

LAMSON PIPE COMPANY

High Density Polyethylene PE 3608 & PE 4710 Pressure Pipe

HDPE Pressure Pipe Solutions for:

*Industrial
Oil/Gas
AWWA – NSF
Geothermal*

Features:

*Superior Flow Rates
Ease of Handling
Environmentally Safe
Superior Corrosion
Resistance
Durability, Long Term
Strength and
Integrity
Flexible and
Lightweight*



HDPE Products for Your Infrastructure Needs

PressureFlex Water/Sewer, and Oil & Gas Gathering HDPE Pipe

PressureFlex Water / Sewer PE 3608 & PE 4710 HDPE 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. The PressureFlex Sewer is manufactured in either black or grey color material. PressureFlex pipe can be made according to the following standards: AWWA C901, AWWA C906, NSF-61.

PressureFlex Water / Sewer can be manufactured out of PE4710 or PE3608 resin material. Size availability in 1" to 16" IPS sizes and 4" to 14" DIPS sizes.

PressureFlex Oil & Gas Gathering PE 3608 & PE 4710 HDPE Pipe

Lamson Pipe Company PressureFlex HDPE is manufactured to strict quality standards from the highest grade of polyethylene materials available. PressureFlex is suitable for oil and gas gathering piping systems, non-potable industrial & mining, landfill, and gas distribution applications and can be made according to the following standards: ASTM D 3035, F714, D2513, and API 15LE.

PressureFlex Oil & Gas Gathering HDPE Pipe can be manufactured out of PE4710 or PE 3608 resin material. Size availability in 1" to 16" IPS sizes and 4" to 14" DIPS sizes.

PE 4710 HDPE Pipe

Ongoing research aimed at improving polyethylene pressure pipe resin materials, has resulted in materials that are today referred to PE4710. Polyethylene pressure pipes made from PE4710 resin have higher operating pressures, increased flow capacities and increased long-term performance characteristics. This is due to higher densities, better Hydrostatic Design Basis (HDB) and improved Slow Crack Growth than conventional PE3608 resins.

The major advantage of PE4710 is that because it offers higher operating pressures, it enables the use of the next higher DR (thinner wall) pipe. For example, an SDR 11 pipe made from PE3608 has an operating pressure of 160 psi. By converting to an SDR 13.5 which is manufactured from PE4710 material, the same 160 psi operating pressure is obtained. This reduces the pipe's wall thickness, it lowers the weight per foot and increases the ID of the system. As a result, the material handling cost is decreased and the system flow capacity is increased. Despite PE4710 being a more costly for resin manufacturers to produce the overall net result is a savings for the end user.

PE4710 not only offers higher operating pressures, increased flow system flow capacities and increased long-term performance characteristics, it does so while still providing the same pipe flexibility, chemical resistance and ease of installation as conventional PE3608 pipe. Additionally, joining PE4710 with leak-tight heat fusion joints provides for a ZERO allowable leakage rate. All of this combines to make PE4710 pressure pipe a superior alternative to PVC pipe and Ductile Iron Pipe piping systems.

PE 3608 - Typical Physical Properties

*Nominal Values

Property	ASTM Standard	Value
Density (Natural)	D792	0.944 g/cc
Density (Black)	D792	0.955 g/cc
High Load Melt Index	D1238	8.75 g/10 min
Tensile Strength @ Yield (2 in/min)	D638	3,500 psi
Tensile Strength @ Break (2 in/min)	D638	5,000 psi
Elongation @ Break (2 in/min)	D638	>800%
Hydrostatic Design Basis, 73.4° F (23° C)	D2837	1,600 psi
Hydrostatic Design Basis, 140° F (60° C)	D2837	800 psi
Flexural Modulus	D790	140,000 psi
Hardness (Shore D)	D2240	66
Brittleness Temperature	D746	<-150° F
ESCR Condition C (100% Igepal F50)	D1693	>5,000 hrs
Slow Crack Growth PENT at 2.4 Mpa and 80° C	D1473	150 hrs
NSF Standard 61		Approved
Cell Classification	D3350	345464C**

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

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

PE 4710 - Typical Physical Properties

*Nominal Values

Property	ASTM Standard	Value
Density (Natural)	D792	0.949 g/cm3
Density (Black)	D792	0.959 g/cm3
High Load Melt Index	D1238	8.5 g/10 min
Melt Index	D1238	0.08 g/10 min
Tensile Strength (Yield)	D638	3,600 psi
Tensile Elongation (Break)	D638	740%
Hydrostatic Design Basis, 73.4° F (23° C)	D2837	1,600 psi
Hydrostatic Design Basis, 140° F (60° C)	D2837	1,000 psi
Flexural Modulus	D790B	150,000 psi
Notched Izod Impact Strength (73° F)	D256	9.10 ft-lb/in
Brittleness Temperature	D3350	<-103° F
Slow Crack Growth PENT at 2.4 Mpa and 80° C	D1473	>24 wk
NSF Standard 61		Approved
Cell Classification	D3350	445574C**

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

** Cell classification 445574C refers to black pipe only.

Iron Pipe Size (IPS) Pipe & Pressure Ratings - PE 3608

Nom. O.D.	Actual O.D.	265 PSI		200 PSI		160 PSI		130 PSI		110 PSI		100 PSI		90 PSI		80 PSI		65 PSI		50 PSI	
		SDR 7		SDR 9		SDR 11		SDR 13.5		SDR 15.5		SDR 17		SDR 19		SDR 21		SDR 26		SDR 32.5	
		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	0.290	0.146	0.230	0.120	0.200	0.097	0.160	-	-	-	-	-	-	-	-	-	-	-	-
1 1/4"	1.660	0.237	0.450	0.184	0.370	0.151	0.310	0.123	0.250	0.107	0.224	-	-	-	-	-	-	-	-	-	-
1 1/2"	1.900	0.271	0.590	0.211	0.480	0.173	0.400	0.141	0.330	0.123	0.295	0.112	0.270	-	-	-	-	-	-	-	-
2"	2.375	0.339	0.940	0.264	0.760	0.216	0.640	0.176	0.530	0.153	0.458	0.140	0.430	0.125	0.390	0.113	0.350	-	-	-	-
3"	3.500	0.500	2.050	0.389	1.660	0.318	1.390	0.259	1.150	0.226	0.997	0.206	0.932	0.184	0.840	0.167	0.770	0.135	0.630	-	-
4"	4.500	0.643	3.390	0.500	2.740	0.409	2.290	0.333	1.900	0.290	1.645	0.265	1.514	0.237	1.390	0.214	1.260	0.173	1.030	0.138	0.830
5"	5.563	0.795	5.170	0.618	4.180	0.506	3.510	0.412	2.910	0.359	2.517	0.327	2.352	0.293	2.120	0.265	1.930	0.214	1.570	0.171	1.270
6"	6.625	0.946	7.330	0.736	5.930	0.602	4.970	0.491	4.130	0.427	3.566	0.390	3.340	0.349	3.010	0.315	2.730	0.255	2.230	0.204	1.800
8"	8.625	1.232	12.430	0.958	10.050	0.784	8.430	0.639	7.000	0.556	6.046	0.507	5.653	0.454	5.100	0.411	4.640	0.332	3.790	0.265	3.050
10"	10.750	1.536	19.320	1.194	15.610	0.977	13.090	0.796	10.870	0.694	9.405	0.632	8.878	0.566	7.920	0.512	7.210	0.413	5.870	0.331	4.750
12"	12.750	1.821	27.160	1.417	21.970	1.159	18.410	0.944	15.290	0.823	13.230	0.750	12.360	0.671	11.140	0.607	10.130	0.490	8.260	0.392	6.670
14"	14.000	1.918	31.640	1.556	26.490	1.273	22.200	1.037	18.450	-	-	0.824	14.900	-	-	0.667	12.220	0.538	9.970	0.431	8.040
16"	16.000	2.192	41.330	1.778	34.600	1.455	28.990	1.185	24.090	-	-	0.941	19.470	-	-	0.762	15.960	0.615	13.020	0.492	10.510

Ductile Iron Pipe Size (DIPS) Pipe & Pressure Ratings - PE 3608

Nom. O.D.	Actual O.D.	265 PSI		200 PSI		160 PSI		130 PSI		110 PSI		100 PSI		90 PSI		80 PSI		65 PSI		50 PSI	
		SDR 7		SDR 9		SDR 11		SDR 13.5		SDR 15.5		SDR 17		SDR 19		SDR 21		SDR 26		SDR 32.5	
		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	3.093	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	0.779	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

NOTE:

- Pressures are based on using water at 73.4°F (23°C) and determined using standard formulas for the industry.
- Service factors should be utilized to compensate for the effect of substances other than water, and for other temperatures.

Iron Pipe Size (IPS) Pipe & Pressure Ratings - PE 4710

Nom. O.D.	Actual O.D.	333 PSI		250 PSI		200 PSI		160 PSI		125 PSI		100 PSI		80 PSI		63 PSI	
		SDR 7		SDR 9		SDR 11		SDR 13.5		SDR 17		SDR 21		SDR 26		SDR 32.5	
		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	0.290	0.146	0.230	0.120	0.200	0.097	0.160	-	-	-	-	-	-	-	-
1 1/4"	1.660	0.237	0.450	0.184	0.370	0.151	0.310	0.123	0.250	-	-	-	-	-	-	-	-
1 1/2"	1.900	0.271	0.590	0.211	0.480	0.173	0.400	0.141	0.330	0.112	0.270	-	-	-	-	-	-
2"	2.375	0.339	0.940	0.264	0.760	0.216	0.640	0.176	0.530	0.140	0.430	0.113	0.350	-	-	-	-
2 1/2"	2.875	-	-	-	-	0.262	0.930	0.213	0.764	-	-	-	-	-	-	-	-
3"	3.500	0.500	2.050	0.389	1.660	0.318	1.390	0.259	1.150	0.206	0.932	0.167	0.770	0.135	0.630	-	-
4"	4.500	0.643	3.390	0.500	2.740	0.409	2.290	0.333	1.900	0.265	1.514	0.214	1.260	0.173	1.030	0.138	0.830
5"	5.563	0.795	5.170	0.618	4.180	0.506	3.510	0.412	2.910	0.327	2.352	0.265	1.930	0.214	1.570	0.171	1.270
6"	6.625	0.946	7.330	0.736	5.930	0.602	4.970	0.491	4.130	0.390	3.340	0.315	2.730	0.255	2.230	0.204	1.800
8"	8.625	1.232	12.430	0.958	10.050	0.784	8.430	0.639	7.000	0.507	5.653	0.411	4.640	0.332	3.790	0.265	3.050
10"	10.750	1.536	19.320	1.194	15.610	0.977	13.090	0.796	10.870	0.632	8.878	0.512	7.210	0.413	5.870	0.331	4.750
12"	12.750	1.821	27.160	1.417	21.970	1.159	18.410	0.944	15.290	0.750	12.360	0.607	10.130	0.490	8.260	0.392	6.670
14"	14.000	1.918	31.640	1.556	26.490	1.273	22.200	1.037	18.450	0.824	14.900	0.667	12.220	0.538	9.970	0.431	8.040
16"	16.000	2.192	41.330	1.778	34.600	1.455	28.990	1.185	24.090	0.941	19.470	0.762	15.960	0.615	13.020	0.492	10.510

Ductile Iron Pipe Size (DIPS) Pipe & Pressure Ratings - PE 4710

Nom. O.D.	Actual O.D.	333 PSI		250 PSI		200 PSI		160 PSI		125 PSI		100 PSI		80 PSI		63 PSI	
		SDR 7		SDR 9		SDR 11		SDR 13.5		SDR 17		SDR 21		SDR 26		SDR 32.5	
		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	3.093	0.436	2.588	0.356	2.148	0.282	1.734	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	0.406	3.583	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	0.532	6.163	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	0.653	9.272	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	0.779	13.110	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	0.900	17.620	0.729	14.430	0.588	11.767	0.471	9.489

NOTE:

- Pressures are based on using water at 73.4°F (23°C) and determined using standard formulas for the industry.
- 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 3608 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"
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Referenced Standards

<ul style="list-style-type: none"> • AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing 1/2" through 3" for Water Services • AWWA C906 Polyethylene (PE) Pressure Pipe 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 	<ul style="list-style-type: none"> • 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
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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:

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

- P_s = Pressure surge (psi)
- a = wave velocity (fps)
- ΔV = change in water velocity (fps)
- g = gravitational acceleration (32.17^{ft}/sec²)

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 Pipe Company 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"	5.375	13018	10500	8787	7292	6417	5886
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 Pipe Company 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.

Geothermal HDPE

Specifications and Data

SCOPE

- Meets overall design requirements for use in closed-loop ground source heat exchangers
- Pipe configured as specified in ASTM D 3035
- Standard specification for Polyethylene (PE) Plastic Pipe (DR-PR) based on controlled outside diameter or ASTM D 2447

PIPE

- Conforms to requirements of ASTM D 3035 or ASTM D 2447
- Loop pipe shall be joined at one end with a factory-installed "U"-Bend with a standard dimension ratio (SDR) of 9
- "U"-Bends will be a single piece, injection molded from PE 3608 HDPE resin with a minimum cell classification of PE345434C
- Working pressure rating of 160 psi water at 73°F for SDR 11 and

200 psi water at 73°F for SDR 9

MATERIAL

- All pipe and heat fused materials are manufactured from virgin high density polyethylene resin exceeding or meeting ASTM D 2513, Sections 4.1 & 4.2
- Hydrostatic Design Basis – 1600 psi at 73°F per ASTM D 2837 and ASTM D 3350
- Listed in PPI-TR4 as PE 3608

MARKING

- Pipe marked with identification, nominal size, trade name, material designation or cell classification, pressure rating at 73°F, ASTM standard, date of manufacture
- Coiled loop pipe shall also have sequential footage marking at two-foot intervals

INSTALLATION

- Installation & backfill shall

comply with IGSHA guidelines, local, state & federal regulations

- When performing heat fusion, IGSHA's recommended fusion procedures or fusion tool manufacturer's joining procedure for PE 3608 should be utilized

TESTING

- DO NOT TEST WITH AIR OR GAS
- The loop assembly shall be hydrostatically tested with water at a pressure not greater than 150% of the pipe pressure rating

GEOTHERMAL PIPE

- Available in coils 3/4"-4"
- Straight lengths (available up to 16 inch) using PE 3608 resin
- For commercial, institutional, residential or industrial applications

GEOTHERMAL LOOPS

- Custom designed to your job requirements

- Coils are configured with a parallel supply and return pipe heat fused to a patent pending "U"-Bend to make a leak tight joint utilizing PE 3608 resin
- 3/4", 1", & 1-1/4" SDR 11 rated @ 160 psi
- 3/4", 1", & 1-1/4" SDR 9 rated @ 200 psi
- Outside width of "U"-Bend less than 2.50" for 3/4", 3.00" for 1", 3.50" for 1-1/4"

FEATURES AND BENEFITS OF LAMSON VYLON PIPE GEOTHERMAL PRODUCTS

- Fusionable
- Flexible
- Abrasion resistant
- Footage markers on loop piping
- Permanent indent printing
- Made from PE 3608 high density polyethylene resin
- Resistant to most chemical compounds and aggressive soils

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

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	30.930	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.

Density 0.955
Corr. Factor 1.045

Geothermal HDPE

Geothermal Pipe Loops Coiled with "U"-Bend* Attached

Pipe Size	SDR 11 O.D.	Min. Wall	Approx Wt./100 ft	Coil Length (Feet)	Coil Dimensions (Inches)		
					I.D.	O.D.	Width
3/4"	1.050	0.095	12 lbs.	310	30.8	44.0	6.00
				410	32.0	44.0	7.50
				510	30.0	48.5	6.00
1"	1.315	0.120	19 lbs.	310	30.0	44.0	8.00
				410	30.0	48.0	9.25
				510	30.0	48.5	9.50
				610	30.0	48.5	11.00
1 1/4"	1.660	0.151	31 lbs.	710	48.0	76.0	9.00
				810	48.0	71.0	12.00

Made to Order Lengths
SDR 9 Available
**"U"-Bend Rated at SDR 9
*Patent Pending



Pipe Loop Assembly



"U"-Bend

Head Loss per 100 ft of SDR 11 PE Pipe

GPM	3/4 Inch	1 Inch	1-1/4 Inch	1-1/2 Inch	2 Inch
1	0.23	0.08	0.02	0.01	
2	0.83	0.27	0.09	0.04	0.01
3	1.76	0.58	0.18	0.09	0.03
4	2.99	0.99	0.31	0.16	0.05
5	4.52	1.49	0.47	0.24	0.08
6	6.34	2.09	0.66	0.34	0.11
7	8.44	2.78	0.88	0.45	0.15
8	10.80	3.56	1.12	0.58	0.19
9	13.44	4.43	1.39	0.72	0.24
10	16.33	5.39	1.70	0.87	0.29
11	19.48	6.43	2.02	1.04	0.35
12	22.89	7.55	2.38	1.23	0.41
13	26.55	8.76	2.76	1.42	0.48
14	30.45	10.05	3.16	1.63	0.55
15	34.60	11.42	3.59	1.85	0.62
20		19.45	6.12	3.16	1.06
25		29.40	9.25	4.77	1.61
30		41.22	12.97	6.69	2.25
40			22.10	11.40	3.84
50			33.40	17.23	5.81
75				36.51	12.31
100					20.96

*U.S. gallons per minute

"Head loss based on Hazen-Williams Formula, C=150 for water"

ASTM D3035 nominal outside diameter and average wall thickness

Technical Information

Property	ASTM Test Method	Typical Values	
		English Units	SI Units
Density (Natural)	D 4883	—	0.944 g/cc
Density (Black)		—	0.955 g/cc
Melt Index ¹	D 1238	—	12.5 g/10 min
Tensile Strength			
@ Yield (2 in/min)	D 638	3300 psi	22.8 MPa
@ Break (2 in/min)	D 638	4500 psi	31.0 MPa
Elongation			
@ Break (2 in/min)	D 638	>800%	>800%
Flexural Modulus ²	D 790	120,000 psi	827 MPa
Notched Izod Impact Strength	D 256	6 ft-lbf/in	0.32 kJ/m
Hardness (Shore D)	D 2240	68	68
Vicat Softening Point	D 1525	259° F	126° C
Brittleness Temperature	D 746	<-180° F	<-118° C
Hydrostatic Design Basis			
@ 23° C	D 2837	1600 psi	11.0 MPa
@ 60° C	D 2837	800 psi	5.5 MPa
Minimum Required Strength	ISO 9080	—	8.0 MPa
Environmental Stress			
Crack Resistance ³	D 1693	>2000 hrs	>2000 hrs
Environmental Stress			
Crack Resistance ⁴	D 1693	>5000 hrs	>5000 hrs
Pipe Ring ESCR ⁵	F 1248	>5000 hrs	>5000 hrs
Notch Tensile (PENT)	F 1473	>100 hrs	>100 hrs
Carbon Black Concentration	D 1603	2.3%	2.3%
Cell Classification	D 3350	345464C	345464C

¹ 190° C/21600 g ² 2% Secant-Method 1 ³ Condition B, 10% ⁴ Condition C ⁵ Two inch, SDR 19

Butt Fusion

Butt Fusion joining process is an approved method of joining HDPE when joint fused appropriately. The following guidelines are provided in appendix A to provide a properly fused joint:

Butt Fusion Time Cycles For HDPE Smoothwall Conduit

Pipe Inches IPS	Heat Time @ 500 Deg. F (Seconds)	Heat Time @ 425 Deg. F (Seconds)	Heat Time Cool Time (Seconds)	Approx Melt Bead Width (inches)	Approx Finished Bead Width (inches)
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
5	44 – 56	77 – 82	225	3/16	3/16
6	56 – 66	80 – 90	240	3/16	3/16

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.

Butt Fusion Time Cycles For PressureFlex PE 3608 Pipe

Pipe Inches IPS	Heat Time @ 500 Deg. F (Seconds)	Heat Time @ 425 Deg. F (Seconds)	Heat Time 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

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.

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 hindrance to sliplining operations. Equipment is available to remove the bead if that is desirable.



Geothermal Pipe – 50 Year Limited Warranty

Lamson Pipe Company will warrant its Geothermal pipe, Geothermal "U"-Bend, and Geothermal pipe loop assemblies for a period of 50 years from the date of manufacture. Lamson Pipe Company will replace free of charge and with freight prepaid the new pipe quantity equivalent to the quantity of pipe that failed.

WARRANTY WILL APPLY IF:

- Geothermal pipe and Geothermal loop assemblies are properly installed, utilized, tested and inspected per the International Ground Source Heat Pump Association (IGSHPA) standards
- Geothermal pipe and Geothermal loop assemblies are tested before sealing/grouting the final installation as per IGSHPA standards
- Your supplier is notified immediately
- Lamson Pipe Company receives written notice explaining the defect within 30 days of discovery of defect

WARRANTY WILL NOT APPLY IF:

- The design, installation, inspection or testing of the Geothermal pipe and Geothermal loop assemblies was not in accordance with the recommendations of the IGSHPA, applicable code requirements, if any, and industry accepted guidelines
- Installed product is affected by a natural disaster or by earth movement, whether caused by persons or by natural cause
- Product affected by
 - Improper handling/storage
 - Inadequate freeze protection
 - Improper temperatures
 - Improper pressure levels
- Product is exposed to petroleum products

THIS WARRANTY DOES NOT COVER:

- Components in the closed-loop Geothermal system other than the pipe or loop assemblies
- Pipe and fitting joining process, method, tools, or equipment
- Uses for other than Geothermal installations

This warranty is in lieu of all other warranties, express, implied or statutory, including but not limited to any warranty for merchantability of fitness for a particular purpose and shall constitute the sole remedy to any original purchaser of Lamson Pipe Company's Geothermal pipe.



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