Engineering Specification

Job Name _____ Contractor Signature _____

Orion Representative _____ Approval Date _____

Quantity Required _____ Contractor's P.O. No. _____

Whiteline™ PVDF Piping Systems

Socket Fusion PVDF Sch 80

Specification

Orion Whiteline PVDF High Purity piping systems will be manufactured from Kynar® brand of Polyvinylidene Fluoride (PVDF). Pipe, fittings and valves will be manufactured to Schedule 80 wall thickness from virgin, unpigmented PVDF resin meeting ASTM D3222. Pipe will meet all dimensional tolerances of ASTM D2447. Fittings are to be joined using the socket fusion method, conforming to ASTM 2657. All Valves test to 150 psi @ 73°F (23°C).

Call customer service if you need assistance with technical details.

NSF B 181.3

UPC® Full Listing

Pipe & Fitting Availability

Pipe & Fittings	Sizes
Pipe	1/2" - 2"
Couplings	1/2" - 2"
45° Elbows - 45E 1/8 Bend	1/2" - 2"
90° Elbows - 90E - 1/4 Bend	1/2" - 2"
Tee - 90T	1/2" - 2"
Reducing Sanitary Tee - R90T	3/4" x 1/2" - 2" x 1 1/2"
Male Adapter	1/2" - 2"
Female Adapter	1/2" - 2"
Reducing Female Adapter	1/2" x 1/4" - 1/2" x 3/8"
CAP	1/2" - 2"
Reducing Bushing	3/4" x 1/2" - 2" x 1 1/2"
Reducing Coupling	3/4" x 1/2" - 2" x 1 1/2"
150# ANSI Flange	1/2" - 2"
Flange Backing Ring	1/2" - 2"
Diaphragm Valve - 150 PSI Max. Pressure	1/2" - 2"
True Union Ball Valve - 150 PSI Max. Pressure	1/2" - 2"
Double Union Spring Check Valve - 150 PSI Max. Pressure	

Note: All dimensions are +/- 0.25". All weights are approximate.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.ye

ORION® A WATTS Brand

High Purity Piping - Physical Properties

Non-Flame Retardant PP

Property	Unit	Value	Test Method
Nominal Melt Flow (at 230° C / 2.16 kg)	g/10 Min.	0.75	ASTM D1238
Density (at 73°F (23°C))	g/cm^3	0.901	ASTM D792
Tensile Strength at Yield	psi	3,400	ASTM D638
Elongation at Yield	%	15	ASTM D638
Modulus of Elasticity	psi	150,000	ASTM D790A
Izod Impact, notched at 73°F (23°C)- 1/8" bar	Ft-Lb/In	13	ASTM D256
Rockwell Hardness	R scale	77	ASTM D785
Melting Point	°F	324	Aristech
	°C	162	Aristech
Specific Gravity		.905	ASTM D792
Water Absorption 24 hrs @ 73°F (23°C))	%	.02	ASTM D570
Polypropylene Material	Cell Class	PP 0348	ASTM D4101

PVDF (740)

Property	Unit	Value	Test Method
Specific Gravity		1.76	ASTM D-792
Water Absorption 24 Hrs.@ 73°F (23°C)	%	.03	ASTM D-570
Tensile Strength psi @ 73°F (23°C)	psi	6,000	ASTM D-638
Modulus of Elasticity @ 73°F (23°C)	psi	210,000	ASTM D-638
Flexural Modulus psi	psi	9,700	ASTM D-790
Izod Impact Strength @ 73°F (23°C) (Notched)	Ft-Lb/In	3.8	ASTM D-256
Hardness	Shore D	78	ASTM D-2240
Melting Point	°F	330	ASTM D-3418
Coefficient of Thermal Expansion	In/In°F x 10^{-5}	7.4	ASTM D-696
Thermal Conductivity	BTU-In/HR/Sq.Ft/°F	1.18	ASTM D-433
Heat Distortion Temp. @ 66psi	psi	251	ASTM D-648
Heat Distortion Temp. @ 264 psi	psi	221	ASTM D-648
Limiting Oxygen Index (%)	%	44	ASTM D-2836
Underwriter's Lab Rating (sub. 94)		V-0	UL. 94
PVDF Material	Class	Type I, Grade II	ASTM D3222
Corrosive Drainage Waste System		Complies	ASTM F1673

High Purity Piping - Physical Properties

PVDF (1000 HD)

Property	Unit	Value	Test Method
Specific Gravity		1.76	ASTM D-792
Water Absorption 24 Hrs.@ 73°F (23°C)	%	.03	ASTM D-570
Tensile Strength psi @ 73°F (23°C)	psi	6,000	ASTM D-638
Modulus of Elasticity @ 73°F (23°C)	psi	210,000	ASTM D-638
Flexural Modulus psi	psi	9,700	ASTM D-790
Izod Impact Strength @ 73°F (23° (Notched)	Ft-Lb/In	3.8	ASTM D-256
Hardness	Shore D	78	ASTM D-2240
Melting Point	°F	330	ASTM D-3418
Coefficient of Thermal Expansion	In/In°F x 10^{-5}	7.4	ASTM D-696
Thermal Conductivity	BTU-In/HR/Sq.Ft/°F	1.18	ASTM D-433
Heat Distortion Temp. @ 66psi	psi	251	ASTM D-648
Heat Distortion Temp. @ 264 psi	psi	221	ASTM D-648
Limiting Oxygen Index (%)	%	44	ASTM D-2836
Underwriter's Lab Rating (sub. 94)		V-0	UL. 94
PVDF Material	Class	Type I, Grade II	ASTM D3222
Corrosive Drainage Waste System		Complies	ASTM F1673
Flame Spread		0-5	ASTM E-84
Smoke Developed		35	ASTM E-84

Recommended Pipe Support Schedule for Above Ground Installations

- Data based on Orion pipe supported on uniform centers; carrying liquids having specific gravities up to 1.30 without major load concentration
- Recommendations are for uninsulated lines. If pipe is insulated, spans should be reduced by 35% to accommodate weight of insulation.
- Never support pipe in tight clamps; lines must be free to move axially.
- Do not use compressed air or other compressed gases for testing of or use in any Orion system. Do not use compressed air or other compressed gases for testing of or use in any Orion system.

⚠ WARNING

Please read carefully before proceeding with installation. Your failure to follow any attached instructions or operating parameters may lead to the product's failure.
Keep this Manual for future reference.

Polypropylene* High Purity Pipe (Maximum Span, Feet)

Schedule 40 -Temperature, °F (°C)

Pipe Size	70 (21)	120 (49)	150 (65)
1/2"	4	3	continuous
3/4"	4	3	continuous
1"	4.5	3	continuous
1 1/2"	5	3.5	continuous
2"	5	3.5	2
3"	6	3.5	2.5
4"	6	4.5	3

Schedule 80 -Temperature, °F (°C)

Pipe Size	70 (21)	120 (49)	150 (65)
1/2"	5	3.5	continuous
3/4"	5	3.5	continuous
1"	5.5	4	continuous
1 1/2"	5.5	4	2.5
2"	6	4.5	2.5
3"	7	5	3
4"	7.5	5	3.5

*Whiteline or Standardline

PVDF High Purity Pipe (Maximum Span, Feet)

Schedule 40 -Temperature, °F (°C)

Pipe Size	70 (21)	120 (49)	150 (65)
1/2"	4	3	continuous
3/4"	4.5	3	continuous
1"	4.5	3.5	continuous
1 1/2"	5.5	4	continuous
2"	5.75	4	2
3"	6.5	4.5	2.5
4"	7.5	5	3

Schedule 80 - Temperature, °F (°C)

Pipe Size	70 (21)	120 (49)	150 (65)
1/2"	5	3.5	continuous
3/4"	5.5	3.5	continuous
1"	5.5	4	continuous
1 1/2"	6	4	2.5
2"	6.5	4.5	2.5
3"	7	5	3
4"	8	5	3.5

High Purity Piping - Physical Properties

Fittings Specifications

Socket Fusion - Polypropylene fittings are manufactured to schedule 80 wall thickness from virgin unpigmented Type I homopolymer polypropylene meeting ASTM D4101 using no antioxidants or pigments. All socket fusion fittings meet or exceed ASTM D2657 standards. All Type I homopolymer (Whiteline) fittings are bagged. All Type II copolymer (Standardline) fittings are packaged.

PVDF fittings are manufactured from virgin unpigmented PVDF resin meeting ASTM D3222. The fittings meet or exceed ASTM D2657 standards. Each fitting is bagged.

Valves - All Orion valves are manufactured from virgin unpigmented polypropylene or PDVF to be fully compatible with the Orion system. All valves test at 150 psi at 73°F (23°C). Each valve is bagged.

Pressure ratings are based on water service at 73°F (23°C) with fused joints. Threaded connections are not recommended for pressure systems. Depending on actual service conditions, derating factors may apply. See Table.

Polypropylene High Purity systems contain no ultraviolet inhibitor and must be protected from direct sunlight or ultraviolet rays.

PP Pressure Rating Correction Chart

Temperature °F (°C)	Correction Factor
73 (23)	1.00
80 (27)	.93
90 (32)	.83
100 (38)	.74
110 (43)	.66
120 (49)	.58
130 (54)	.51
140 (60)	.40
150 (66)	.38
160 (71)	.35
180 (82)	.23
200 (93)	.14
210 (99)	.10

PVDF Pressure Rating Correction Chart

Temperature °F (°C)	Correction Factor
73 (23)	1.00
80 (27)	.93
90 (32)	.83
100 (38)	.74
110 (43)	.66
120 (49)	.58
130 (54)	.51
140 (60)	.40
150 (66)	.38
160 (71)	.35
180 (82)	.23
200 (93)	.14
210 (99)	.10

High Purity Piping - Whiteline Testing Procedures

Testing Procedures for Orion Socket Fusion / Whiteline

Hydrostatic testing of Orion's Socket Fusion pressure systems can be performed one hour after the final joint has been completed. The testing procedure detailed below should be strictly adhered to.

1. Fully inspect the installed piping for evidence of mechanical abuse and suspect joints.
2. Split the system into convenient test sections, not exceeding 1000 ft. The piping should be capped off at the end of the pipe section to be tested.
3. Slowly fill the pipe section with water, taking care to remove all trapped air in the piping. Use air release valves in any high spots in the system. Do not pressurize at this stage. Do not air test, test hydrostatically only.
4. Leave the pipe for at least on hour, to allow an equilibrium temperature to be achieved.
5. Visually check the system for leaks. If clear, check for an remove any remaining air from the system.
6. Pressurize the system to 1-1/2 times the working pressure - not to exceed a maximum of 150 psi by means of a low pressure hand pump.
7. Leave the line at test pressure for a period of up to 1 hour, during which time the pressure gauge reading should not change.
8. If there is a significant drop in pressure, or extended times are required to achieve the desired pressure, either joint leakage has occurred or air is still trapped in the line. In this event, inspect for joint leaks. If none are found, check for trapped air - this must be removed prior to continuing the test.
9. If joints are found to be leaking, the system must be fully drained and the joints repaired or replaced. To repair a Socket Fusion joint, either backwelding can be performed (see our published backwelding procedures) or the joint can be cut out and a new one installed in accordance with our published installation instructions.
10. Once joints are repaired or replaced, repeat the pressure test following the procedure described above.

⚠ WARNING

Under no circumstances should plastic piping be tested with air or any type of compressed gases. This type of test method could result in system damage and personal injury.

Plastic piping should be hydrostatically tested ONLY.

High Purity Piping - Design Data

Typical plastic pipe standards state that the pressure rating of piping is based on it's hydrostatic design stress and the following formula:

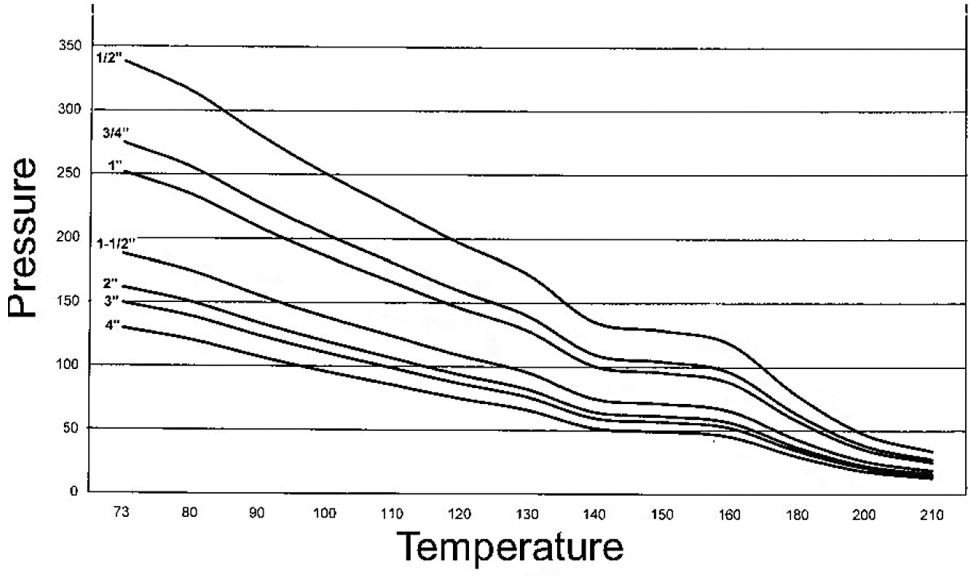
$$SDR = \frac{\text{Pipe O.D.}}{\text{Min. Wall Thickness}} \qquad P = \frac{2 \times S}{SDR-1}$$

P = Internal Pipe Pressure Rating
S = Hydrostatic Design Stress
S = 800 psi for PP
S-2300 psi for PVDF
SDR = Standard Dimension Ration of Pipe

The charts below have been developed based on the above formula. It should be noted that these charts indicate the maximum non-shock pressure ratings and do not take joining methods or poor installation practices into account. Joint strength is limited by flanges, valves, joining techniques, stress and other limiting factors.

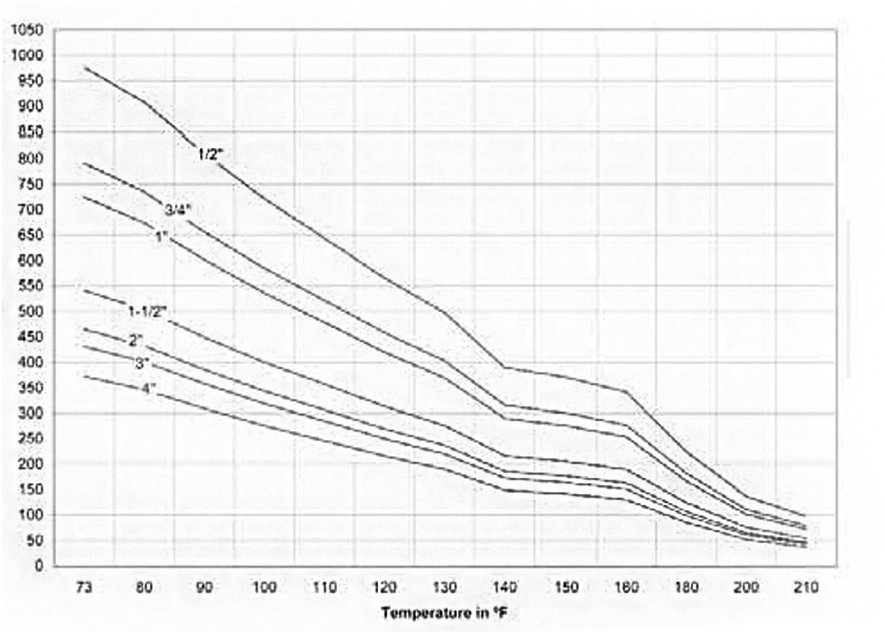
Maximum Operating Pressures (PSI) at 73°F (23°C)

Pipe Size	Polypropylene	PVDF
-	Sch 80	Sch 80
1/2"	340	975
3/4"	275	790
1"	250	725
1 1/2"	190	540
2"	165	465
3"	150	430
4"	130	370



High Purity Piping - Design Data

PVDF Pipe Pressure Tables Sch 80



Operating Temperature	PP Max. PSI	PVDF Max. PSI
73°F (23°C)	150	150
80°F (27°C)	140	145
90° (32°C)	125	130
100° (38°C)	110	120
120° (49°C)	87	105
140° (60°C)	60	87
160° (71°C)	53	74
180° (82°C)	35	63
200° (93°C)	21	54
220° (104°C)	N/A	45
240° (116°C)	N/A	38
280° (138°C)	N/A	27

High Purity Piping - Design Data

Friction Loss in Fittings

Equivalent Length of Pipe, Feet											
Size Fittings	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	8"	10"	12"
Type Fittings											
90° Standard Elbow	1.6	2.1	2.6	4.0	5.5	7.7	10.1	15.2	20.0	25.1	29.8
45° Standard Elbow	0.8	1.1	1.4	2.1	2.8	4.1	5.4	8.1	10.6	13.4	15.9
90° Long Radius Elbow	1.0	1.4	1.7	2.7	4.3	6.3	8.3	12.5	16.5	20.7	24.7
90° Street Elbow	2.6	3.4	4.4	6.7	8.6	12.8	16.8	25.3	33.3	41.8	49.7
45° Street Elbow	1.3	1.8	2.3	3.0	4.5	6.6	8.7	13.1	17.3	21.7	25.9
Square Corner Elbow	3.0	3.9	5.0	7.6	9.8	14.6	19.1	28.8	37.9	47.6	56.7
Standard with Flow thru run	1.0	1.4	1.7	2.7	4.3	6.3	8.3	12.5	16.5	20.7	24.7
Tee with flow thru Branch	4.0	5.1	6.0	8.1	12.0	16.3	22.1	32.2	39.9	50.1	59.7

Friction Loss in Fitting Valves

As an aid, liquid sizing constants Cv values are shown for valves. These values are defined as the flow rate through the valve required to produce a pressure drop of 1 psi. To determine the pressure drop for a given GPM, the following formula may be used:

$\Delta P = (G^2)\ (SG) / Cv^2$

Where:

AP = Pressure Drop

G = Flow in GPM

SG = Specific Gravity of the liquid (water = 1.0)

Cv = Flow Coefficient

Example: Find the pressure drop across a 1/2" Ball valve with a water flow rate of 10 GPM.

$\Delta P = (G^2)\ (SG)/Cv^2$ P = (10) (10) (1)/(22) (22) P = .206

Size	Cv Ball Valve (TU)	Cv Diaphragm Valve
1/2"	22	6.5
3/4"	55	9.5
1"	112	12.3
1 1/2"	285	29.2
2"	540	53.7

High Purity Piping - Design Data

Friction Loss in Fittings

Carrying Capacity & Friction Loss for Schedule 80 Thermoplastic Pipe

GPM	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Velocity Feet per Second
	1/2"			3/4"			1"			1 1/2"			2"			3"		
1	1.48	4.02	1.74	0.74	0.86	0.37												
2	2.95	8.03	3.48	1.57	1.72	0.74	0.94	0.88	0.38	0.38	0.10	0.041						
5	7.39	45.23	19.59	3.92	9.67	4.19	2.34	2.75	1.19	0.94	0.30	0.126	0.56	0.10	0.04	0.25	0.02	0.009
7	10.34	83.07	35.97	5.49	17.76	7.69	3.28	5.04	2.19	1.32	0.55	0.24	0.78	0.15	0.065	0.35	0.028	0.012
10				7.84	33.84	14.65	4.68	9.61	4.16	1.88	1.04	0.45	1.12	0.29	0.13	0.50	0.04	0.017
15	4"			11.76	71.70	31.05	7.01	20.36	8.82	2.81	2.20	0.95	1.68	0.62	0.27	0.75	0.09	0.039
20	0.57	0.04	0.017				9.35	34.68	15.02	3.75	3.75	1.62	2.23	1.06	0.46	1.00	0.15	0.065
25	0.72	0.06	0.026				11.69	52.43	22.70	4.69	5.67	2.46	2.79	1.60	0.69	1.25	0.22	0.095
30	0.86	0.08	0.035				14.03	73.48	31.82	5.63	7.95	3.44	3.35	2.25	0.97	1.49	0.31	0.13
35	1.00	0.11	0.048							6.57	10.58	4.58	3.91	2.99	1.29	1.74	0.42	0.18
40	1.15	0.14	0.061							7.50	13.55	5.87	4.47	3.83	1.66	1.99	0.54	0.23
45	1.29	0.17	0.074	6"						8.44	16.85	7.30	5.03	4.76	2.07	2.24	0.67	0.29
50	1.43	0.21	0.091	0.63	0.03	0.013				9.38	20.48	8.87	5.58	5.79	2.51	2.49	0.81	0.35
60	1.72	0.30	0.13	0.75	0.04	0.017				11.26	28.70	12.43	6.70	8.12	3.52	2.99	1.14	0.49
70	2.01	0.39	0.17	0.88	0.05	0.022							7.82	10.80	4.68	3.49	1.51	0.65
75	2.15	0.45	0.19	0.94	0.06	0.026							8.38	12.27	5.31	3.74	1.72	0.74
80	2.29	0.50	0.22	1.00	0.07	0.030	8"						8.93	13.83	5.99	3.99	1.94	0.84
90	2.58	0.63	0.27	1.13	0.08	0.035							10.05	17.20	7.45	4.48	2.41	1.04
100	2.87	0.76	0.33	1.25	0.10	0.043							11.17	20.90	9.05	4.98	2.93	1.27
125	3.59	1.16	0.50	1.57	0.16	0.068	0.90	0.045	0.019							6.23	4.43	1.92
150	4.30	1.61	0.70	1.88	0.22	0.095	1.07	0.05	0.022	10"						7.47	6.20	2.68
175	5.02	2.15	0.93	2.20	0.29	0.12	1.25	0.75	0.033							8.72	8.26	3.58
200	5.73	2.75	1.19	2.51	0.37	0.016	1.43	0.09	0.039	0.90	0.036	0.015	12"			9.97	10.57	4.58
250	7.16	4.16	1.81	3.14	0.56	0.24	1.79	0.14	0.610	1.14	0.045	0.02				12.46	16.00	6.93
300	8.60	5.83	2.52	3.76	0.78	0.34	2.14	0.20	0.087	1.36	0.07	0.03						
350	10.03	7.76	3.36	4.39	1.04	0.45	2.50	0.27	0.12	1.59	0.085	0.037	1.12	0.037	0.016			
400	11.47	9.93	4.30	5.02	1.33	0.58	2.86	0.34	0.15	1.81	0.11	0.048	1.28	0.05	0.022			
450				5.64	1.65	0.71	3.21	0.42	0.18	2.04	0.14	0.061	1.44	0.06	0.026			
500				6.27	2.00	0.87	3.57	0.51	0.22	2.27	0.17	0.074	1.60	0.07	0.030			
750				9.40	4.25	1.84	5.36	1.08	0.47	3.40	0.36	0.16	2.40	0.15	0.065			

High Purity Piping - Design Data

Friction Loss in Fittings

Carrying Capacity & Friction Loss for Schedule 80 Thermoplastic Pipe

GPM	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Friction Loss lbs per Sq. In.	Velocity Feet per Second	Friction Head Feet	Velocity Feet per Second
	1/2"			3/4"			1"			1 1/2"			2"			3"		
1000				12.54	7.23	3.13	7.14	1.84	0.80	4.54	0.61	0.26	3.20	0.26	0.11			
1250							8.93	2.78	1.20	5.67	0.92	0.40	4.01	0.40	0.17			
1500							10.71	3.89	1.68	6.80	1.29	0.56	4.81	0.55	0.24			
2000										9.07	2.19	0.95	6.41	0.94	0.41			
2500										11.34	3.33	1.44	8.01	1.42	0.62			
3000													9.61	1.99	0.86			
3500													11.21	2.65	1.15			
4000													12.82	3.41	1.48			

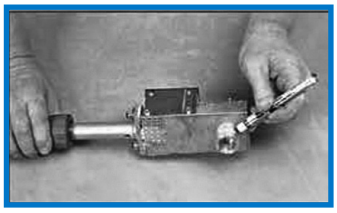
High Purity Piping - Assembly

Socket Fusion Assembly

A socket fusion tool kit, including heat tool and various sizes of heads, is available from Orion (Sold Separately).

Note:

- Make all field cuts of pipe square and true using a pipe cutter for designed plastic pipe.
- Make certain heads are installed properly on heat tool.
- Heads are marked "M" and "F", indicating male and female.
- Bevel the leading edge of each pipe section with a 1/8"45 degree chamfer. This will minimize the amount of bead on the inside of the fitting when fused.



Step 1.

Check the heads for proper temperature (482°F - 520°F or (250°C - 270°C). If necessary, adjust the thermostat dial so that the 488°F (253°C) Tempil stick burns, but the 525°F (274°C) does not. ***Note:*** **The newest Orion fusion tools may have a temperature dial in degrees celsius which has a maximum temperature of 300˚ C. If this is the case, see temperature conversion chart below.** Heat tools are factory set, however settings can vary due to factors such as weather, current variances, cord lengths, generators, etc. These variables should be checked on site. To increase tool temperature, turn dial "in" (clockwise). To decrease, turn screw "out" (counterclockwise).

Step 2.

Measure depth of fitting. Subtract 1/16".

Step 3.

Transfer measurement to pipe. Mark pipe with measurement obtained in Step 2.

Step 4.

Insert fitting on the male side of the heat tool. Then insert pipe on the female side. Do not insert past the mark on the pipe.

Step 5.

Keep pipe and fitting absolutely straight on heat tool. Use the chart below to determine how long to leave the pipe and fittings on the heater bushings. It should be noted that pipe and fittings will normally have a slight interference with the fusion tools. However, if the pipe and/or fittings do not fit tightly on the heater bushing, the heating time should be started when the components have swelled to just contact the surface of the bushing.

Step 6.

Hold joint under pressure for 15 seconds to allow surfaces to fuse. Do not stress joint until fully cooled. Clean any melted material from heater bushing using a cotton rag. Do not use abrasive materials to clean the heater bushings.

High Purity Piping - Assembly

Confirm the heater bushings are the correct temperature before fusing next joint.

The following chart shows the approximate time that the pipe and fitting should be held on the heater bushings. These times are a guideline only. It may be necessary to increase or decrease times to obtain the correct melt conditions.

Fusion Times					
Material	1/2"	3/4"	1"	1 1/2"	2"
PP	7-10 Sec.	7-10 Sec.	10-15 Sec.	10-15 Sec.	15-20 Sec.
PVDF	10-15 Sec.	13-18 Sec.	14-20 Sec.	15-20 Sec.	20-25 Sec.

°F	°C
122	50
212	100
300	150
392	200
482	250
520	270
572	300

Temperature Conversion Factors
°F = Degrees in Fahrenheit
°C = Degrees in Celsius (Centigrade)

Temperature Conversion Factors
°F = (°C x 1.8 m+ 32
°C = (°F - 32) x .555

⚠ WARNING

Do not test any Orion Piping System with compressed air or gases. Test Hydrostatically only.

High Purity Piping - Assembly

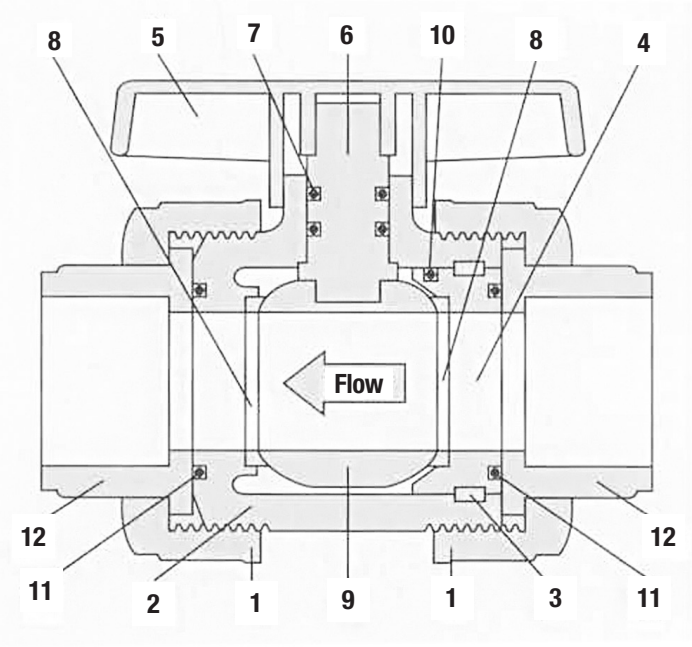
Valve Welding Instructions

Ball Valves must be dis-assembled before the welding process. Remove union nuts and socket ends from the body. Slide the union nut over the pipe and weld the socket ends to the pipe. Re-assemble the valve in line. Care must be taken so that the o-rings are properly seated when re-assembling the union nuts. This procedure will eliminate the possibility of heat from the socket fusion tool distorting the ball and seats.

⚠ WARNING

Valve must be in closed position before tightening union nuts.

1. Union Nut
2. Valve Body
3. Locking Ring
4. Carrier
5. Handle
6. Stem
7. Stem O-ring
8. Ball
10. Carrier O-ring
11. Face O-ring
12. Socket end (can be supplied as threaded)



Installation

A. Turn valve to closed position.
B. Install assembled valve body (2) in line, being careful not to dis-lodge face O-rings (11).
C. Hand tighten Union nuts (1).
D. Tighten an additional 1/2 turn maximum with wrench. **DO NOT OVER TIGHTEN**.

Disassembly

⚠ WARNING

Do not dismantle under operating pressure.

A. Loosen union nuts (1) and remove valve body (2) from line.
B. Support valve body with minimum pressure in clamp or vice. Turn handle (5) to open position.
C. Using pick or small screwdriver, extract locking strip (3) from recess. Complete removal by gripping end with pliers and pulling in a counter-clockwise motion around valve body.
D. Turn valve to closed position. Using a wooden dowel, carefully tap ball (9) in direction of locking strip until ball and carrier (4) are removed.
E. Pull handle (5) from stem (6). ***Note:*** Some models require removal of small metal screws at base of handle.
F. Remove stem by pressing into valve body

Assembly

A. Inspect body and ball for excessive wear or damage. Replace complete valve if these components are damaged.
B. Roll stem seal O-rings (7) into grooves on stem and insert in valve body.
C. Install teflon seal (8) in solid end of valve body. Bevel side of seal must be towards valve ball.
D. Install valve ball.
E. Install handle and turn ball to open position.
F. Roll carrier seal O-rings (10) in groove on carrier.
G. Install teflon seal in carrier with bevel side toward valve ball.
H. Install carrier in valve body. Install locking strip with clockwise motion until rectangular end snaps in place in valve body.
I. Install face O-rings in valve body and carrier grooves.