LAMSON VYLON PIPE

High Density Polyethylene Pipe

HDPE

NSF PLASTICS PIPE INSTITUTE

High Density Polyethylene Pipe

PressureFlex Water HDPE PE 3408 Pipe

Our PressureFlex Water HDPE is manufactured to strict quality standards from the highest grade of polyethylene materials available. The PressureFlex Water is NSF listed and suitable for potable water applications and can be made according to the following standards: AWWA C901, AWWA C906, NSF-61. Available in 1″ to 16″ IPS sizes and 4″ to 14″ DIPS sizes.

PressureFlex HDPE PE 3408 Pipe

Our PressureFlex HDPE is manufactured to strict quality standards from the highest grade of polyethylene materials available. PressureFlex is suitable for pressure and gravity flow sewer and other non-potable applications and can be made according to the following standards: ASTM D 3035 and F714.

Lamson Vylon Pipe's PressureFlex HDPE pipe can be joined by the generic heat fusion guidelines published by the Plastics Pipe Institute (Refer to guidelines on page 4).

Handling/Shipping/Storage Guidelines

- Follow all applicable safety guidelines.
- Do not drop pipe from delivery truck into an open trench or onto uneven surfaces.
- Inspect pipe prior to installation.
- Temperature extremes have minimal affect on the strength or handling characteristics of polyethylene pipe. Polyethylene remains highly impact resistant even in sub-zero conditions.
- Avoid dragging pipe over the ground.
- Hot weather especially when coupled with direct sunlight, will raise the pipe temperature, but will not significantly affect handling or installation behavior.
- Avoid driving over the pipe.
- Carbon black is added to polyethylene to protect against UV. Unprotected plastic can become less impact resistant over time.

Typical Physical Properties

*Nominal Values

PROPERTY	TEST METHOD	ASTM SI UNITS	ENGLISH UNITS
Density (Natural)	D1505	0.944g/cc	
Density (Black)	D1505	0.955g/cc	
Flow Rate(190/21.6)	D1238	8.75 g/10 min.	
Tensile Strength @ Ultimate	D638	31.0 MPa	5000psi
Tensile Strength @ Yield	D638	22.8 MPa	3500psi
Ultimate Elongation	D638	>800%	>800%
Flexural Modulus (2% secant)	D790	827MPa	120,000psi
Environmental Stress Crack Resistance (ESCR) Condition C	D1693	>5,000 hrs.	>5,000 hrs.
Brittleness Temperature	D746	<-117 C	<-180 F
Vicat Softening Temperature	D1525	126 C	259 F
Hardness, Shore D	D2240	66	66
Thermal Expansion Coefficient	D696	1.8x10(-4) cm/cm/C	1.0x10(-4) in/in/F
HYDROSTATIC DESIGN BASIS	D2837	11.0MPa @ 23 C	1600psi @ 73.4F
CELL CLASSIFICATION	D3350	345464C**	345464B**
MATERIAL CLASSIFICATION	D1248	Type III Category 5	Grade P34 Class C or B

*Nominal values are to be used as guides only, and not as specification limit.

**Cell classification 345464C refers to black pipe only.

**Cell classification 345464B refers to all other colors.

High Density Polyethylene IPS Pipe and Pressure Ratings

Iron Pipe Size (IPS)		265 psi SDR 7		200 psi SDR 9		160 psi SDR 11		130 psi SDR 13.5		110 psi SDR 15.5		100 psi SDR 17		90 psi SDR 19		80 psi SDR 21		65 psi SDR 26		50 psi SDR 32.5	
Nom. O.D.	Act. O.D.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.
1″	1.315	0.188	0.291	0.146	0.234	0.119	0.196	0.097	0.163												
1 1/4″	1.66	0.237	0.463	0.184	0.374	0.150	0.313	0.122	0.259	0.107	0.228										
1 1/2″	1.9	0.271	0.607	0.211	0.489	0.172	0.41	0.140	0.34	0.123	0.299	0.112	0.274								
2″	2.375	0.339	0.948	0.264	0.765	0.216	0.640	0.176	0.531	0.153	0.467	0.140	0.429								
3″	3.500	0.500	2.059	0.389	1.661	0.318	1.390	0.259	1.153	0.226	1.015	0.206	0.931	0.184	0.838	0.167	0.763				
4″	4.500	0.643	3.404	0.500	2.746	0.409	2.297	0.333	1.907	0.290	1.678	0.265	1.539	0.237	1.387	0.214	1.261	0.173	1.028	0.138	0.829
5″	5.563	0.795	5.202	0.618	4.196	0.506	3.511	0.412	2.914	0.359	2.564	0.327	2.352	0.293	2.120	0.265	1.927	0.214	1.571	0.171	1.267
6″	6.625	0.946	7.378	0.736	5.951	0.602	4.980	0.491	4.133	0.427	3.636	0.390	3.336	0.349	3.007	0.315	2.733	0.255	2.228	0.204	1.797
8″	8.625	1.232	12.505	0.958	10.086	0.784	8.440	0.639	7.004	0.556	6.164	0.507	5.654	0.454	5.093	0.411	4.631	0.332	3.777	0.265	3.046
10″	10.750	1.536	19.426	1.194	15.668	0.977	13.111	0.796	10.881	0.694	9.575	0.632	8.783	0.566	7.913	0.512	7.195	0.413	5.867	0.331	4.731
12″	12.750	1.821	27.326	1.417	22.041	1.159	18.443	0.944	15.306	0.823	13.469	0.750	12.355	0.671	11.127	0.607	10.121	0.490	8.253	0.392	6.655
14″	14.000	2.000	32.947	1.556	26.575	1.273	22.237	1.037	18.455	0.903	16.239	0.824	14.896	0.737	13.419	0.667	12.203	0.538	9.951	0.431	8.024
16″	16.000	2.286	43.033	1.778	34.710	1.455	29.044	1.187	24.104	1.032	21.210	0.941	19.457	0.842	17.521	0.762	15.938	0.615	12.997	0.492	10.481

High Density Polyethylene DIPS Pipe and Pressure Ratings

Density 0.955
Corr. Factor 1.045

Ductile Iron Pipe Size (DIPS)		265 psi SDR 7		200 psi SDR 9		160 psi SDR 11		130 psi SDR 13.5		110 psi SDR 15.5		100 psi SDR 17		90 psi SDR 19		80 psi SDR 21		65 psi SDR 26		50 psi SDR 32.5	
Nom. O.D.	Act. O.D.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.	Min. Wall	Wt. Lb./Ft.
4″	4.800	0.686	3.835	0.533	3.0930	0.436	2.588	0.356	2.148	0.310	1.890	0.282	1.734	0.253	1.561	0.229	1.420	0.185	1.158	0.148	0.934
6″	6.900	0.986	7.924	0.767	6.391	0.627	5.348	0.511	4.438	0.445	3.909	0.406	3.583	0.363	3.227	0.329	2.935	0.265	2.393	0.212	1.930
8″	9.050	1.293	13.630	1.006	10.995	0.823	9.200	0.670	7.635	0.584	6.719	0.532	6.163	0.476	5.551	0.431	5.049	0.348	4.117	0.278	3.320
10″	11.100	1.586	20.510	1.233	16.540	1.009	13.840	0.822	11.490	0.716	10.107	0.653	9.272	0.584	8.350	0.529	7.595	0.427	6.193	0.342	4.994
12″	13.200	1.886	29.000	1.467	23.390	1.200	19.570	0.978	16.240	0.852	14.290	0.776	13.110	0.695	11.809	0.629	10.740	0.508	8.758	0.406	7.063
14″	15.300	2.186	38.960	1.700	31.420	1.391	26.300	1.133	21.820	0.987	19.200	0.900	17.620	0.805	15.865	0.729	14.430	0.588	11.767	0.471	9.489

*Iron Pipe Size - Pressures are based on using water at 23°C (73°F) and are determined by using standard formulas for the industry.
NOTE: Service factors should be utilized to compensate for the effect of substances other than water, and for other temperatures.

AWWA Pipe Referenced Standards

MATERIAL
Material used for the manufacturing of polyethylene pipe shall be PE 3408 High Density Polyethylene (HDPE) meeting the ASTM D 3350 cell classification 345464C

PIPE
Polyethylene pipe shall be manufactured in accordance with AWWA C901 for size 1/2″ through 3″ and in accordance with AWWA C906 for sizes 4″ through 63″

Referenced Standards

- **AWWA C901**
  Polyethylene (PE) Pressure Pipe and Tubing 1/2″ through 3″ for Water Services
- **AWWA C906**
  Polyethylene (PE) Pressure Pipe and Fittings 4″ through 63″ for Water Distribution
- **ASTM D 2683**
  Socket Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe
- **ASTM D 3261**
  Butt Fusion Polyethylene (PE) Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- **ASTM D 3350**
  Standard Specification for Polyethylene Plastic Pipe and Fittings Material
- **PPI TR-3**
  Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
- **PPI TR-4**
  Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds
- **NSF Standard #61**
  Plastic Piping Components and Related Materials

Superior Hydraulics

Lamson Vylon HDPE Pipe has superior hydraulic characteristics. In order to calculate the friction loss of water, the Hazen-Williams formula is used:

$$H = \frac{1044 \times Q^{1.85}}{C^{1.85} \times D_i^{4.865}}$$

Where

H = Friction loss in feet of water per 100 ft.
Q = Flow rate (gpm)
C = Hazen-Williams Coefficient
D_i = Inside Diameter (in.)

The Hazen-Williams coefficient for Lamson Vylon HDPE pipe is 150 and doesn't change over time. With its superior corrosion resistance it will remain smooth and not corrode or tuberculate.

Construction Advantages

The combination of butt-fused, leak free joints and flexibility allows for more construction options than is possible with rigid pipe. Lamson Vylon HDPE pipe can be bent to a radius 25 times the nominal pipe diameter. This makes Lamson Vylon HDPE pipe ideal for installation methods such as Horizontal Directional Drilling, Pipe Bursting or Sliplining.

Water Hammer Effects

Water Hammer is a sharp pressure differential caused by differences in the velocity of fluids in a pressurized system. These differences can be originated by pump and valve operations, together with other aspects. AWWA has design formulas that calculate pressure surges for different piping materials.

Pressure Surge

The formula for pressure surge is:

$$Ps = \frac{a \times \Delta V}{2.31 \times g}$$

Ps = Pressure surge (psi)
a = wave velocity (fps)
ΔV = change in water velocity (fps)
g = gravitational acceleration ($32.17^{ft}/sec^2$)

where the wave velocity is calculated by:

$$a = \frac{4660}{[1+(k(DR-2)/E)]^{1/2}}$$

k = Water Modulus (psi)
DR = Dimensional Ratio
E = Modulus of Elasticity (psi)

HDPE pipe is viscoelastic in nature, which causes it to absorb a sizable amount of energy from a pressure surge. This energy absorption enables HDPE piping systems not to be oversized, hence, yielding a cost saving.

Lamson Vylon Pipe HDPE Maximum Pull Force (MPF) lbs*

TENSILE Strength
3200 psi

Size	Nom. OD	SDR 7	SDR 9	SDR 11	SDR 13.5	SDR 15.5	SDR 17
1 1/4″	1.660	1242	1002	838	696	612	
1 1/2″	1.900	1627	1312	1098	911	802	
2″	2.375	2542	2050	1715	1424	1253	
3″	3.500	5520	4452	3726	3092	2721	2496
4″	4.500	9125	7360	6159	5111	4498	4126
5″	5.563	13945	11248	9412	7811	6873	6305
6″	6.625	19778	15952	13349	11078	9748	8942
8″	8.625	33521	27038	22625	18776	16522	15156

Lamson & Sessions recommends a load cell be used to monitor the applied force.
* MPF values are based on a temperature of 73° F and are in lbs., not psi.

Butt Fusion

The most widely used method for joining individual lengths of large diameter polyethylene pipe is by heat fusion of the pipe butt ends. This technique, which precludes the need for specially modified pipe ends or couplings, produces a permanent, economical and flow-efficient connection. Field-site butt fusions may be made readily by trained operators using specially developed butt fusion machines that secure and precisely align the pipe ends for the fusion process.

The six steps involved in making a butt fusion joint are:

1. Securely fasten the components to be joined
2. Face the pipe ends
3. Align the pipe profile
4. Melt the pipe interfaces
5. Join the two profiles together
6. Hold under pressure

Secure
Each component that is to be fused must be held in position so that it will not move unless it is moved by the clamping device.

Face
The pipe ends must be faced to establish clean, parallel mating surfaces. Most, if not all, equipment manufacturers have incorporated the rotating planer block design in their facers to accomplish this goal. Facing is continued until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. This operation provides for a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.

Butt Fusion Time Cycles

For PressureFlex PE 3408 Pipe

Pipe Inches IPS	Heat Time @ 500 Deg. F. (Seconds)	Heat Time @ 425 Deg. F. (Seconds)	Cool Time (Seconds)	Approx. Melt Bead Width (Inches)	Approx. Finished Bead Width (Inches)
1/2	9 – 12	18 – 22	80	1/16	1/16
3/4	12 – 16	24 – 26	80	1/16	1/16
1	16 – 20	27 – 32	90	1/16	1/16 – 1/8
1 1/4	20 – 24	35 – 40	90	1/16	1/16 – 1/8
2	28 – 32	52 – 57	90	1/8	1/8
3	32 – 38	59 – 66	180	1/8	1/8
4	38 – 44	68 – 75	210	3/16	3/16
6	56 – 66	80 – 90	240	3/16	3/16
8	72 – 82	105 – 130	300	3/16	1/4
10	88 – 98	140 – 165	360	3/16	5/16
12	104 – 120	175 - 220	420	3/16	5/16

Note: The information given above is an estimate and may vary depending upon prevailing weather and jobsite conditions.
Recommended interface pressure on these sizes is 75 psi.
For sizes larger than 12 inch, use visual fusion procedures. Recommended interface pressure on these sizes is 40 psi.

Butt Fusion continued

Align

The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by adjusting the clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion. The minimal distance requirement between fixed- and moveable-jaws mentioned above allows the pipe to be rounded as close as possible to the joint area. The closer to the joint area that the pipe can be clamped, the better control the operator has in properly aligning the pipe.

Melt

Heat the ends of the pipe to the pipe manufacturer's recommended temperature, interface pressure, and time duration. By doing so, the heat will penetrate into the pipe ends and a molten "bead" of material will form at the pipe ends. Heating tools which simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, they can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature measuring device should be used periodically to insure proper temperature of the heating tool. If temperature indicating crayons are used, do not use them on a surface which will come in contact with the pipe or fitting. Additionally, heating tools are usually equipped with suspension and alignment guides which center them on the pipe ends. The heater faces which come into contact with the pipe should be coated by the manufacturer to prevent molten plastic from sticking to the heater faces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions.

Join

After the pipe ends have been heated for the proper time and to the proper temperature, the heater tool is removed and the molten pipe ends are brought together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. The pipe manufacturer's instructions may specify either interface pressure or bead size of molten material as a guide for a proper joint. There are machines available for pipe sizes from 5/8-inch through 72-inch diameters that will assist the operator to apply sufficient force to obtain the proper fusion pressure. Machines for 4-inch diameter and smaller sizes are normally lever-operated. Many of these smaller machines can be fitted with torque wrenches to obtain a theoretical value which allows the operator to consistently apply the approximate force required to properly fuse a joint.

Larger machines employ hydraulics with various types of control systems such as:

1. Manual with hydraulic hand pump.
2. Semi-automatic with motorized hydraulics including pressure reducing, selector, and directional control valves.
3. Fully automatic with computer- or microprocessor-control of the heat and fusion cycles and pressures.

Hold

The molten joint must be held immobile under pressure until cooled adequately to develop strength. The designs of the machines vary from a lever-arm-assist to manual or automatic locking devices that assist the operator to accomplish this step. The proper cooling times for the joint are material-, pipe-diameter-, and wall-thickness-dependent and are established by the pipe manufacturer. Allowing proper times under pressure for cooling prior to removal from the clamps of the machine is important in achieving joint integrity.

Optional Bead Removal

In some pipe system usage, the bead from the butt fusion process may be undesirable. Inside beads may create minor flow turbulence of liquids or may become an obstacle on which solids in the fluids may become lodged. Furthermore, outside beads may be a hinderance to sliplining operations. Equipment is available to remove the bead if that is desirable.

VYLON® PIPE

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