See also the section on installation of buried pipes in this manual.

The size or need for reinforcements should be based on the design engineer's evaluation of flow velocities and pressure increases due to the fluid's momentum. Note that the thrust created at unrestrained fittings can be considerable (as shown in table below) and should be addressed during installation.

Thrust at Fittings in pounds per 100 Psi of Internal Pressure

Size (in)	Blank ends and junctions	90° Bends	45° Bends
1/2	60	85	50
3/4	90	130	70
1	140	200	110
1-1/4	220	320	170
1-1/2	300	420	230
2	450	630	345
2-1/2	650	910	500
3	970	1,360	745
4	1,600	2,240	1,225
6	3,450	4,830	2,650

Note from above, not sure if we are keeping a section on Underground piping. If not, should delete last sentence in 1st paragraph.

Expansion and Contraction Design

As with all construction materials, AquaRise piping undergoes expansion and contraction when subjected to variances in temperature. The expansion coefficient for AquaRise is 3.8 x 10-5 in /in /°F which corresponds to 0.456" per 10 ft. of pipe length per 100°F temperature change.

IMPORTANT: Designers and installers must consider this physical property of AquaRise prior to installation so that anticipated expansion and contraction is accommodated.

IMPORTANT: Designers and installers must anticipate and account for the total change in temperature (ΔT) between the date of installation and the final operating temperature of the AquaRise system. As an example, installation during colder winter months at temperatures as low as 5oC (40oF) could see AquaRise systems subjected to see a ΔT as high as 77oC (140oF) if the system is designed to operate at its maximum temperature.

WARNING: Failure to properly design for and accommodate anticipated expansion and contraction due to temperature changes can lead to system failure.
Follow all IPEX recommendations for accommodating expansion and contraction. For additional information contact your IPEX representative.

Calculating Expansion and Contraction

Determine the total amount of expansion that any particular straight section of piping will undergo. To do this, the formula below should be used:

$$\Delta L = Y \times \frac{(T - F)}{10} \times \frac{L}{100}$$

Where, ΔL = change in length due to temp. variance

Y = expansion coefficient for AquaRise (.456" / 10 ft./100 °F)

T = initial system installation temperature (°F)

F = final system operating temperature (°F)

L = length of straight section (ft.)

For fast reference, a table of expansions values is presented below for various temperature changes and pipe section (run) lengths. It should be noted that these expansion length values are independent of pipe size.

AquaRise CPVC Linear Thermal Expansion (Δℓ) in inches

Temp. Change ΔT (°F)	Length of Run (feet)									
	10	20	30	40	50	60	70	80	90	100
10	0.05	0.09	0.14	0.18	0.23	0.27	0.32	0.36	0.41	0.46
20	0.09	0.18	0.27	0.36	0.46	0.55	0.64	0.73	0.82	0.91
30	0.14	0.27	0.41	0.55	0.68	0.82	0.96	1.09	1.23	1.37
40	0.18	0.36	0.55	0.73	0.91	1.09	1.28	1.46	1.64	1.82
50	0.23	0.46	0.68	0.91	1.14	1.37	1.60	1.82	2.05	2.28
60	0.27	0.55	0.82	1.09	1.37	1.64	1.92	2.19	2.46	2.74
70	0.32	0.64	0.96	1.28	1.60	1.92	2.23	2.55	2.87	3.19
80	0.36	0.73	1.09	1.46	1.82	2.19	2.55	2.92	3.28	3.65
90	0.41	0.82	1.23	1.64	2.05	2.46	2.87	3.28	3.69	4.10
100	0.46	0.91	1.37	1.82	2.28	2.74	3.19	3.65	4.10	4.56

AquaRise CPVC Linear Thermal Expansion (Δℓ) in mm

Temp. Change ΔT (°C)	Length of Run (m)									
	3	6	9	12	15	18	21	24	27	30
5	1.0	2.1	3.1	4.1	5.1	6.2	7.2	8.2	9.2	10.3
10	2.1	4.1	6.2	8.2	10.3	12.3	14.4	16.4	18.5	20.5
15	3.1	6.2	9.2	12.3	15.4	18.5	21.5	24.6	27.7	30.8
20	4.1	8.2	12.3	16.4	20.5	24.6	28.7	32.8	36.9	41.0
25	5.1	10.3	15.4	20.5	25.7	30.8	35.9	41.0	46.2	51.3
30	6.2	12.3	18.5	24.6	30.8	36.9	43.1	49.2	55.4	61.6
35	7.2	14.4	21.5	28.7	35.9	43.1	50.3	57.5	64.6	71.8
40	8.2	16.4	24.6	32.8	41.0	49.2	57.5	65.7	73.9	82.1
45	9.2	18.5	27.7	36.9	46.2	55.4	64.6	73.9	83.1	92.3
50	10.3	20.5	30.8	41.0	51.3	61.6	71.8	82.1	92.3	102.6

Accommodating Expansion and Contraction

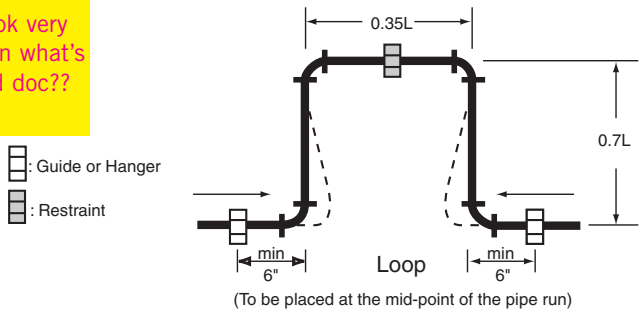
After determining the amount of expansion or contraction to be expected in the operation of the AquaRise piping system, designers and installers must choose one of two methods to accommodate the movement. These two methods are 1) designing pipeline configurations or 2) installing in-line expansion devices.

1. Pipeline Configuration

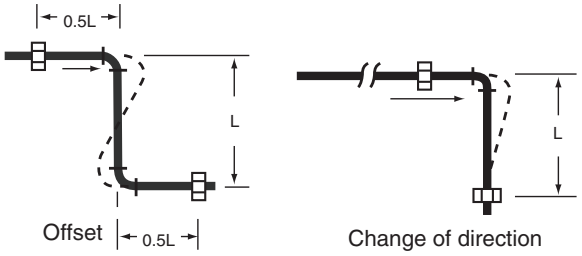
Installers may accommodate stresses and movement of AquaRise under varying temperature conditions through one of three pipeline configurations. These configurations are commonly used for all types of piping materials including metals. Specific options include expansion loops, offsets and changes in direction. Diagrams for each are shown below:

Insert existing diagram! Page 10 of existing AquaRise Manual - Randy to provide specifics

digrams look very different than what's in the Word doc??



(To be placed at the mid-point of the pipe run)



In each case, a critical variable, L, must be calculated in order to design the chosen piping configuration. To calculate L, the following formula is used:

$$L = \sqrt{(3ED(\Delta l)/S)}$$

Where, L = critical length (ft.)

E = Modulus of Elasticity for AquaRise at maximum operating temperature (psi)

D = nominal size of pipe (in.)

Δl = change in length due to expansion (ft.)

S = working stress at maximum operating temperature (psi)

To illustrate the use of this formula, the following example is presented:

Example: For a run of 90 ft. of 3" nominal size AquaRise pipe, installed at 65°F and operating at 140°F, how long should the loop legs be for an expansion joint in order to compensate for the system expansion?

Step 1: Calculate the amount of expansion to be expected.

$$\Delta l = Y \times \frac{(T - F)}{10} \times \frac{L}{100}$$

Known: L = 90 ft, T = 140°F, F = 65°F,

Y = 0.456in/10°F/100ft

(Coefficient of Thermal Expansion)

$$\Delta l = 0.456 \times \frac{(140 - 65)}{10} \times \frac{90}{100}$$

$$\Delta l = 3.08 \text{ inches}$$

Step 2: Calculate the expansion loop length

$$L = \sqrt{3ED\,(\Delta l)\,/S}$$

Known: Δl = 3.08 in., E = 323,000 psi, S = 1000 psi

(from Pg 3 – Modulus of Elasticity & Working Stress for CPVC), D = 3.5 in

(from OD, Pg 3, Dimensions & Weights)

$$L = \sqrt{\frac{3 \times 323000 \times 3.5 \times 3.08}{1000}}$$

$$L = 102.2 \text{ inches}$$

For expansion loop, 0.7L = 71.5 in. and 0.35L = 35.8 in.
For offset, 0.5L = 51.1 in.
For Change in Direction, L = 102.2 in.

Table on page 11 of existing AquaRise Manual needs to be extended to include 4" and 6" values, which I have tabulated below:

In order to assist in calculating L, a table of its values has been prepared for various run lengths and temperature changes. It should be noted that this table has been prepared assuming the maximum system temperature is 140°F.

Tabulated Values for Critical Length, L (Ft.)

	Nominal D (in)	Outside D (in)	Run Length (ft) 20	40	50	60	80	100
			L = in inches					
ΔT = 60°F	1/2	0.840	21	30	33	37	42	47
	3/4	1.050	24	33	37	41	47	53
	1	1.315	26	37	42	46	53	59
	1-1/4	1.660	30	42	47	51	59	66
	1-1/2	1.900	32	45	50	55	63	71
	2	2.375	35	50	56	61	71	79
	2-1/2	2.875	39	55	62	68	78	87
	3	3.500	43	61	68	75	86	96
	4	4.500	49	69	77	85	98	109
	6	6.625	59	84	94	103	119	133
ΔT = 80°F	1/2	0.840	24	34	39	42	49	54
	3/4	1.050	27	39	43	47	54	61
	1	1.315	30	43	48	53	61	68
	1-1/4	1.660	34	48	54	59	69	77
	1-1/2	1.900	37	52	58	63	73	82
	2	2.375	41	58	65	71	82	92
	2-1/2	2.875	45	64	71	78	90	101
	3	3.500	50	70	79	86	99	111
	4	4.500	56	80	89	98	113	126
	6	6.625	68	97	108	119	137	153
ΔT = 100°F	1/2	0.840	27	39	43	47	54	61
	3/4	1.050	30	43	48	53	61	68
	1	1.315	34	48	54	59	68	76
	1-1/4	1.660	38	54	61	66	77	86
	1-1/2	1.900	41	58	65	71	82	92
	2	2.375	46	65	72	79	92	102
	2-1/2	2.875	50	71	80	87	101	113
	3	3.500	56	79	88	96	111	124
	4	4.500	63	89	100	109	126	141
	6	6.625	76	108	121	133	153	171
ΔT = 120°F	1/2	0.840	30	42	47	52	60	67
	3/4	1.050	33	47	53	58	67	75
	1	1.315	37	53	59	65	75	83
	1-1/4	1.660	42	59	66	73	84	94
	1-1/2	1.900	45	63	71	78	90	100
	2	2.375	50	71	79	87	100	112
	2-1/2	2.875	55	78	87	96	110	123
	3	3.500	61	86	96	106	122	136
	4	4.500	69	97	109	120	138	154
	6	6.625	84	118	133	145	168	187
ΔT = 140°F	1/2	0.840						
	3/4	1.050						
	1	1.315						
	1-1/4	1.660						
	1-1/2	1.900						
	2	2.375						
	2-1/2	2.875						
	3	3.500						
	4	4.500						
	6	6.625						

140˚ was also added in the Word doc but missing info for it ??

In-line Expansion Devices

A number of in-line expansion devices are available in the marketplace. Options include piston style devices, spring style devices and rubber bellows. These devices are typically designed for metallic piping systems and require a threaded or flanged connection to AquaRise pipe.

If an in-line device is used to accommodate expansion and contraction of AquaRise pipe designers and installers must ensure the device is approved for potable water and also, that the device is flexible enough to accommodate changes in length of AquaRise.

Care must also be taken to select in-line devices that have the necessary design travel to accommodate the calculated expansion and contraction conditions for the piping situation at hand. Some devices may not be suitable for accommodating larger amounts of expansion and contraction over lengthy horizontal pipe runs.

WARNING: Follow all design and installation instructions provided by the in-line expansion device manufacturer. Follow all AquaRise installation recommendations provided by IPEX when using transition fittings to connect to an in-line expansion device.

Horizontal Pipe Runs

Horizontal installations typically provide sufficient space to incorporate one or more of the recommended pipeline configurations into the system design. However, horizontal runs can become crowded with other piping systems, electrical conduit, HVAC components, etc. Always make certain to incorporate the necessary expansion loops, offsets and changes in direction, or combinations of these piping configurations to ensure that expansion and contraction is properly addressed. For additional information and assistance contact your IPEX representative.

The use of in-line expansion devices in horizontal runs is not common as additional consideration must be given to the proper support and anchoring of the in-line device in order for it to function properly. Consult manufacturers of these in-line devices for further information.

Vertical Pipe Risers

The installation of AquaRise vertical risers presents a more challenging situation for designers and installers to accommodate for expansion and contraction as the amount of available space is greatly reduced. Regardless of these design and installation challenges, vertical installations of AquaRise pipes must include proper accommodation of expansion and contraction. Often more creative approaches must be considered.

For vertical risers the recommended solutions of properly sized expansion loops, offsets or changes in direction remain a requirement. In-line expansion compensators are also an option and may present an easier solution where space is limited.

WARNING: Industry practice has condoned the tight clamping of vertical pipes between each floor of a building in an attempt to isolate sections of vertical pipe within one or two stories of the building. This practice fails to incorporate the necessary flexible areas into the vertical piping system which are required to transfer loads created by growing and shrinking pipes. Such loads when unaccounted for can lead to pipe buckling and misalignment. Such misalignment can place excessive force on the pipe, fittings, valves, branch lines and solvent cement connections within the system.

Add a drawing of a vertical riser installation tightly clamped between floors without any expansion/contraction method and indicate that this approach is expressly prohibited for Aquarise

Randy to provide.

Add a similar drawing showing creative options to be used ... include an in line device as well as loops, offsets and changes in direction that extend into adjacent stud bays thanks to careful cutting out of a channel in the stud ... - Randy to provide details

WARNING: Failure to properly accommodate for expansion and contraction in horizontal or vertical installations in accordance with IPEX recommendations will void the AquaRise Limited Warranty.

Thermal Conductivity

AquaRise being similar to most vinyl materials possesses some excellent resistance to thermal conductivity. In particular, the rate of thermal conductivity is a very low 0.95 BTU /hr / ft2 /°F /in, also expressed as 0.137 W /m /K. These values compare very favorably to those of metal pipe being 380 times lower than carbon steel and a huge 2800 times lower than copper.

Condensation Potential

The thermal resistance of AquaRise greatly reduces the need for insulation on cold water installations and thus the potential for condensation. In general, it has been the experience of IPEX that cold water piping installed in a controlled environment is highly unlikely to generate condensation on the pipe exterior.

However, to accurately assess individual installations, IPEX has can assist designers in calculating condensation potential. To make these computations, the following parameters must be provided by the designer: pipe diameter of AquaRise, cold water temperature, indoor air temperature, design relative humidity and insulation thickness (if any). Using these input variables, both the pipe external wall temperature and the Dew Point temperature for the air conditions can be computed. Should the pipe wall temperature exceed the Dew Point Temp., condensation will not occur. IPEX can also assist in assessing other pipe materials including Types L and K copper.

Hot Water Insulation

Designers may wish to use external pipe insulation on AquaRise hot water lines for possible energy savings. This is a more of an economic analysis rather than performance assessment. Designers typically will do a cost / benefit analysis of pipe insulation versus no insulation in terms of energy consumption costs. Performance of AquaRise pipe will be unaffected with or without insulation on hot water lines.

Chemical Resistance

AquaRise is designed and suitable for use as hot or cold potable water only. As such, all pipe, fittings, valves and cements offered by IPEX for use in an AquaRise system have been tested to offer acceptable long-term performance in this potable water application.

However, the CPVC plastic used to make AquaRise pipe and fittings can be damaged by contact with chemicals found in some construction products. Care must be taken to ensure that products contacting AquaRise are chemically compatible.

It is the responsibility of designers and installers to confirm chemical compatibility with CPVC by checking with manufacturers of such common piping system components as

- fire stop materials
- thread sealants
- pipe insulation and adhesives
- heat trace cables
- wear pads or other rubber components contacting AquaRise

Additional information on CPVC chemical compatibility is provided by Lubrizol Advanced Materials, Inc., suppliers of the TempRite® CPVC used to make AquaRise pipe and fittings. Designers and installers are encouraged to visit http://www.lubrizol.com/CPVC/Resources/System-Compatible-Program.html for more information.

WARNING: Do not allow flexible electrical wire or cables to contact AquaRise CPVC pipe or fittings. Outer plastic coatings of these wiring products normally contain plasticizers that will damage CPVC plastic

Section Three: Installation

Handling and Storage

Care must be taken when handling AquaRise products to ensure that pipes, fittings, valves and accessories are not damaged prior to installation. Take the following precautions to ensure AquaRise products remain in top condition.

Failure to follow handling, storage and installation instructions will void the AquaRise Limited Warranty.

Pipe

- Keep pipe clean and covered in its original packaging
- Do not expose pipe to UV light prior to installation
- Do not drop pipe
- Do not drag pipe
- Do not store other products on top of pipe
- Always check pipe for damage before installation
- Do not install pipes that have gauges, drag marks or cracked pipe ends
- Remove and discard any damaged pieces of pipe

Fittings and Valves

- Store indoors in original packaging
- Do not expose to UV light prior to installation
- Do not drop fittings and valves
- Always check fittings and valves for damage before installation
- Do not install fittings and valves that have gauges, drag marks or cracks
- Remove and discard any damaged fittings and valves

Primers and Cements

- Always check that primer and cement has not exceeded its best before date
- Properly discard primer and cement that exceeds its best before date
- Store primer and cement with lids tightly closed
- For cold weather installation store primer and cement in a warm location above 40oF (5oC)
- For hot weather installation store primer and cement in a cool, shaded location
- Vigorously shake solvent cements before use
- Discard solvent cement that has hardened or jelled

Solvent Cementing

Delete all pics from current manual... We need all new pics done showing steps of solvent cementing ...use AquaRise pipes and fittings. Randy to provide

INSTALLATION WARNING

- Dry fit all joints prior to solvent cementing to confirm proper interference fit.
- Discard fitting joints without proper interference fit.
- Do not solvent cement joints that are too loose or too tight.
- Always use AquaRise bevelling tools to prepare pipe ends before cementing.
- Do not solvent cement joints without first bevelling pipe ends.
- Use only AquaRise primer and solvent cements in accordance with IPEX instructions
- Do not use other cements to connect AquaRise pipe, fittings and accessories.
- Follow all solvent cementing instructions provided with this product.
- Follow all AquaRise installation instructions. See www.installaquarise.com for details.

SAFETY WARNING

- IPEX fully endorses safety and protective measures recommended by government agencies when installing AquaRise CPVC pipe, other plastic pipe or metal pipe.
- Always provide proper ventilation when applying primers and cements and/or soldering materials.
- Avoid unnecessary skin or eye contact with primers and cements and/or soldering materials.
- Wash immediately if contact occurs to avoid prolonged exposure.
- Follow all manufacturer-recommended precautions when cutting or sawing pipe or when using any flame, heat or power tools.
- After hydrostatic testing, thoroughly flush the system for at least 10 minutes to remove residual trace amounts of solvent cement or flux/solder components.
- Avoid open flames or soldering around solvent cement joints.
- Never test AquaRise pipe, fittings or accessories with compressed air. Serious injury or death can occur.

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

⚠ WARNING

During the curingof the solvent cement joints, vapors may accumulate inside the pipeline, especially should one end of the line be capped. Nearby sparks from welders or torches may inadvertently ignite these vapors and create a hazardous incident. Attention should be given to removing all vapors using air-blowers or water flushing prior to capping one end of an empty pipeline.

Safe Handling of Primers and Solvent Cements

1. AquaRise primer and solvent cements for plastic pipe is made from flammable liquids and should be kept away from all sources of ignition. Good ventilation should be maintained to reduce fire hazard and to minimize the breathing of solvent vapors. Avoid contact with skin and eyes.

2. Refer to ASTM F 402, Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

3. For additional safety information consult the material safety data sheet for this product which is available from IPEX. See www.installaquarise.com for details.

Summary of Practice

⚠ CAUTION

AquaRise primers and solvent cements are formulated for use on AquaRise pipes and fittings. DO NOT USE any other primers or cements on AquaRise.

The following procedures should be clearly understood and followed:

- The joining surfaces must be softened (dissolved) and made semi-fluid.
- Sufficient solvent cement must be applied to fill the gap between pipe and fitting.
- Assembly of pipe and fitting must be made while the surfaces are still wet and fluid.
- Joint strength develops as the solvent cement dries. In the tight part of the joint, the surfaces will tend to fuse together; in the loose part, the solvent cement will bond to both surfaces.

For 1/2" to 2" diameters penetration and dissolving can be achieved by using the AquaRise One-Step solvent cement itself (see Figure 1). **Do not use a primer with One-Step solvent cement.**

For 2-1/2" to 4" diameters penetration and dissolving must be achieved by applying AquaRise primer before using the AquaRise Two-Step solvent cement. **Always use primer with Two-Step solvent cement for these diameters.**

In cold weather and hot weather more time and additional care is required. See cold and hot weather solvent cementing procedures in this guide for special instructions.

Sufficient cement must be applied to fill the gap in the loose part of the joint (see Figure 2). Besides filling the gap, adequate solvent cement layers will penetrate the surfaces and also remain wet until the joint is assembled.

If the solvent cement coatings on the pipe and fittings are wet and fluid when assembly takes place, they will tend to flow together and become one solvent cement layer. Also, if the solvent cement is wet, the surfaces beneath them will still be soft, and these dissolved surfaces in the tight part of the joint will tend to fuse together (see Figure 3).

As the solvent dissipates, the solvent cement layer and the dissolved surfaces will dry and harden with a corresponding increase in joint strength. Completed joints should not be disturbed until they have cured sufficiently to withstand handling. Joint strength develops as the solvent cement dries. For information about curing and hardening and the minimum time before the piping system can be pressure tested see Table 1. << where's Table 1?

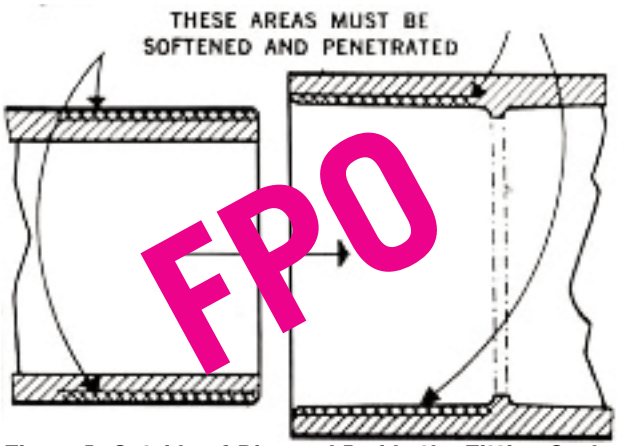


Figure 1: Outside of Pipe and Inside the Fitting Socket to be Softened and Penetrated

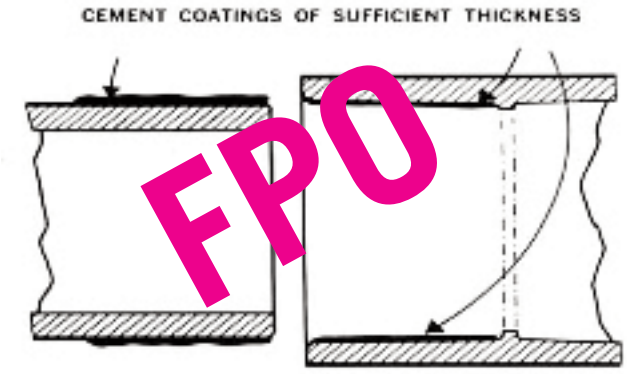


Figure 2: Solvent Cement Coatings of Sufficient Thickness Applied Uniformly around Pipe and inside Fitting Socket

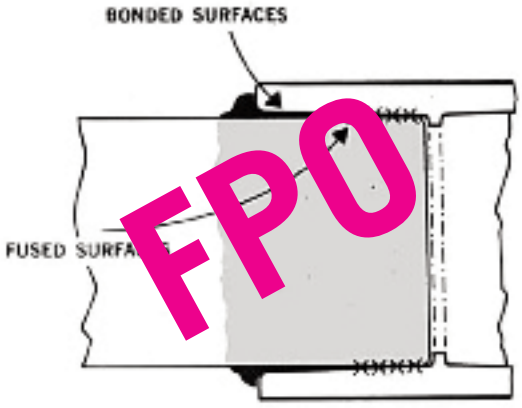


Figure 3: Fused and Bonded Surfaces of Joined Pipe and Fitting

Assume this comment > pertains to these ^ diagrams?

Use new drawings that design team has

Material Preparation

1. Cutting the Pipe. It is important to cut the pipe square. A square cut provides the surface of the pipe with the maximum bonding area. Pipe can be easily cut with a wheel-type plastic tubing cutter, power saw, chop saw, or fine toothed saw. Do not use reciprocating saws. Tools used to cut pipe must be designed for plastic piping and must be in good condition in accordance with the tool manufacturer's recommendations. If there is any indication of pipe damage or evidence of pipe end cracking, cut off at least 2 inches (50mm) beyond any visible crack. Using ratchet cutters is not recommended as they may split the pipe if not properly used and maintained.

2. Deburring and Beveling. Burrs and filings can prevent proper contact between pipe and fitting during assembly, and must be removed from the outside and the inside of the pipe prior to assembly. Use the tools provided by IPEX which have been specifically designed for this purpose.

AquaRise beveling tool 1-1/4″ to 4″ diameter

AquaRise beveling tool 1/2" to 1″ diameter

3. Cleaning. Using a clean dry rag, wipe any dirt and moisture from the fitting socket and the pipe end. Moisture will slow the cure time, and at this stage of assembly, excessive water can reduce joint strength.

4. Dry-Fit all joints to confirm Interference Fit. Before applying primer or solvent cement, test all connections (pipes, fittings and accessories) to confirm a proper interference fit exists. Dry-fit contact between properly bevelled pipe and fitting sockets is essential in making a good joint. The bevelled pipe should easily enter the fitting socket and make contact with the inner fitting socket wall before bottoming out. A proper interference fit is present when the bevelled pipe can only be inserted 1/3 to 2/3 of the way into the fitting socket.

This interference fit allows the One-Step solvent cement to effectively join the pipe and fitting.

Do not solvent cement pipe, fittings or accessories that fit loosely together or where pipe bottoms out. Proper joint strength cannot be developed.

Do not solvent cement pipe, fittings or accessories if a bevelled pipe cannot easily be inserted at least 1/3 of the way into the fitting socket. In this case the interference fit is too great and may cause excessive stresses at the connection leading to joint failure.

5. Applicator Size. Use the applicators (daubers and swabs) provided with AquaRise solvent cements and in accordance with these instructions. Proper applicator size is critical to ensuring the correct amount of AquaRise solvent cement is applied to the pipe, fittings and accessories.

One-Step Solvent Cementing Procedure for 1/2" to 2" diameters

1. Measure the fitting socket depth and mark the outside of the pipe with this dimension. This will help with application of the proper amount of solvent cement on the pipe and also helps indicate full and proper insertion of the pipe inside the fitting socket.

2. AquaRise One-Step cement comes with a small dauber inside the can. Use this small dauber for 1/2" (12mm), 3/4" (19mm) and 1" (25mm) diameter joints. A larger dauber is also provided separately inside this carton. Use the larger dauber for 1-1/4" (32mm), 1-1/2" (38mm) and 2" (50mm) diameter joints.

Do not use the larger dauber for 1/2" (12mm), 3/4" (19mm) and 1" (25mm) joints. Joint failure can occur if excessive amounts of One-Step cement are applied. Do not permit One-Step cement to pool inside of fittings or accessories.

Do not use the small dauber on 1-1/4" (32mm), 1-1/2" (38mm) and 2" (50mm) joints. Sufficient One-Step cement must be applied in a timely manner and kept wet prior to assembly of the joint.

3. Apply a medium layer of AquaRise One-Step solvent cement to the bevelled pipe end. Apply enough cement to just cover the socket insertion mark on the outside of the pipe. Be aggressive and work One-Step cement onto the pipe surface. Apply enough solvent cement to fill the gap between the pipe and fitting to soften the surfaces.

4. Apply a thin, light layer of AquaRise One-Step solvent cement to the inside of the fitting socket and work this thin layer of One-Step cement into the wall of the fitting socket. For smaller diameters it may not be necessary to re-dip the dauber. A thin layer will prevent puddling of the One-Step solvent cement inside of the pipe or fitting. Excessive solvent cement applied to the fitting socket can cause the joint to clog and the wall of the pipe or fitting to weaken due to softening by the trapped solvents.

5. Without delay, while the One-Step solvent cement is still wet, assemble the pipe and fitting, and twist 1/8 to 1/4 turn as the pipe is being inserted. Once the pipe end has reached the bottom of the fitting socket, do not turn any further; doing so could break any fusion that is starting to occur.

6. Hold the pipe and fitting together for approximately 30 seconds to avoid "push-out".

7. A bead of One-Step solvent cement must be formed around the entire socket fitting entrance. With a clean, dry cloth remove the excess solvent cement from the surface of the pipe and fitting.

Two-Step Solvent Cementing Procedure for 2-1/2" to 4" diameters

1. Measure the fitting socket depth and mark the outside of the pipe with this dimension. This will help with application of the proper amount of primer and Two-Step solvent cement on the pipe and also helps indicate full and proper insertion of the pipe inside the fitting socket.

2. Use the dauber supplied in the can of primer or use the swab provided for larger diameters. Apply AquaRise primer to the pipe end, equal to the depth of the fitting socket. Be aggressive and work the primer into the pipe.

3. Apply AquaRise primer to the inside of the fitting socket

again.

4. While the primer is still wet and the surfaces are soft, use the swab provided to apply a full, even layer of AquaRise Two-Step solvent cement to the pipe end, equal to the depth of the fitting socket. Like the primer, be aggressive. Remember to apply enough Two-Step solvent cement to fill the gap between the pipe and fitting.

5. Apply a thin layer of AquaRise Two-Step solvent cement to the inside of the fitting socket. This will prevent puddling of the solvent cement inside of the pipe or fitting. Excessive solvent cement applied to the fitting socket can cause the joint to clog and the wall of the pipe or fitting to weaken due to softening by the trapped solvents.

6. Apply a second full, even layer of AquaRise Two-Step solvent cement to the pipe end. Excessive solvent cement on the pipe outer diameter (O.D.) can be wiped away after assembly.

7. Without delay, while the solvent cement is still wet, assemble the pipe and fitting, and twist a 1/8 to 1/4 turn as the pipe is being inserted, if possible. For larger diameter joints mechanical assistance may be required to fully assemble the pipe into the fitting socket. Once the pipe end has reached the fitting socket stop, do not turn any further; doing so could break any fusion that is starting to occur.

8. Hold the pipe and fitting together for approximately 30 seconds to avoid "push-out".

9. A bead of solvent cement must be formed around the entire socket fitting entrance. With a clean, dry cloth, remove the excess solvent cement from the pipe and fitting socket entrance. This will allow the solvent to evaporate from within the joint.

INSERT CHART - Solvent Cement Cure Times

Randy to provide

Cold Weather Solvent Cementing Instructions – BELOW 50oF (10oC)

1. Prefabricate as much of the system as possible in a heated area.

2. Store AquaRise primer and solvent cement in a warm location above 40oF (5oC) when not in use and make certain cement remains fluid.

3. Take special care to remove moisture including snow and ice from the surfaces being joined including pipe ends and fitting and valve sockets.

4. Ensure that the pipe, fittings and valves are at the same temperature prior to solvent cementing.

5. Ensure the surfaces are sufficiently softened before joining. Check for proper softening of surfaces and correct amount of cement on a sample pipe. Surfaces are sufficiently softened when scraping a blade on the treated part results in the effortless removal of some of the plastic.

6. Allow a longer cure period before the system is pressure tested. A heating blanket may be used to speed up the set and cure times.

7. Read and follow all instructions carefully before installation.

Hot Weather Solvent Cementing Instructions – ABOVE 30oC (86oF)

1. Store AquaRise primer and solvent cement in a cool or shaded area prior to use.

2. If possible store pipe and fittings in a shaded area prior to solvent cementing.

3. Cool surfaces to be joined with a clean, damp rag. Be sure the surface is dry prior to solvent cementing.

4. Try solvent cementing joints in the cooler morning hours.

5. Make sure both surfaces to be joined are still wet with solvent cement when joining them together.

6. Vigorously stir or shake the AquaRise solvent cement before use.

7. System anchoring and final connections should be made during the cooler hours of the day to account for expansion and contraction.

Solvent Cementing Ball Valves

In all cases prevent solvent cement from pooling or running inside of AquaRise ball valves. Extra precaution must be taken when installing ball valves in vertical applications as solvent cement can more easily run down into the valve.

Add drawings or images reflecting the above precautions ... drawing with union end pieces cemented to pipes and then sliding the body of the valve into position for tightening of the union nuts. – Randy to order parts

True Union Ball Valves

Disassemble union nuts and solvent cement the socket end pieces of the connectors first; then slide the valve into position and tighten union nuts to complete the installation.

Show solvent cementing of fully assembled valve with handle in open position with emphasis on the handle being in the open position. Add "WARNING" and image of valve being installed with handle in the closed position advising that this must not happen otherwise the valve will be damaged and require replacement. – Randy to provide

Alternatively, if disassembly of union nuts is not an option, make certain that the valve is in the open position during solvent cementing. This will help ensure that any excess cement reaching the ball inside the valve will not dry and damage the outside sealing surface of the valve.

Socket Ball Valves

Show solvent cementing of valve with handle in open position with emphasis on the handle being in the open position. Also emphasize not using excessive amounts of cement in the valve sockets. Add "WARNING" and image of valve being installed with handle in the closed position advising that this must not happen otherwise the valve will be damaged and require replacement.
– Randy to provide.

Do not use excessive amounts of cement and do not allow cement to pool inside the valve socket.

Always install AquaRise socket ball valves with the handle in the open position. Any excess solvent cement will reach the inner bore of the valve ball and not damage the sealing surface of the ball.

Flange Connections

AquaRise flanges are available in two (2) configurations. Both flange configurations are certified to ASTM F1970 and

(….add a pic of a regular flange)
– Randy to provide.

NSF-61 for potable water. Consult the pressure rating charts in this manual to confirm the maximum allowable operating pressures for flanges.

Solid Flange

This flange is available in ½" to 6" sizes and incorporates a solvent cement socket end with a 150lb bolt pattern in accordance with ANSI/ASME standards.

Installers must source an appropriate gasket and hardware to complete the connection. Gasket materials for AquaRise solid flanges must be elastomeric, have Durometer hardness between 50-70 and must be NSF-61 listed for use with potable water. IPEX offers approved flange gaskets and hardware if the installer is unable to source these items. Contact your IPEX representative for more information.

(….add a pic of a flange kit with all components)
– Randy to provide.

Full Pressure Flange Kit

The AquaRise full pressure flange kit is available in 2-1/2", 3", 4" and 6" sizes and includes a standard solid flange, gasket, hardware (bolts, nuts, washers) and a unique split backer ring to reinforce the flange connection. The split backer ring allows for easy installation and retrofitting of existing flanges.

Flange Bolts

Pipe Size (in.)	# Of Holes	Bolt Diameter (in.)	Bolt Length (in.)
1/2	4	0.50	1.75
3/4	4	0.50	2.00
1	4	0.50	2.00
1-1/4	4	0.50	2.25
1-1/2	4	0.50	2.50
2	4	0.63	2.75
2-1/2	4	0.63	3.00
3	4	0.63	3.00
4	8	0.63	3.25
6	8	0.75	3.50

This kit was designed to increase the allowable operating pressure of the flange to equal the ratings of AquaRise pipe and regular fittings. See pressure rating charts in this manual for specific details.

Bolt patterns for all flange sizes are 150lb as per ANSI/ASME standards.

Flange Installation

Make certain to follow all instructions when connecting AquaRise flanges to accessories such as valves, pumps, metal flanges, etc.

WARNING: Make certain the solvent cement connection is allowed to adequately dry and cure before bolting the flange to the required accessory. Attaching heavy accessories to a freshly cemented AquaRise flange will create movement and stress on the flange socket that can damage the solvent cement joint. Never bolt an accessory to a fresh solvent cement flange joint that has not been allowed to properly dry and cure. Check solvent cement drying and curing tables provided in this manual.

WARNING: Always provide proper support of accessories attached to AquaRise flanges such as valves, pumps, metal flanges, etc. Improperly supported accessories can stress the flange socket connection and damage the flange as well as the solvent cement connection.

To avoid damage to the solvent cemented flange socket, installers are advised to first bolt and fully tighten the AquaRise flange to the accessory. Only after providing proper support to the accessory and ensuring the AquaRise flange is stabilized should the solvent cement connection be made between the AquaRise pipe and the flange socket. This will help ensure optimal flange performance.

Add drawing of flange already bolted to an accessory and then being solvent cemented to a pipe. State this is the preferred method to avoid disturbing the solvent cement connection. Randy to provide.

Add drawing of a flange cemented to a pipe with the statement that stresses created during connection to accessories may cause damage to the solvent cement joint. Make sure solvent cement flange joints are fully dried and cured and use caution. – Randy to provide.

Hot Water Flange Connections

For connections to metal flanges in a hot water application, IPEX recommends using the full-pressure flange kit. By assembling this flange kit to a metal flange, the flange connection will provide a full pressure rating of 100 psi at 180oF (82oC). Compare this with a regular solid flange which is rated for 38psi at 180oF (82oC).

Step 1 - Slide back up ring onto back of solid AquaRise flange

Step 2 - Position full-faced gasket between mating surfaces

Step 3 - Align bolt holes of back up ring, both flanges and gasket

Step 4 - Insert all bolts

Step 5 - Hand-tighten bolts until flange faces are in light contact

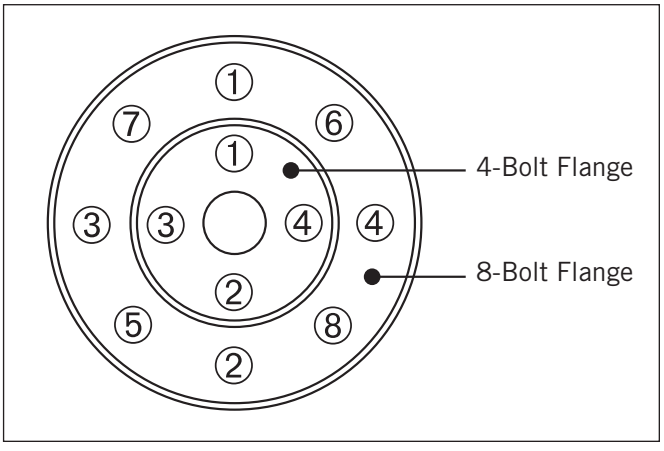
Step 6 - The bolts should be well lubricated with a lubricant fully compatible with AquaRise such as IPEX Ring-Tite pipe lubricant, and flat face washers should be used on each bolt end;

Step 7 - Bolts must be tightened with a torque wrench to the recommended torque specified in the table below. Tighten bolts using the cross star pattern shown below.

Solid Flange and Full Pressure Flange Kit Maximum Bolt Torque Values

Flange Size (in.)	Recommended Maximum Torque (Ft.lb)
1/2 to 1-1/2	15
2 to 4	30
6	50

Cross Star Bolt Tightening Pattern



CAUTION

1. Do not over-torque flange bolts
2. Use the proper bolt tightening sequence
3. Make sure the system is in proper alignment
4. Flange joints should not be used to draw piping assemblies together
5. Full face gaskets must be used
6. Flat washers must be used under every nut and bolt head

For hot water connections to wafer style butterfly valves, installers are advised to use a metal back up ring to enhance the pressure rating of the flange joint beyond 150 psi.

A. Cold Water

(i) Ensure all bolt holes of the matching flanges are aligned and full-face flange gasket is in place between mating surfaces;

(ii) Insert all bolts;

(iii) Manually or hand-tighten bolts until flange faces are in light contact;

(iv) The bolts should be well lubricated with a lubricant fully compatible with AquaRise such as IPEX Ring-Tite pipe lubricant, and flat face washers should be used on each bolt end;

(v) Bolts must be tightened with a torque wrench to the recommended torque specified below in this section; a cross star pattern should be used in determining order of bolt tightening.

C. Wafer Style Valves

(i) If on hot water, first slide back up rings onto backs of solid AquaRise flanges, for cold water, back up rings are optional;

(ii) Assemble both flanges (one after the other) to the valve before installing the valve;

(iii) Ensure valve is well supported to relieve any stress on AquaRise piping;

(iv) Solvent weld AquaRise pipe into flange sockets and allow sufficient cure time before exerting any force onto the valve assembly.

Important – it is imperative that solvent weld connection for AquaRise flanges be given sufficient time to cure so that the possible pulling and torsion forces of valve connections and operation do not disturb and thus damage the weld during curing.

Threaded Connections

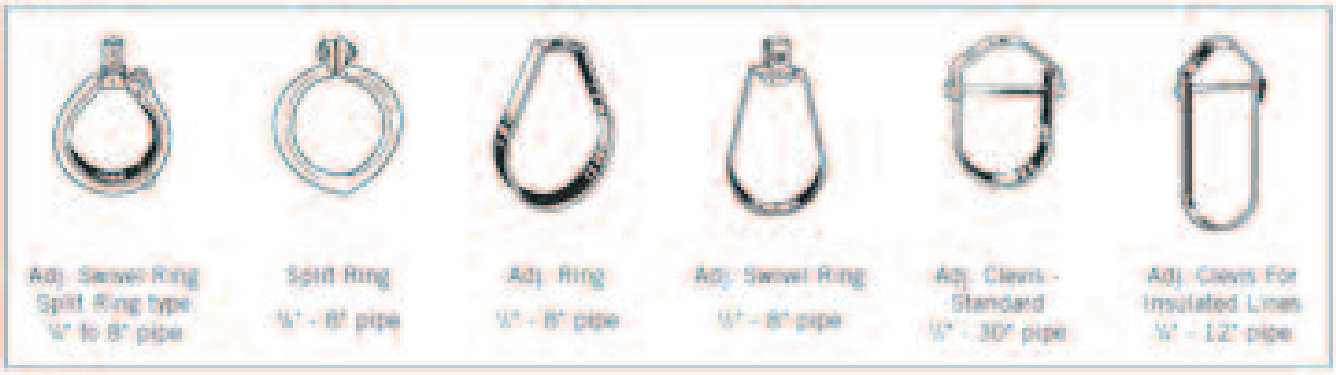
Pipe Supports

Hanger Spacing
Mid-story guides
Studs and Joists

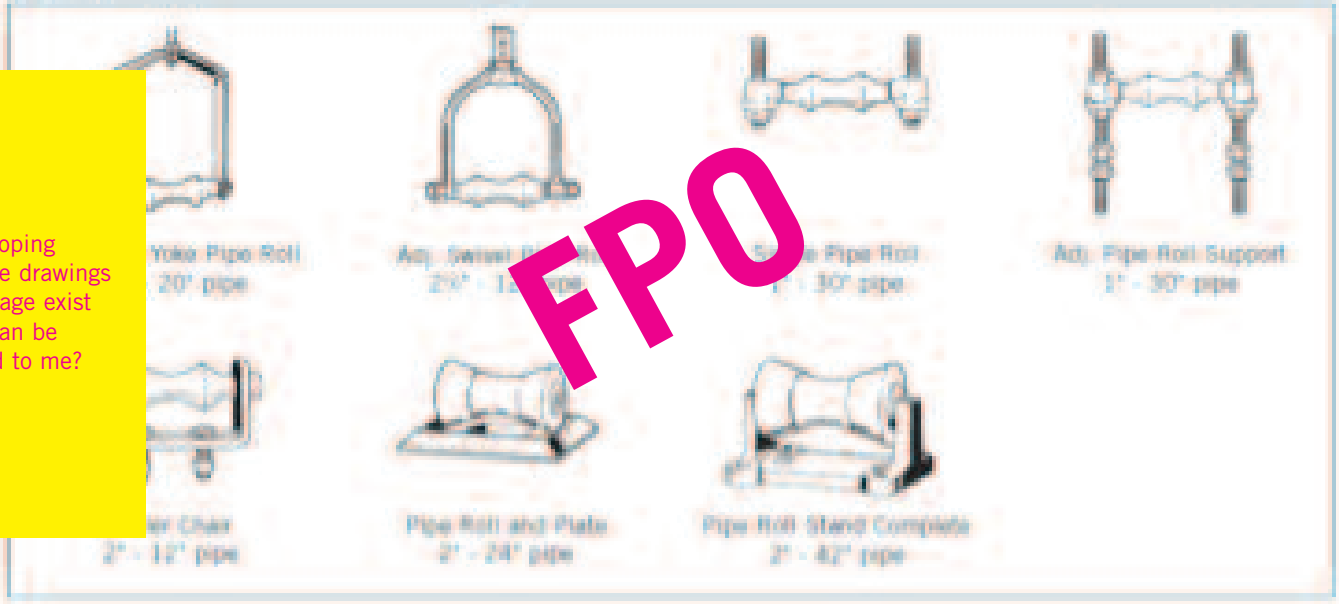
<<< Missing content for these ?

Figure 9 – Recommended Pipe Hangers for Thermoplastic Piping Systems

Pipe Rings



Pipe Rolls



I'm hoping that all the drawings on this page exist and can be supplied to me?

FPO

Pipe Straps and Hooks

Pipe Clips

All pipe clips should permit free axial pipe movement at all temperatures and should provide adequate bearing support to the pipe. Metal clips and supports should be free of sharp edges to prevent damaging the pipe.

Pipe Clamps

Pipe Clamp Medium
½" - 24" pipe

Double Bolt Pipe Clamp
¾" - 36" pipe

I'm hoping that all the drawings on this page exist and can be supplied to me?

Pipe Covering

Insulation Protection Shield
½" - 24" pipe

FPO

Bolt

*Also available plastic coated.

U Bolt*
Standard: ½" - 30" pipe
Light Weight: ½" - 10" pipe

Note: Clamps used as anchors (such as U-bolts, etc.), if over-tightened, can produce a point-of-load stress on the pipe. This can result in cracking or premature burst failure. If U-bolts must be used, then a metal shield should be placed between the U-bolt and pipe surface. When anchoring plastic pipe, it is always desirable to spread the load over a wide area of contact.

Riser Clamps

Missing content?

System Acceptance (Hydrostatic Pressure) Test

DANGER: Pressure testing with compressed air is dangerous and can result in injury or death. Do not use air to test AquaRise pipe, fittings and accessories.

Hydrostatic Test Procedure

1) Fully inspect the installed piping for evidence of mechanical abuse and/or dry suspect joints.
2) Split the system into convenient test sections not exceeding 1,000 ft.
3) Slowly fill the pipe section with water, preferably at a velocity of 1.0 fps or less. Any entrapped air should be evacuated by venting from the high points. Do not pressurize at this stage.
4) Leave the section for at least 1 hour to allow equilibrium temperature to be achieved.
5) Check the system for leaks. If clear, check for and remove any remaining air and increase pressure up to 50 psi. Do not pressurize further at this stage.
6) Leave the section pressurized for 10 minutes. If the pressure decays, inspect for leaks. If the pressure remains constant, slowly increase the hydrostatic pressure to 1.5 times the nominal working pressure.
7) Leave the section pressurized for a period not exceeding 1 hour. During this time, the pressure should not change if the test is successful.

If there is a significant drop in static pressure or extended times are required to achieve pressure, either joint leakage has occurred or air remains in the line. Inspect for leakage and if none is apparent, reduce the pressure and check for trapped air. This must be removed before further testing.

Any joint leaks should be repaired and allowed to cure fully before re-pressurizing. For more detail, refer to the joint cure schedules on pg 19.

WARNING

- **NEVER** use compressed air or gas in AquaRise pipe and fittings.
- **NEVER** test AquaRise pipe and fittings with compressed air or gas, or air-over-water boosters.
- **ONLY** use AquaRise pipe for water and approved chemicals.

Use of compressed air or gas in AquaRise pipe and fittings can result in explosive failures and cause severe injury or death.

Safety

Extensive studies of CPVC piping demonstrate that no significant health risks are associated with installing CPVC pipe, and that risk levels are well below accepted standards, especially when new, Low VOC cement is used.

IPEX fully endorses safety and protective measures recommended by government agencies when installing AquaRise CPVC pipe, other plastic pipe or metal pipe.

Whenever possible, ensure proper ventilation when applying primers and cements and/or soldering materials.

Avoid unnecessary skin or eye contact with primers and cements and/or soldering materials.

Wash immedietly if contact occurs to avoid prolonged exposure.

Follow all manufacturer-recommended precautions when cutting or sawing pipe or when using any flame, heat or power tools.

After testing, thoroughly flush the system for at lease 10 minutes to remove residual trace amounts of solvent cement or flux/solder components.

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

Section 4 – System Maintenance and Repairs

General Maintenance

Building maintenance staff or Plumbing/HVAC maintenance staff should perform routine inspection of piping systems within the building. For AquaRise, ensure that system operating conditions do not exceed the maximum allowable temperature and pressure ratings for the AquaRise system. Make system adjustments as needed and contact your IPEX representative if operating conditions exceed AquaRise limitations.

Ensure that no materials or chemicals that may be incompatible with AquaRise have come into contact with the AquaRise system. For additional information contact your IPEX representative.

Ensure that no other piping systems, accessories or elements of the building are hung from AquaRise pipes. All other systems, accessories and building materials must be p[properly anchored and supported in accordance with Plumbing and Building Codes.

Ensure that no electrical wires are wrapped around AquaRise or contact AquaRise. The plasticizers contained in the plastic jackets of these wires may not be compatible with AquaRise CPVC. Remove any wires that are in contact with AquaRise and contact your IPEX representative for further assistance.

Ensure that AquaRise pipes maintain straight alignment and do not bend or snake after the piping system is commissioned. This movement after installation signifies that expansion and contraction forces may not be properly accounted for in the piping system. This movement can cause excessive stresses on solvent cement joints, flange connections, on pipes, fittings and lateral branch lines. Contact your IPEX representative for recommendations and assistance if this misalignment is observed.

System Repair

When repairs are necessary be sure to carefully inspect and remove all damaged portions of the AquaRise system. Inspect pipes for any damage such as cracking and be sure to remove all damage. Locate the end of any pipe cracks and be sure to cut at least 2" beyond the crack line to ensure it is removed. Carefully inspect any fitting for damage and remove and replace them accordingly.

In most cases repairs can be made by solvent cementing new sections of pipe and fittings. Cold water lines can often be returned to service in a matter of a few hours. However, certain situations may require an extended period of time for the solvent cement joint to properly dry and cure before the system can be returned to operation. Hot water lines present a more demanding challenging for solvent cement repairs. Depending on the pipe diameter, ambient room conditions (humidity and temperature) and depending on the system operating pressure and operating temperature, solvent cement joints may need to dry and cure for extended periods of time before returning to full operating conditions.

Insert chart from IPS – Randy to provide.

Along with its solvent cement partners, IPEX has undertaken extensive testing in order to provide installers with more accurate information on back to service times for solvent cement joints. The following chart provides additional guidance on the time required for solvent cement joints to develop sufficient strength to return to service in hot water applications.

WARNING: The values provided in these charts are for guidance only and do not necessarily reflect the actual return to service time required for every situation. Installers should err on the side of caution when returning AquaRise systems to hot water service.

When required drying and curing times make it difficult to affect a repair or make modifications to an existing AquaRise piping system, installers may choose to employ the AquaRise maintenance coupler to aid in quicker return to service times.

Maintenance Couplers

When AquaRise systems need to be modified or when a repair is required due to inadvertent damage, the AquaRise maintenance coupler provides a quick and reliable option to solvent cementing.

This mechanical coupler is designed specifically for AquaRise pipes. It is NSF-61 listed for potable water and offers full pressure ratings of 400psi at 73oF (2,758kPa at 23oC) and 100psi at 180oF (690kPa at 82oC).

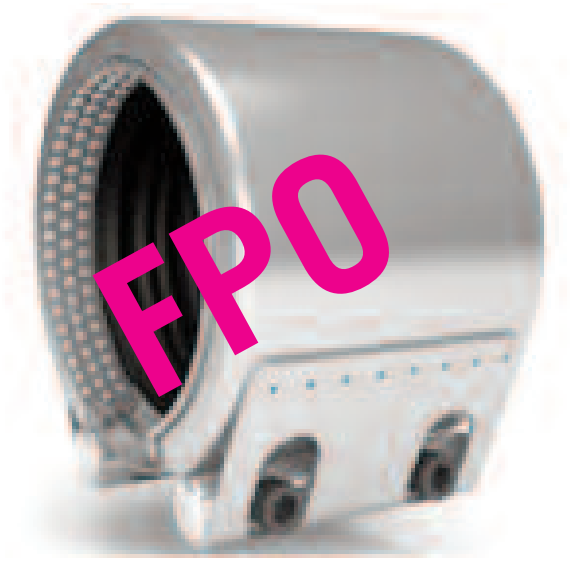
The coupler's metallic components are made with 304 stainless steel. Its steel gripping ring is specially designed to provide pull-out resistance for AquaRise pipes by providing a low profile, extra wide gripping surface with three rows of gripping teeth. The EPDM sealing gasket is PTFE coated for resistance to aggressive water and potable water treatment chemicals.

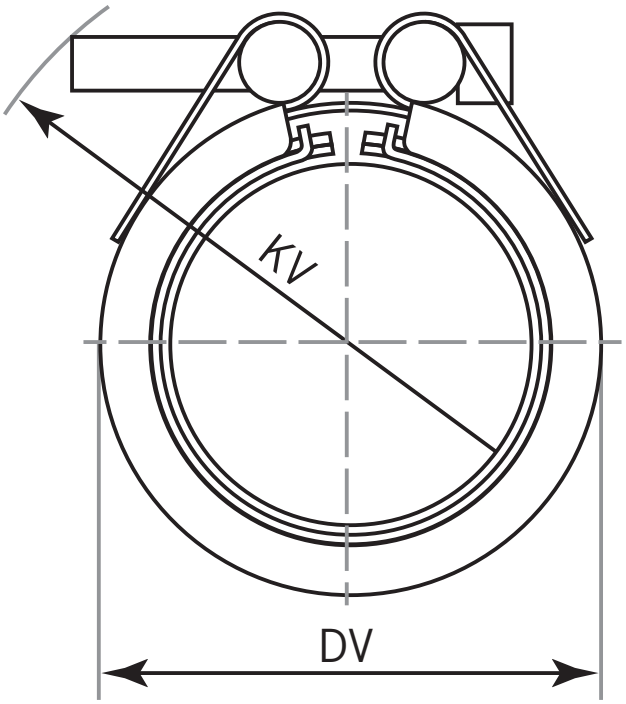
System changes can be planned in advance with pre-assembly of solvent cement sections done off-sight. These new sections can then be quickly and simply connected to the existing AquaRise piping system using AquaRise maintenance couplers.

Repairs to damaged AquaRise pipes can be made quickly by shutting down the damaged portion of the piping system, removing damaged pipe and installing a new section or pipe using two AquaRise maintenance couplers.

Add group shot of all couplers –

– Randy to provide.





Nominal Diameter in (mm)	Length, L in (mm)	Body Width, W in (mm)	Maximum Overall Width including Bolt, Wb in (mm)
1 (25)	3.35 (85.1)	1.55 (30.4)	2.88 (73.2)
1-1/4 (32)	3.83 (97.3)	1.85 (47.0)	3.50 (88.9)
1-1/2 (38)	4.32 (109.7)	2.19 (55.6)	4.14 (105.2)
2 (50)	5.24 (133.1)	3.17 (80.5)	5.24 (133.1)
2-1/2 (63)	5.51 (140.0)	3.17 (80.5)	5.24 (133.1)
3 (75)	6.32 (160.5)	3.95 (100.3)	6.14 (156.0)
4 (100)			

<<Appear to be missing some figures?>>

Installation Instructions

Taken from installation sheet…

From Paul

Section 5 – Specifications

Intro section here….

Gordon to advise.

Product Standards

Pipe, Fittings and Valves

AquaRise pipes and fittings are designed to comply with Iron Pipe Size Outside Diameters (IPS O.D.) with SDR11 wall thickness.

AquaRise products are clearly marked with third party certification logos and applicable product standards.

AquaRise products are third party certified to the following product standards:

- CSA B137.6
- ASTM F442
- ASTM F43
- ASTM F439
- ASTM F1970
- NSF-61

Primers and Solvent Cements

The use of AquaRise brand primers and solvent cements is mandatory when installing AquaRise CPVC systems. Do not substitute other primers or solvent cements as this will void the AquaRise Limited Warranty.

AquaRise primers and solvent cements are certified to the following standards:

- CSA B137.6
- ASTM F493
- NSF-61

Flame and Smoke Standards

AquaRise products are third party certified and listed to CAN/ULC S102.2 for Flame Spread of 25 or less and Smoke Developed of 50 or less. In Canada this allows AquaRise to be installed in noncombustible construction, high-rise buildings and air plenums subject to applicable Building Code and Plumbing Code requirements. AquaRise may not be installed in vertical shafts.

There are no spacing restrictions between pipes or fittings and no usage restrictions for AquaRise flame spread and smoke developed listings. Designers and installers may install AquaRise pipes, fittings and valves as required, subject to all applicable Building Code and Plumbing Code requirements.

For jurisdictions outside of Canada, consult with the applicable regulatory agency and contact IPEX for more information.

Fire Stopping Devices

Listed fire stop systems are required whenever AquaRise penetrates a fire-rated vertical or horizontal separation. Fire stop products shall be third party listed to CAN/ULC S115 taking into consideration regional requirements for testing such as the 50 Pa pressure differential as required by some provinces in Canada.

Fire stop devices shall be specifically approved for use on AquaRise pipe or on IPS O.D. SDR11 CPVC pipe.

Various fire stop manufactures provided devices listed for use with AquaRise. For more information on available devices contact your IPEX representative.

Building Code and Plumbing Code Compliance

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Gordon to advise.

Section 6 - AquaRise Limited Warrany and Limitation of Liabilty

This limited warranty covers all AquaRise products sold by AquaRise Inc. or AquaRise USA LLC (the "Vendor")

The Vendor warrants that its AquaRise products comply with the CSA, ASTM, CAN/ULC and NSF standards applicable at the time of their sale by Vendor and that they are free from defects resulting from Vendor's faulty manufacturing.

The Vendor will replace, free of charge, including shipping charges at the original point of delivery, any Product which is found to breach this limited warranty. Any such defective Product will be replaced with a Product of the same type, size, and quality as the defective Product.

ANY LIABILITY IN RESPECT TO THE PRODUCTS IS STRICTLY LIMITED TO THEIR REPLACEMENT AS HEREINBEFORE SPECIFIED AND THERE SHALL NOT, IN ANY EVENT, BE ANY LIABILITY FOR ANY LABOUR CHARGES OR OTHER DAMAGES OR FOR ANY OTHER CLAIM FOR INCIDENTAL, CONSEQUENTIAL, SPECIAL OR PUNITIVE DAMAGES. THERE IS NO WARRANTY, CONDITION OR REPRESENTATION OF ANY NATURE WHATSOEVER, EXPRESSED OR IMPLIED, BY STATUTE OR OTHERWISE, EXCEPT AS HEREIN CONTAINED. ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS OF ITS PRODUCTS FOR A SPECIAL PURPOSE OR OTHER WARRANTY OF QUALITY IS EXPRESSLY DISCLAIMED.

THIS LIMITED WARRANTY WILL ONLY APPLY IF ALL OF THE FOLLOWING CONDITIONS ARE MET:

The Product must have been used only in applications and under conditions (handling, installation, testing, use, etc.) that are strictly in compliance with the AquaRise Technical Manual and the AquaRise Installation Guide currently available from the Vendor at the time of installation. The AquaRise system has specifically designed pipe, fittings, valves and sealants and is only designed for operation using genuine AquaRise products.

The defect must not be due to faulty installation, misalignment of Products, vibration, ordinary wear and tear, corrosion, erosion, U.V. degradation, incompatible lubricants, pastes and thread sealants, unusual pressure surges or pulsation, water hammer, temperature shocking, or fouling.

The Product must have been installed in good and workmanlike manner consistent with the Vendor's latest published instructions and with the state of the art industry standards and plumbing practices, and in conformance with all applicable laws and regulations.

The Product must have not been altered or modified after leaving the Vendor's premises, and must have been used in no more than one installation, show no evidence of disassembly or tampering, and have not been subjected to abnormal operating conditions, accident, abuse, misuse, unauthorized alteration, or repair.

The Product must not have been subject to acts of nature such as earthquakes, fire, flood, or lightning, or any other event of force majeure.

The Product must not have been subject to water freezing inside the pipes.

If the Product is perishable, the Product must have been used prior to the expiration date as outlined in the installation instructions provided with the Product.

The Claimant must notify the Vendor in writing within ten (10) days of when the defect was discovered, or should have been discovered in the exercise of ordinary care, and the defective Product must be promptly returned to the Vendor. Notice of a defective Product under this limited warranty should be mailed to: AquaRise Limited Warranty Claims... [AquaRise address]. Claimant must provide documentary evidence of failure, as well as the failed components themselves or representative samples of Product that is alleged to have failed, and must agree to allow a meaningful and reasonable opportunity for Vendor to inspect the system in which the alleged defective Product was installed.

The Vendor disclaims any liability or responsibility:

for labor, materials, and/or other expenses required to replace a defective Product

for any damage to a person or property caused by a defective Product,

for expenses to repair any damage resulting from the use of a defective Product;

for calculations, product drawings, or engineering design specifications;

regarding the accuracy of any plans, drawings, or specifications furnished to the purchaser as part of the sale of any of its products;

for loss or damage resulting from failure to abide by manufacturer's warnings, safety instructions, or other precautionary guidelines.

ANY CLAIM, WHETHER IN CONTRACT OR IN TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, WITH RESPECT TO OR ARISING OUT OF THE SALE, DELIVERY, INSTALLATION, REPAIR OR USE OF ANY PRODUCTS SOLD TO BUYER SHALL NOT IN ANY EVENT EXCEED THE PURCHASE PRICE OF THE PRODUCTS FOUND TO BE DEFECTIVE. It is the responsibility of the owner to obtain and pay for emergency repairs;

No statement, conduct, or description by the Vendor, its representative, its distributor or its agent, in addition to or beyond this Limited Warranty, shall constitute a warranty. This limited warranty may only be modified in a writing signed by an officer of the Vendor.

ANY DISPUTE, CLAIM, OR CONTROVERSY ARISING OUT OF OR RELATING TO THE TERMS OR EFFECT OF THIS LIMITED WARRANTY SHALL BE RESOLVED BY BINDING ARBITRATION IN ACCORDANCE WITH THE COMMERCIAL ARBITRATION RULES OF THE AMERICAN ARBITRATION ASSOCIATION (THE "AAA"). THIS ARBITRATION SHALL BE HELD IN DALLAS, TEXAS. The obligation to arbitrate shall extend to any affiliate, subsidiary, officer, employee, shareholder, principal, agent, trustee in bankruptcy, or guarantor of a party making or defending any claim hereunder.

CAUTION: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters.

SALES AND CUSTOMER SERVICE

Vancouver
Tel (604) 534-8631
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Tel (403) 236-8333
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Edmonton
Tel (780) 415-5300
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Saskatoon
Tel (306) 933-4664
Fax (306) 934-2020

Winnipeg
Tel (204) 633-3111
Fax (204) 633-3075

Toronto
Tel (905) 670-7676
Fax (905) 670-5295

Montreal
Tel (514) 337-2624
Fax (514) 337-7886

Saint John
Tel (506) 633-7473 (PIPE)
Fax (506) 633-8720

St. John's
Tel (709) 747-7473 (PIPE)
Fax (709) 368-9111

Cdn. Toll Free 1-866-473-9462 (IPEXINC)

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About IPEX

IPEX is a leading supplier of thermoplastic piping systems. We provide our customers with one of the largest and most comprehensive product lines. All IPEX products are backed by over 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers, the IPEX name is synonymous with quality and performance.

Our products and systems have been designed for a broad range of customers and markets. Contact us for information on:

- Plumbing and mechanical pipe systems
- PVC, CPVC, PEX, PP, FR-PVDF, ABS, PEX and PE pipe and fittings (¼" to 48")
- Industrial process piping systems
- Electrical systems
- Municipal pressure and gravity piping systems
- PE Electrofusion systems for gas and water
- Telecommunications and utility piping systems
- Irrigation systems
- Industrial, plumbing and electrical cements

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