PIPELINE PLASTICS

MUNICIPAL WATER PIPE



Corporate Headquarters
1301 Solana Blvd., Bldg. 1 Suite 1440, Westlake, TX 76262
O: 817-693-4100 **F:** 817-693-4101

Applications

Pipeline Plastics PE4710 Water Pipe is a high performance, bimodal, high density polyethylene (HDPE) pipe designed specifically for potable and municipal water distribution systems. HDPE pipe uses heat fusion for leak free joining, and is cost effective to install both in open cut and trenchless applications. NSF certified, our PE4710 Water Pipe is extremely low maintenance by withstanding pressure cycling and seismic events better than traditional materials to achieve a >100 year design life.

Features and Benefits of HDPE Water Pipe

- Heat fused leak-free joints for the entire life cycle
- Flexibility and small minimum bend radius reduces number of fittings/joints
- Impact & Rapid Crack Propagation Resistant even at cold temperatures
- Extremely resistant to fatigue failure from repetitive surge events
- Immune to corrosion & scale build up that can reduce flow capacities
- High fluid flow coefficient C=150 over the life of the piping system
- Can withstand flow velocities up to 15 fps



Pressure Design

Pipeline Plastics Water Pipe is manufactured using a high performance PE4710 compound that meets the demanding and rigorous requirements of the harshest water distribution systems with operating pressures up to 250 psi and temperatures up to 140°F.

Maximum operating pressures follow the PPI Handbook of Polyethylene Pipe, second edition, Chapter 3 and 6 for determination of maximum operating pressures. For design temperatures above 80°F a temperature service factor must also be used (see Chapter 3, Table A.2). For the transportation of fluids other than water see PPI publication TR-9 for additional service factor guidance.

Temperature Service Factor, ST							
Service Temperature °F (°C)	<80 (27)	90 (32)	100 (38)	110 (43)	120 (49)	130 (54)	140 (60)
	1.0	0.9	0.8	0.8	0.7	0.7	0.6

$$PC = \frac{2 * HDS}{(DR - 1)} * SF_E * SF_T$$

Where:

PC = pressure class, psi
HDS = hydrostatic design stress
= 1000 psi for PLP Water Pipe at 73°F
DR = dimension ratio (actual avg. OD/min wall thickness, t)
SF_E = environmental service factor
= 1.0 for water and most sanitary sewer (see PPI TR-9 for additional information)
SF_T = temperature service factor
= 1.0 at 73°F (see chart)

Design, Installation and Leak Testing

HDPE pipe is considered the best solution for trenchless applications, and also provides significant advantages over traditional pipes in open cut installations. It is an extremely tough material that can withstand the rigors of unloading, handling and installation without damage. Expensive breaks and failures caused by over extension of the pipe into bells – i.e. “over-belling” - are non-existent with HDPE. Trench grading and preparation are far easier with HDPE due to its flexibility and smaller bend radius. Above ground joining of HDPE utilizing 40 foot joints is more efficient and immensely safer, eliminating the need to have personnel in the ditch. Simple heat fused joints return a 100 year leak-free system with very significant installation advantages.

Pipeline Plastics recommends following the practices and guidance of AWWA M55 and the Plastics Pipe Institute (PPI) Handbook of Polyethylene Pipe, second edition available on the PPI website, www.plasticpipe.org. Additional design guidance is available with the PPI HDPEapp and PPI-PACE.

Leak testing can be performed up to 1.5x the maximum pressure rating of the piping system. Leak testing should be performed according to ASTM F2164, “Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.” Appropriate safety considerations should always be followed.

Joining

With Pipeline Plastics' PE4710 Water Pipe heat fused joints, the pipe joints are designed to be at least as strong as the pipe itself, with no leaks for the entire 100 year design life. Other pipe materials typically see the joint as the "weak-link" in the system that is often the source of leaks and infiltration. HDPE pipe can be joined by heat fusion using the industry accepted ASTM F2620 procedure for butt-fusion and saddle fusion. Electro-fusion as well as many types of mechanical couplings, MJ adaptors or flange adaptors designed for use on HDPE pipe can also be used. Always follow the fitting manufacturer installation procedure.

Surge Events and Their Effect on Pipe Design Life

With an aging and failing infrastructure, water utilities have a keen interest in how long their piping products will last. Today, a 100 year design life for municipal water systems is the new benchmark, twice the 50 years once considered standard. Both HDPE and PVC have abilities to withstand working pressure and pressure surges in a properly designed system. However, another factor—often overlooked when designing a water piping system—is the effect of repetitive surge events on fatigue and life expectancy. Repetitive pressure surges affect the life of the system significantly—more than pressure itself. In other words, like a boxer taking multiple punches, repetitive surge has a cumulative effect on expected pipe design life. This is where HDPE, because of its greater ductility and toughness, has significant advantages over PVC. The following chart reflects typical municipal water distribution system operating conditions, and illustrates the superiority of HDPE in designing for a 100 year life expectancy.

Pipeline Plastics Water Pipe can withstand surge events associated with frequent pump on/off cycles, fast valve closures or catastrophic system shutdown. Even in pressures and surge events generating up to 2X PC for occasional surge, and 1.5X PC for repeated surge, HDPE outperforms traditional materials.



Design System Operating Conditions

Pipeline Length	1000 ft
Design Velocity for Recurring Surge	4 ft/s
Design Velocity for Occasional Surge	8 ft/s
Anticipate Recurring Surges	55 per day
Temperature	57°F
Working Pressure	70 psi
Minimum Design Life	**100 years**

HDPE C906 10" DIPS DR11/PC200			PVC C900 10" CIOD DR18/PC235	
Recurring	Occasional		Recurring	Occasional
786	1,572	Flow Rate [gpm]	939	1,878
2.3	8.1	Head Loss [psi]	2.0	7.3
57	115	Surge Pressure [psi]	70	139
127	185	Total Pressure [psi]	140	209
300	400	Allow. Total Press. (with surge) [psi]	235	376
OK	OK	Surge Pressure Check	OK	OK
35 Billion		Number of Cycles to Failure	**2.3 Million**	
>100		Design Fatigue Life [years; SF = 2]	**58**	
PASS		Design Fatigue - 100 years	**FAIL**	

Source – PPI PACE Ver. 2.0 © eTrenchless Group Inc.

Conformance

- ANSI/AWWA C906, "Polyethylene (PE) Pressure Pipe and Fittings 4" to 65" (100mm to 1,650mm), for Waterworks."
- ASTM F714, "Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter."
- Cell Classification PE445574C per ASTM D3350
- NSF/ANSI Standard 14 Certified to AWWA C906 for Potable Water Contact
- Plastics Pipe Institute (PPI) TR-4 Listing as PE4710 / PE3408
- Hydrostatic Design Basis 1,600 psi @ 73°F (23°C) and 1,000 psi @ 140°F (60°C) per ASTM D2837
- Color & UV Stabilizer: Black with 2% min Carbon Black per ASTM D3350
- Heat Fusion Joining as per ASTM F2620 and PPI TR-33/TR-41
- Installation as per AWWA M55 and PPI PE Handbook, 2nd edition

Physical Properties	Nominal Value*	Test Method	Physical Properties	Nominal Value*	Test Method
Density	0.960 g/cm^3	ASTM D1505	Elongation @ Break	>150%	ASTM D638
Melt Index (MI) 190°C/2.16kg	0.07 g/10 min	ASTM D1238	Flexural Modulus	150,000 psi	ASTM D790
High Load Melt Index (190°C/21.6kg)	7-16 g/10 min	ASTM D1238	Brittleness Temperature	<-103°F	ASTM D746
PENT	>500 hours	ASTM F1473	Hardness	62 Shore D	ASTM D2240
Tensile Stress @ Yield	3,500 psi	ASTM D638	Vicat Softening Temperature	256°F	ASTM D1525
Tensile Stress @ Break	5,000 psi	ASTM D638	Thermal Expansion	1.0 x 10^4 in/in/°F	ASTM D696

* Nominal values are typical results and are not guaranteed or intended to be used as a product specification.

Municipal Water Distribution Pipe Sizes

DIPS - DIOD		DR	9	Most Commonly Used 11	Most Commonly Used 13.5	17
Size	OD (in)	*Working Pressure (WP) Pressure Class (PC)*	**250 psi**	**200 psi**	**160 psi**	**125 psi**
		WP+Recurring Surge	**375 psi**	**300 psi**	**240 psi**	**188 psi**
		WP+Occasional Surge	**500 psi**	**400 psi**	**320 psi**	**250 psi**
4"	4.5	*Min Wall (in)*	0.533	**0.436**	**0.356**	-
		ID[A] (in)	3.669	**3.875**	**4.046**	-
		Wt[B] (lb/ft)	3.129	**2.625**	**2.180**	-
6"	6.625	*Min Wall (in)*	0.767	**0.627**	**0.511**	0.406
		ID[A] (in)	5.275	**5.570**	**5.816**	6.040
		Wt[B] (lb/ft)	6.470	**5.421**	**4.506**	3.638
8"	8.625	*Min Wall (in)*	1.006	**0.823**	**0.670**	0.532
		ID[A] (in)	6.918	**7.306**	**7.629**	7.921
		Wt[B] (lb/ft)	11.13	**9.324**	**7.752**	6.258
10"	10.75	*Min Wall (in)*	1.233	**1.009**	**0.822**	0.653
		ID[A] (in)	8.485	**8.961**	**9.357**	9.716
		Wt[B] (lb/ft)	16.74	**14.03**	**11.66**	9.417
12"	12.75	*Min Wall (in)*	1.467	**1.200**	**0.978**	0.776
		ID[A] (in)	10.09	**10.66**	**11.13**	11.55
		Wt[B] (lb/ft)	23.68	**19.84**	**16.48**	13.32

Note - These tables represent standard sizes. IPS and other sizes in C906 are available.
A - ID (in): Inside Diameter may vary due to manufacturing tolerances.
B - Wt (lb/ft): Weight per foot in pounds may vary due to manufacturing tolerances.

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