FLYING W PLASTICS

Municipal & Industrial High-Density Polyethylene Pipe

PRODUCT SPECIFICATIONS

FLYING W PLASTICS, INC.

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OVERVIEW

Flying W Plastics' high-density polyethylene municipal and industrial pipe is NSF and/or AWWA-approved for potable water, and is available in various sizes and specifications to meet the standards detailed in the following data sheets. Applications include water transport, municipal sewage, domestic sewage, landfills, industrial process liquids, effluent, and slurries. Available color combinations include:

- Solid black
- Black with blue stripes for potable water
- Black with green stripes for sewer
- Black with purple stripes for reclaimed water
- Black with other stripes for use in coding

Unless otherwise requested at the time of quote, all municipal and industrial pipe is manufactured from select PE4710 resins. These resins meet or exceed the pressure ratings and physical properties of PE3608 and PE3408 resins (see below).

I.P.S. and D.I.P.S. pipe can be easily connected by fusion processes. Flying W Plastics recommends either butt fusion, socket fusion, or electrofusion, and can provide the recommended guidelines and procedures for connecting municipal and industrial pipe utilizing these methods.

PE 4710 and PE3408/3608 Pressure Chart

PE 3408/3608 - ASTM F714/D3035 and AWWA - (All Sizes)

DR 32.5	DR 26	DR 21	DR 17	DR 13.5	DR 11	DR 9	DR 7.3	DR 7
50 PSI	64 PSI	80 PSI	100 PSI	125 PSI	160 PSI	200 PSI	254 PSI	266 PSI

PE 4710 - ASTM F714/D3035 - (All Sizes)

DR 32.5	DR 26	DR 21	DR 17	DR 13.5	DR 11	DR 9	DR 7.3	DR 7
63 PSI	80 PSI	100 PSI	125 PSI	160 PSI	200 PSI	250 PSI	317 PSI	333 PSI

PE 4710 - AWWA (1/2" Through 3")

DR 32.5	DR 26	DR 21	DR 17	DR 13.5	DR 11	DR 9	DR 7.3	DR 7
63 PSI	80 PSI	100 PSI	125 PSI	160 PSI	200 PSI	250 PSI	317 PSI	333 PSI

PE 4710 - AWWA (4" and above)

DR 32.5	DR 26	DR 21	DR 17	DR 13.5	DR 11	DR 9	DR 7.3	DR 7
50 PSI	64 PSI	80 PSI	100 PSI	130 PSI	160 PSI	200 PSI	254 PSI	266 PSI

Under ASTM, the PE4710 has higher pressure ratings than PE3408 (200 psi for DR 11 and 250 psi for DR 9). AWWA has two standards for HDPE piping which do not currently match ASTM. AWWA C901 is for piping up through 3" and AWWA C906 is for 4" and larger. AWWA C901 has been revised to accept the higher ratings of PE4710 material, but AWWA C906 has not yet been revised. The result is that when AWWA C906 compliance is needed, the lower pressure ratings need to be observed.

Custom Perforation

Flying W Plastic also offers its 4"-18" Spec II piping custom perforated. We can do a wide variety of patterns and hole sizes done in line as a cost and labor saving alternative to shipping pipe to a perforation facility, making the perforations, re-bundling the pipe, and shipping onto a job site. Our inline perforation capabilities are wide ranging, but there are some limits, as follows:

- Perforations must be round holes ¼" to 1" in diameter.
- A limit of 6 perforated rows to complete pattern.
- Spacing can be 3" to 24"
- Holes can be lined up or staggered (off-set).
- The angles between rows of holes are infinitely adjustable so long as no two rows are closer than 20 degrees apart.
- Any staggering profiles must repeat in 24" or less.

Material Properties PE4710

The PE4710 materials offer higher working pressures in most applications than PE3608. Flying W certifies that its PE4710 Industrial Pipes are manufactured from high-quality HDPE copolymers having the typical properties listed. These copolymers have NSF 14, AWWA C901 and AWWA C906 certification for potable water applications, comply with ANSI/NSF Standard 61 health effects requirement, and are recognized by the Plastics Pipe Institute as having a pipe material designation code of PE4710 & PE100.

Typical Properties [1]	English	SI Units	ASTM Method
Density Black	-	.959 g/cc	D 4883
Melt Index[2]	-	8.0 g/10 min	D 1238
Tensile Strength			
@ Yield (2 in/min)	3625 psi	25.0 MPa	D 638
@ Break (2 in/min)	5500 psi	38.0 MPa	D 638
Elongation @ Break (2 in/min)	>600%	>600%	D 638
Flexural Modulus[3]	150,000 psi	1.035 MPa	D 790
Notched Izod Impact Strength	9 ft-lbf/in	0.49 kj/m	D 256
Hardness (Shore D)	66	66	D 2240
Vicat Softening Point	259 °F	126 °C	D1525
Brittleness Temperature	<-180 °F	<-118 °C	D 746
Hydrostatic Design Basis			
@ 23 °C	1600 psi	11.0 MPa	D 2837
@ 60 °C	1000 psi	6.9 MPa	D 2837
Minimum Required Strength	-	100 MPa	ISO 9080
Environmental Stress Crack Resistance[4]	>5000 hrs	>5000 hrs	D 1693
Notch Tensile (PENT)	75,000 hrs	75,000hrs	F 1473
Carbon Black Concentration	2.3%	2.3%	D 1603
Cell Classification	445574C	445574C	D 3350

(1) Typical properties will vary within specification limits
(2) 190 °C / 21.100g
(3) 2% Secant-Method I
(4) Condition C

IRON PIPE SIZES

IRON PIPE SIZES - OUTSIDE DIAMETER / DR 7, 7.3, 9

Pipe weights are calculated in accordance with PPI TR-7. Average ID is calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual inside diameter will vary. Pipe dimensions are in accordance with applicable ASTM standards.

I.P.S. Data

"Spec I" Controlled Outside Diameter (1/2" - 3")
- ASTM D3035
- NSF 14
- AWWA C901

"Spec II" Controlled Outside Diameter (4"-18")
- ASTM F-714
- NSF 14
- AWWA C906

All pipe is manufactured from select PE4710 resins unless requested otherwise at the time of quote. While PE4710 resins are used, these resins meet or exceed the pressure ratings and physical properties of PE3608/3408 resins.

		IPS DR - 7			IPS DR - 7.3			IPS DR - 9		
Pipe Size	Nom. OD	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)
1/2"	0.840	0.120	0.58	0.118	0.115	0.59	0.114	0.093	0.64	0.096
3/4"	1.050	0.150	0.73	0.185	0.144	0.74	0.18	0.117	0.80	0.15
1"	1.315	0.188	0.91	0.29	0.180	0.93	0.28	0.146	1.00	0.235
1-1/4"	1.660	0.237	1.15	0.462	0.227	1.17	0.447	0.184	1.26	0.374
1-1/2"	1.900	0.271	1.32	0.606	0.260	1.34	0.585	0.211	1.45	0.49
2"	2.375	0.339	1.65	0.947	0.325	1.68	0.914	0.264	1.81	0.766
2-1/2"	2.875	0.411	2.00	1.39	0.389	2.05	1.34	0.319	2.19	1.12
3"	3.500	0.500	2.44	2.06	0.479	2.48	1.99	0.389	2.67	1.66
4"	4.500	0.643	3.13	3.40	0.616	3.19	3.28	0.500	3.44	2.75
5"	5.563	0.795	3.87	5.19	0.762	3.94	5.02	0.618	4.25	4.20
6"	6.625	0.946	4.61	7.37	0.908	4.70	7.12	0.736	5.06	5.96
8"	8.625	1.232	6.01	12.49	1.182	6.12	12.06	0.958	6.59	10.10
10"	10.750	1.536	7.49	19.40	1.473	7.62	18.74	1.194	8.21	15.68
12"	12.750	1.821	8.88	27.28	1.747	9.04	26.36	1.417	9.74	22.06
14"	14.000							1.556	10.70	26.60
16"	16.000							1.778	12.23	34.74
18"	18.000							2.000	13.76	43.97

O.D. controlled water/fluids pipe
Recommended for municipal, industrial, and government applications
Easily connects by fusing, eliminating the need for common connections

IRON PIPE SIZES - OUTSIDE DIAMETER / DR 11, 13.5, 15.5

Pipe weights are calculated in accordance with PPI TR-7. Average ID is calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual inside diameter will vary. Pipe dimensions are in accordance with applicable ASTM standards.

I.P.S. Data

"Spec I" Controlled Outside Diameter (1/2" - 3")
- ASTM D3035
- NSF 14
- AWWA C901

"Spec II" Controlled Outside Diameter (4"-18")
- ASTM F-714
- NSF 14
- AWWA C906

All pipe is manufactured from select PE4710 resins unless requested otherwise at the time of quote. While PE4710 resins are used, these resins meet or exceed the pressure ratings and physical properties of PE3608/3408 resins.

		IPS DR - 11			*IPS DR - 13.5*			*IPS DR - 15.5*		
Pipe Size	Nom. OD	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)
1/2"	0.840	0.076	0.67	0.08	0.062	0.70	0.071			
3/4"	1.050	0.095	0.84	0.125	0.078	0.88	0.104			
1"	1.315	0.120	1.06	0.197	0.097	1.10	0.163	0.085	1.13	0.144
1-1/4"	1.660	0.151	1.34	0.313	0.123	1.39	0.26	0.107	1.43	0.229
1-1/2"	1.900	0.173	1.53	0.411	0.141	1.60	0.341	0.123	1.64	0.30
2"	2.375	0.216	1.91	0.642	0.176	2.00	0.533	0.153	2.05	0.469
2-1/2"	2.875	0.261	2.32	0.94	0.213	2.42	0.781	0.185	2.48	0.69
3"	3.500	0.318	2.82	1.39	0.259	2.95	1.16	0.226	3.02	1.02
4"	4.500	0.409	3.63	2.30	0.333	3.79	1.91	0.290	3.88	1.69
5"	5.563	0.506	4.49	3.52	0.412	4.68	2.93	0.359	4.80	2.58
6"	6.625	0.602	5.34	4.99	0.491	5.58	4.15	0.427	5.71	3.65
8"	8.625	0.784	6.96	8.46	0.639	7.27	7.03	0.556	7.44	6.19
10"	10.750	0.977	8.67	13.14	0.796	9.06	10.92	0.694	9.27	9.62
12"	12.750	1.159	10.29	18.49	0.944	10.74	15.36	0.823	11.00	13.53
14"	14.000	1.273	11.30	22.29	1.037	11.80	18.52	0.903	12.08	16.31
16"	16.000	1.455	12.91	29.12	1.185	13.48	24.19	1.032	13.81	21.30
18"	18.000	1.636	14.53	36.85	1.333	15.17	30.62	1.161	15.53	26.96

O.D. controlled water/fluids pipe
Recommended for municipal, industrial, and government applications
Easily connects by fusing, eliminating the need for common connections

PRODUCT SPECS

IRON PIPE SIZES - OUTSIDE DIAMETER / DR 17, 21, 26, 32.5

Pipe weights are calculated in accordance with PPI TR-7. Average ID is calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual inside diameter will vary. Pipe dimensions are in accordance with applicable ASTM standards.

I.P.S. Data

"Spec I" Controlled Outside Diameter (1/2" - 3")
- ASTM D3035
- NSF 14
- AWWA C901

"Spec II" Controlled Outside Diameter (4"-18")
- ASTM F-714
- NSF 14
- AWWA C906

All pipe is manufactured from select PE4710 resins unless requested otherwise at the time of quote. While PE4710 resins are used, these resins meet or exceed the pressure ratings and physical properties of PE3608/3408 resins.

		IPS DR - 17			*IPS DR - 21*			*IPS DR - 26*			*IPS DR - 32.5*		
Pipe Size	Nom. OD	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)
1/2"	0.840												
3/4"	1.050												
1"	1.315	0.077	1.15	0.132									
1-1/4"	1.660	0.098	1.45	0.21									
1-1/2"	1.900	0.112	1.66	0.276									
2"	2.375	0.140	2.07	0.431	0.113	2.13	0.35						
2-1/2"	2.875	0.169	2.51	0.631	0.137	2.58	0.52						
3"	3.500	0.206	3.06	0.935	0.167	3.14	0.767	0.135	3.21	0.63	0.108	3.27	0.50
4"	4.500	0.265	3.93	1.55	0.214	4.04	1.27	0.173	4.13	1.03	0.138	4.20	0.835
5"	5.563	0.327	4.86	2.36	0.265	5.00	1.94	0.214	5.10	1.58	0.171	5.20	1.28
6"	6.625	0.390	5.79	3.35	0.315	5.95	2.75	0.255	6.08	2.24	0.204	6.19	1.81
8"	8.625	0.507	7.54	5.68	0.411	7.75	4.66	0.332	7.92	3.80	0.265	8.06	3.07
10"	10.750	0.632	9.40	8.83	0.512	9.66	7.23	0.413	9.87	5.90	0.331	10.04	4.76
12"	12.750	0.750	11.16	12.41	0.607	11.46	10.18	0.490	11.71	8.30	0.392	11.91	6.70
14"	14.000	0.824	12.25	14.97	0.667	12.58	12.27	0.538	12.85	10.01	0.431	13.08	8.08
16"	16.000	0.941	14.00	19.55	0.762	14.38	16.03	0.615	14.69	13.08	0.492	14.95	10.55
18"	18.000	1.059	15.75	24.74	0.857	16.18	20.28	0.692	16.53	16.55	0.554	16.82	13.35

O.D. controlled water/fluids pipe
Recommended for municipal, industrial, and government applications
Easily connects by fusing, eliminating the need for common connections

DUCTILE IRON PIPE SIZE - OUTSIDE DIAMETER

Pipe weights are calculated in accordance with PPI TR-7. Average ID is calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual inside diameter will vary. Pipe dimensions are in accordance with applicable ASTM standards.

D.I.P.S. Data
- ASTM F-714
- NSF 14
- AWAA C906

All pipe is manufactured from select PE4710 resins unless requested otherwise at the time of quote. While PE4710 resins are used, these resins meet or exceed the pressure ratings and physical properties of PE3608/3408 resins.

		DIPS DR - 7			DIPS DR - 7.3			DIPS DR - 9			DIPS DR - 11		
Pipe Size	Nom. OD	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)
3"	3.96							0.44	3.02	2.13	0.36	3.19	1.78
4"	4.800	0.686	3.34	3.87	0.658	3.40	3.74	0.533	3.66	3.13	0.436	3.87	2.62
6"	6.900	0.986	4.81	7.99	0.945	4.89	7.72	0.767	5.27	6.46	0.627	5.57	5.42
8"	9.050	1.293	6.30	13.75	1.240	6.42	13.28	1.006	6.91	11.12	0.823	7.30	9.32
10"	11.100							1.233	8.48	16.72	1.009	8.96	14.01
12"	13.200							1.467	10.09	23.65	1.200	10.65	19.82
14"	15.300										1.391	12.35	26.63
16"	17.400										1.582	14.04	34.44

		DIPS DR - 13.5			DIPS DR - 17			DIPS DR - 21			DIPS DR - 26		
Pipe Size	Nom. OD	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)	Min. Wall	Ave. ID	Weight (lbs/ft.)
3"	3.96	0.293	3.33	1.48	0.233	3.46	1.20	0.189	3.55	0.982			
4"	4.800	0.356	4.04	2.18	0.282	4.20	1.76	0.229	4.31	1.44	0.185	4.40	1.18
6"	6.900	0.511	5.81	4.50	0.406	6.03	3.64	0.329	6.20	2.98	0.265	6.33	2.43
8"	9.050	0.670	7.62	7.74	0.532	7.92	6.25	0.431	8.13	5.13	0.348	8.31	4.18
10"	11.100	0.822	9.35	11.64	0.653	9.71	9.41	0.529	9.97	7.71	0.427	10.19	6.29
12"	13.200	0.978	11.12	16.47	0.776	11.55	13.31	0.629	11.86	10.91	0.508	12.12	8.90
14"	15.300	1.133	12.89	22.12	0.900	13.39	17.88	0.729	13.75	14.66	0.588	14.05	11.96
16"	17.400	1.289	14.66	28.61	1.024	15.23	23.12	0.829	15.64	18.95	0.669	15.98	15.46

O.D. controlled water/fluids pipe
Recommended for municipal, industrial, and government applications
Easily connects by fusing, eliminating the need for common connections

Flying W Plastics & PPI

Flying W Plastics, Inc. is a member in good standing with the Plastics Pipe Institute (PPI). PPI is the major trade association representing all segments of the plastics piping industry. As an association, PPI focuses collaborative efforts to accumulate data, concentrate facts, and target resources toward advancements in plastics piping application and usage. PPI promotes contemporary use of plastics piping for water and gas distribution, sewer and wastewater, oil and gas production, industrial and mining uses, power and communications, and ducting and irrigation.

PPI's vision and leadership have resulted in the establishment of uniform testing and design criteria that has become the foundation for all current applications of plastics piping. As PPI members, Flying W Plastics recommends PPI's *Handbook of Polyethylene Pipe, Second Edition* for testing and design criteria of all HDPE pipe manufactured by Flying W Plastics. This handbook is available for purchase online (**www.plasticpipe.org**). The individual chapters can be downloaded free of charge (**www.plasticpipe.org/publications/pe_handbook.html**). Many case studies, technical bulletins, and pipe calculations can also be found at the PPI web site.

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