Installing Drainage Systems

Proper installation of Orion drainage systems is extremely important in assuring that installations perform flawlessly for years.

Supporting a Drainage System

Since Polypropylene has a higher expansion rate than that of other materials, it cannot be anchored to restrict movement from thermal expansion incurred from chemical reactions or the inadvertent dumping of hot water into the acid waste system.

Orion recommends the use of clevis or loop type pipe hangers. If split-ring or other hanger types are used the hanger should be a size larger than the pipe being supported so the polypropylene pipe is free to move. (For example, if supporting 2" pipe, use 3" hangers, or when supporting 3" pipe, use 4" hangers, etc.)

Warnings:

- The use of uni-strut type hangers or any hanger which relies on clamp tightness for support voids manufacturers warranty.
- Do not clamp a polypropylene pipe system tightly. It must be free to move.

Recommended Hanger Spacing for Orion Polypropylene Drainage Systems Schedule 40 & Schedule 80*

Pipe size, inches	Hanger Spacing, feet
1½	4
2	4
3	5
4	6
6	6
8	6
10	7
12	7

*Or per code.

Recommended Hanger Spacing for Orion PVDF Drainage Systems*

Pipe, size, inches	Hanger spacing, feet
1½	4.5
2	5
3	5.5
4	6
6	7

*Or per code.

Pipe Specifications

Polypropylene Acid Waste Pipe manufactured from resin meeting ASTM D4101. Pipe meets the dimensional tolerances of ASTM D2447. All pipe is supplied in 10' sections (20' optional). All pipe is pregrooved at the factory.

PVDF Pipe manufactured from resin meeting ASTM D3222. Pipe meets the dimensional tolerances of ASTM D2447. All pipe is supplied in 10' sections (20' optional). All pipe is pregrooved at the factory. All PVDF pipe is marked with UL 723 classified.

Fitting Specifications

No-Hub/Plain End Fittings— Orion No-Hub/Plain End fittings meet or exceed ASTM F1412. The fittings are manufactured from polyolefin material in accordance with ASTM D4101. The outer band of each No-Hub/Plain End is 300 series stainless steel, and 5/16" bolts, nuts and washers plated to meet a 100 hour salt spray test per ASTM B117.

Socket Fusion Fittings— Socket fusion systems conform to ASTM F1412. Orion socket fusion fittings meet or exceed ASTM D2657 standards. Polypropylene fittings are manufactured from polyolefin material in accordance with ASTM D4101. PVDF fittings are manufactured from Kynar® brand of PVDF resin meeting ASTM D3222.

Rionfuse Electrofusion Fittings— Orion Rionfuse fittings meet or exceed ASTM F1412. Polypropylene fittings are manufactured from polyolefin material in accordance with ASTM D4101.

The molded coil is made of heavy gauge wire. Clamps are not to be used at any time during installation.

Underground Installation of Orion Acid Waste Systems

The trench as excavated for the pipe installation must be free of loose stones, building materials or outcroppings, and must provide minimum clearance around pipe of half the pipe diameter on each side (horizontally) and one pipe diameter above and below (vertically). The trench shall be backfilled over the unexcavated base to a depth of one pipe diameter with clean backfill. The backfill material shall be free of stones and foreign matter and shall be capable of passing a No. 10 screen.

Mechanical Couplings

Part	Material	Type	Standard	Size,"	Galvanic Reaction
Outer band	Stainless steel	AISI 304-2B	ASTM A240	—	—
Bolt bar	Stainless steel	AISI 304-2B	ASTM A240	—	—
Bolt*	Carbon steel	Cadmium plated with dichromate coating	Grade 8	5/16-18x1/4	—
Nut*	Carbon steel	Cadmium plated with dichromate coating	—	5/16-18	—
Washers*	Carbon steel	Cadmium plated with dichromate coating	—	5/16	—
Welding	Stainless steel	Automatic MIG with Tri-Mix	—	—	Basically nil

Coupling body: Made from thermoplastic resin. This material has similar chemical resistant properties as the pipe and fittings manufactured by Orion. It has been selected because of its excellent ability to be used as a gasket.

		ASTM		
Density	.914	D792Tensile	2100	D1238
Low temp. brittleness	(-76(F)	D746		
Vical softness point	185(F (85(C)	D1525		
Flexural stiffness	12,700 psi	D747		
Torsional stiffness	14,900 psi	D1043		

*Bolt, nut, washer are plated to meet 100 hour salt spray test per ASTM D117.

The piping shall be installed over this material and tested in accordance with applicable plumbing codes.

After testing, initial backfilling must be carefully accomplished, still using No. 10 screen material until fill surrounds the pipe. When the selected backfill meets a depth of one diameter over the pipe, then backfilling can proceed with normal fill until complete. Fill shall be compacted using hand held compacting equipment when fill is midway up the pipe, and again when the fill is over one diameter over the pipe. Heavy-duty compacting equipment can be used after the initial backfill is completed.

Testing Procedures

Fully inspect the installed piping for evidence of mechanical abuse and suspect joints.

Split the system into convenient test sections, not exceeding 1000 ft. The piping should be capped off with an expandable plug at the end of the pipesection to be tested.

We suggest that straight lengths of pipe should be backfilled between the fittings being tested, prior to testing.

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.

Leave the pipe for at least one hour, to allow an equilibrium temperature to be achieved.

Visually check the system for leaks. If clear, check for and remove any remaining air from the system.

Pressurize the system to a suggested maximum of 10 feet head by means of a standard 10 foot standing water test using a 10-foot vertical riser, or a low pressure hand pump.

Leave the line at 10 feet of head pressure for a period of up to 8 hours, during which time the water level should not change, (standing water test) or the pressure gauge reading should not change (hand pump test).

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 air must be removed prior to continuing the test.

If joints are found to be leaking, the system must be fully drained and the joints repaired. Dry or marginal Rionfuse joints can be easily re-fused by following the procedures detailed in this catalog. Leaking joints can be backwelded if necessary. It should not be necessary to cut out joints, unless the joint has
previously been overheated, contaminated, fractured or very badly made in the first place. Where joints have to be cut out and replaced, the procedures for field cuts and joint installation detailed in this manual should be followed.

Repeat the 10 feet head test after repairing any leaking joints, following the procedure described above.

NOTE: Tanks should not be pressure tested.

Pressure:

This system was designed for acid waste of a gravity nature. Some low-pressure applications are possible, but should be checked with factory engineering department before specification or installation. Do not use compressed air or other compressed gases for testing or use.

The manufacturer DOES NOT RECOMMEND No-Hub/Plain End couplings for use in systems used for dumping hot water appliances (autoclaves, dishwashers, sterilizers, etc). For these systems, Orion socket fusion is recommended on main stacks carrying hot water and all runs within 75 feet of appliance.

Thermal Expansion Table

Polypropylene

	ΔT	ΔT	ΔT	ΔT	ΔT	ΔT	ΔT
Length	40ºF	50ºF	60ºF	70ºF	80ºF	90ºF	100ºF
20 ft	.57	.70	.85	.99	1.13	1.27	1.42
40 ft	1.13	1.42	1.67	1.98	2.27	2.55	2.83
60 ft	1.70	2.12	2.55	2.97	3.40	3.82	4.25
80 ft	2.27	2.83	3.40	3.97	4.53	5.10	5.66
100 ft	2.83	3.54	4.25	4.96	5.66	6.37	7.08

PVDF

	ΔT	ΔT	ΔT	ΔT	ΔT	ΔT	ΔT
Length	40ºF	50ºF	60ºF	70ºF	80ºF	90ºF	100ºF
20	.72	.90	1.08	1.26	1.44	1.62	1.80
40	1.44	1.80	2.16	2.52	2.88	3.24	3.60
60	2.16	2.70	3.24	3.78	4.32	4.86	5.40
80	2.88	3.60	4.32	5.04	5.76	6.48	7.20
100	3.60	4.50	5.40	6.30	7.20	8.10	9.00

To calculate thermal expansion, use the formula: $^{3}L=12eL^{3}T$

e= coefficient of thermal expansion

e = 5.9 x 10^{-5} in/in ºF (.000059") for Polypropylene
e = 7.5 x 10^{-5} in/in ºF (.000075") for PVDF

Polypropylene Example:

Highest temperature expected: 100ºF

Lowest temperature expected: 50ºF

Total variation: $^{\Delta}T$: 50ºF

Length of run: 20 ft.

Change in T: 50ºF

Change in L: .708"

Where: Change in L = change in length from thermal expansion or contraction (inches)

$^{\Delta}T$ = difference between highest and lowest temperature expected (0ºF)

e = coefficient of thermal expansion

L = length of pipe run (feet)

Example:

L = 20ft

$^{\Delta}T$ = 50(F

$^{\Delta}L$ = 12 x .000059 x 50 x 20

$^{\Delta}L$ = .708"

Pipe Dimension Data—ASTM F1412

Nom Size inches	Average O.D.	Schedule 40 wall thickness	Schedule 80 wall thickness
1½	1.900	.145	.200
2	2.375	.154	.218
3	3.500	.216	.300
4	4.500	.237	.337
6	6.625	.280	.432
8	8.625	.322	.500
10	10.750	.365	.593
12	12.750	.406	.687

All Orion Drainage Pipe Dimensions Meets ASTM F1412 Specifications

Pitch

Orion drainage systems are designed to allow for ¼" pitch per foot. Installation should be planned to allow for full usage of this pitch.

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.
- These recommendations are for uninsulated lines. If pipe is insulated the spans should be reduced by 35% to accommodate the 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. Use of compressed air or gases voids any and all warranties.Schedule 40

Polypropylene* High Purity Pipe (maximum span, feet).

Schedule 40
Temperature, ºF

Pipe Size	70	120	150
½"	4	3	continuous
¾"	4	3	continuous
1"	4.5	3	continuous
1½"	5	3.5	continuous
2"	5	3.5	2
3"	6	3.5	2.5
4"	6	4.5	3

Schedule 80
Temperature, ºF

Pipe Size	70	120	150
½"	5	3.5	continuous
¾"	5	3.5	continuous
1"	5.5	4	continuous
1½"	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, ºF

Pipe Size	70	120	150
½"	4	3	continuous
¾"	4.5	3	continuous
1"	4.5	3.5	continuous
1½"	5.5	4	continuous
2"	5.75	4	2
3"	6.5	4.5	2.5
4"	7.5	5	3

Schedule 80
Temperature, ºF

Pipe Size	70 Deg F	120	150
½"	5	3.5	continuous
¾"	5.5	3.5	continuous
1"	5.5	4	continuous
1½"	6	4	2.5
2"	6.5	4.5	2.5
3"	7	5	3
4"	8	5	3.5

Maximum Service Temperatures

As with all plastics, Polypropylene and PVDF have minimum and maximum service temperatures. Exposure to certain chemicals may effect the maximum service temperatures of plastics and therefore our chemical compatibility charts should be considered when determining the maximum working temperatures of our piping systems. The joining method will also effect the maximum temperature of any plastic piping system.

The below information can be used as a guide for determining the maximum service temperatures for polypropylene and PVDF based on water as the medium.

Polypropylene

Socket Fusion

•200ºF - *Constant or Intermittent* Flow

Rionfuse CF

•210ºF - *Constant* Flow

•210ºF - *Intermittent* Flow

PVDF

Socket Fusion/Rionfuse CF

•285ºF - *Constant or Intermittent Flow*

Soil Loading and Soil Loading Resistance Information For Schedule 40 and Schedule 80 Blueline, Blackline, and Browline PP Pipe

Nom. Size	Wc` = Load Resistance of Pipe (lb./ft.)				Height of Fill Above Pipe	Wc = Soil Loads at Various Trench Widths at Top of Pipe (lb./ft.)		
	Schedule 40 Pipe		Schedule 80 Pipe					
	E`=1000	E`=2000	E`=1000	E`=2000	(ft.)	2 ft.	3 ft.	4 ft.
1-1/2	756	1149	1343	1709	10	106	125	136
					20	138	182	212
					30	144	207	254
2	780	1284	1274	1747	10	132	156	170
					20	172	227	265
					30	180	259	317
3	1098	1846	1663	2371	10	196	231	252
					20	256	336	392
					30	266	384	469
4	1259	2241	1745	2679	10	252	297	324
					20	328	432	502
					30	342	493	603
6	1688	3168	2188	3594	10	371	437	477
					20	484	636	742
					30	503	725	888
8	2134	4081	2571	4432	10	483	569	621
					20	630	828	966
					30	656	945	1156
10	2619	5064	3095	5429	10	602	710	774
					20	785	1032	1204
					30	817	1177	1405
12	3083	5996	3616	6392	10	714	842	918
					20	931	1225	1429
					30	969	1397	1709

Note 1: Figures are calculated from minimum soil resistance values (E` = 200 psi for uncompacted sandy clay loam) and compacted soil (E` = 700 for side fill soil that is compacted to 90% or more of Proctor Density for distance of two pipe diameters on each side of the pipe). If Wc` is less than Wc at a given trench depth and width, then soil compaction will be necessary.

Note 2: These are soil loads only and do not include live loads.

$$Wc` = \frac{\Delta x(EI + 0.061\ E`r^3)80}{r^3}$$

Wc` = Load Resistance of the Pipe lb./ft.
Δx = Deflection in Inches @ 5% (.05 x ID)
E = Modulus of Elasticity = 2×10^5 psi
t = Pipe Wall Thickness, in.
r = Mean Radius of Pipe (OD - t)/2
E` = Modulus of Passive Soil Resistance, psi
H = Height of Fill Above Top of Pipe, ft.
I = Moment of Inertia $t^3/12$