

HDPE PE 4710

Municipal, Industrial and Irrigation Documents for Submittals

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Product description with key benefit highlights for municipal, industrial and irrigation applications

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Temperature vs Dimensional Ratio chart based on pipe application and burial classification

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Model specification for HDPE PE 4710 Pipe, Tubing, Fitting and Fusion Tools

Pipe Size Chart – Page 4-5

HDPE Iron pipe size (IPS) chart and pressure for various HDPE Standard Dimensional Ratio (SDR)

This publication is intended for use as a piping system guide and shall not be used in place of a professional engineer's judgment or guidance. The information in this publication does not constitute a guarantee or warranty for piping installations and cannot be guaranteed because the conditions of use are beyond individual controls. The user of this information assumes all risk associated with its use. P&F Distributors has made every reasonable effort to ensure accuracy, but the information in this publication may not be complete, especially for special or unusual applications. Changes to this publication may occur from time to time without notice. Please contact P&F Distributors to determine if you have the most current edition.



Total Piping Solution for Municipal, Industrial and Irrigation Applications

Lowest Total Cost of Ownership

Lowest life cycle cost of any piping material when accounting for all costs: direct, indirect and operational costs

Installation Flexibility – So Many Choices

Durable, lightweight and flexible paves way for trench and trenchless installation methods whether above, below grade or under rivers, lakes and obstacles

Environmental and Health Friendly

HDPE is potable water safe per NSF 14/61 and is manufactured, used and recycled without the emission of pollutants and toxins into the environment

50+ Year Rated – Same Pipe New and Old

Hydrostatic design basis is established per ASTM D2837 to provide high confidence interval of lifetime material performance

Consistent Pipe Joint Solution

Fusion joints are leak-free, fully restrained, homogenous, and repeatable through the innovative butt, socket, saddle and electrofusion joining methodology of ASTM F2620 and ASTM F1290 – When equipped with a Data Logging Device, joint information become fully transparent and worry-free

Seismic Resistant Pipe

HDPE materials's high strain allowance combined with the lowest force generation provides a critical lifeline and complete piping solution to seismically active regions

Please Contact for Additional Technical Information or Tailored Presentation

NORTHERN CALIFORNIA
511 Tunnel Avenue
Brisbane, CA 94005
415.467.4630
PFDistributors.com

NEVADA
675-B Edison Way
Reno, NV 89502
775.856.1888

SOUTHERN CALIFORNIA
1304 E. San Bernardino Ave
San Bernardino, CA 92408
909.799.7800

CENTRAL CALIFORNIA
4039-C Well Tech Way
Bakersfield, CA 93308
661.589.7300

High Density Polyethylene Pipe Common Sizing

HDPE - PE 100/4710

HDPE - IPS Sizing		DR 7*			DR 9*			DR 11*			DR 17		
Pressure Class		335 psi			250 psi			200 psi			125 psi		
Pipe Size	Actual OD	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight
in.	in.	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft
3/4	1.05	0.150	0.732	0.19	0.117	0.803	0.15	0.095	0.848	0.13	0.062	0.919	0.08
1	1.315	0.188	0.917	0.29	0.146	1.005	0.23	0.120	1.062	0.20	0.077	1.151	0.13
1 1/4	1.66	0.237	1.157	0.46	0.184	1.269	0.37	0.151	1.340	0.31	0.098	1.453	0.21
1 1/2	1.90	0.271	1.325	0.61	0.211	1.452	0.49	0.173	1.534	0.41	0.112	1.663	0.28
2	2.375	0.339	1.656	0.95	0.264	1.816	0.77	0.216	1.917	0.64	0.140	2.079	0.43
3	3.50	0.500	2.440	2.06	0.389	2.676	1.66	0.318	2.825	1.39	0.206	3.064	0.94
4	4.50	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.31	0.265	3.939	1.55
6	6.625	0.946	4.619	7.37	0.736	5.064	5.96	0.602	5.348	5.00	0.390	5.799	3.36
8	8.625	1.232	6.013	12.50	0.958	6.593	10.11	0.784	6.963	8.47	0.507	7.549	5.69
10	10.75	1.536	7.494	19.42	1.194	8.218	15.70	0.977	8.678	13.16	0.632	9.409	8.83
12	12.75	1.821	8.889	27.31	1.417	9.747	22.08	1.159	10.293	18.51	0.750	11.160	12.43
14	14	2.000	9.760	32.93	1.556	10.702	26.63	1.273	11.302	22.32	0.824	12.254	14.98
16	16	2.286	11.154	43.01	1.778	12.231	34.78	1.455	12.916	29.15	0.941	14.005	19.57
18	18	2.571	12.549	54.43	2.000	13.760	44.02	1.636	14.531	36.89	1.059	15.755	24.77
20	20	2.857	13.943	67.20	2.222	15.289	54.34	1.818	16.145	45.54	1.176	17.506	30.58
22	22	3.143	15.337	81.32	2.444	16.818	65.75	2.000	17.760	55.10	1.294	19.256	37.00
24	24	3.429	16.731	96.77	2.667	18.347	78.25	2.182	19.375	65.58	1.412	21.007	44.03
26	26	3.714	18.126	113.57	2.889	19.876	91.84	2.364	20.989	76.96	1.529	22.758	51.67
28	28	4.000	19.520	131.72	3.111	21.404	106.51	2.545	22.604	89.26	1.647	24.508	59.93
30	30				3.333	22.933	122.27	2.727	24.218	102.47	1.765	26.259	68.80
32	32				3.556	24.462	139.12	2.909	25.833	116.58	1.882	28.009	78.28
34	34				3.778	25.991	157.05	3.091	27.447	131.61	2.000	29.760	88.37
36	36				4.000	27.520	176.07	3.273	29.062	147.55	2.118	31.511	99.07
42	42							3.818	33.905	200.84	2.471	36.762	134.84
48	48										2.824	42.014	176.12
54	54										3.176	47.266	222.90
63	63										3.706	55.144	303.40

Pipe sizing per ASTM F714 (> 4") and ASTM D3035 (≤ 3") . Pressure Class calculations based on Water applications at 73F. Average ID is approximate. Weights calculated based on PPI TR-7. *Compliance to FM 1613

Molded and Fabricated Fittings

HDPE – PE 100/4710

HDPE Pipe (3/4" – 63")
 MDPE Pipe (3/4" – 12")
 PERT (High Temperature PE)
 High Abrasion PE Pipe
 Electrofusion
 Fusion Equipment and Tools
 Bead Trimmer
 Custom Fabrication

Elbows
 Tees
 Branch/Service Saddle
 Tapping Tee
 Caps and Couplers
 Reducers
 Lateral Wye
 Cross

Trasition Fittings
 MJ Adapter
 Poly Valves
 Wall Anchor
 Blind Flange
 Flange Adapter With Backup Rings
 Clean Out & Caps

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NORTHERN CALIFORNIA
 511 Tunnel Avenue
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 PFDistributors.com`

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 675-B Edison Way
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 1304 E. San Bernardino Ave
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CENTRAL CALIFORNIA
 4039-C Well Tech Way
 Bakersfield, CA 93308
 661.589.7300

HDPE PE 4710 Technical Data Chart

Nominal HDPE Pipe Property ¹	ASTM Test Method	Unit	Required by ASTM D3350 cell class PE445574C	Required by AWWA C906 for PE4710	Typical Value
Cell Classification	D3350	-	PE 445574C	PE 445574C	PE 445574C
Density w/ Min 2% Carbon Black	D1505	g/cm ³	> 0.947	> 0.947	0.955 - 0.960
Melt Flow Index (190/2.16)	D1238	g/10 min	< 0.15*	< 0.15*	0.3
Hydrostatic Design Basis (HDB) @ 73°F (23°C)	D2837	psi	1,600	1,600	1,600
Hydrostatic Design Stress (HDB) @ 140°F (60°C)	D2837	psi	1,000	1,000	1,000
Color: UV Stabilizer [C]	D3350	-	> 2%	> 2%	2-3%
Hazen Williams C-Factor (Lifetime)	-	-	-	-	150-155
Manning's n Value	-	-	-	-	0.008 - 0.011
Nominal HDPE Material Property ²	ASTM Test Method	Unit	Required by ASTM D3350 cell class PE445574C	Required by AWWA C906 for PE4710	Typical Value
Tensile Strength at Yield	D638	psi	3,500 - < 4,000	> 3,200	3,500 - 4,000
Tensile Elongation at Break	D638	%	-	> 400%	> 400%
Slow Crack Growth (PENT)	F1473	hrs	> 500	> 500	> 500
Flexural Modulus	D790	psi	> 110,000 - 160,000	> 110,000 - 160,000	> 120,000
Modulus of Elasticity (Dynamic ³)	D638	psi	-	-	150,000
Vicant Temperature	D1525	°F	-	-	259
Brittleness Temperature	D746	°F	-	-	< -103
Hardness	D2240		-	-	64 Shore D
Coefficient of Thermal Expansion/Contraction	D696	in/in ·°F	-	-	8.0 x 10 ⁻⁵
Compressive Stress	-	psi	-	-	1,150
Thermal Conductivity		BTU ·in /hr ·sq. ft ·°F	-	-	3.1
Poisson's Ratio	-	-	-	-	0.45

¹The nominal pipe properties were determined on pipe extruded from a pellet blend of typical resin and an approved carbon black concentrate. ²The nominal properties reported are typical of the resin when blended with an approved color concentrate, except the density value which is representative of the natural resin, but do not reflect normal testing variance and therefore should not be used for specification purposes. Values are rounded. ³Ratio of stress to strain that occurs under instantaneous rate of increasing stress, such as can occur in a water-hammer reaction in a pipeline. This modulus is used as a parameter for the computing of a localized surge pressure that results from a water hammer event.

P & F

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**“HDPE PIPE
IS OUR BUSINESS”**

Municipal and Industrial Sizing Chart - HDPE

HDPE - IPS Sizing		DR 7			DR 9			DR 11			DR 13.5		
Pressure Class		335 psi			250 psi			200 psi			160 psi		
Pipe Size	Actual OD	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight
in.	in.	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft
3/4	1.05	0.150	0.732	0.19	0.117	0.803	0.15	0.095	0.848	0.13	0.078	0.885	0.10
1	1.315	0.188	0.917	0.29	0.146	1.005	0.23	0.120	1.062	0.20	0.097	1.108	0.16
1 1/4	1.66	0.237	1.157	0.46	0.184	1.269	0.37	0.151	1.340	0.31	0.123	1.399	0.26
1 1/2	1.9	0.271	1.325	0.61	0.211	1.452	0.49	0.173	1.534	0.41	0.141	1.602	0.34
2	2.375	0.339	1.656	0.95	0.264	1.816	0.77	0.216	1.917	0.64	0.176	2.002	0.53
3	3.50	0.500	2.440	2.06	0.389	2.676	1.66	0.318	2.825	1.39	0.259	2.950	1.16
4	4.50	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.31	0.333	3.793	1.92
6	6.63	0.947	4.622	7.39	0.737	5.068	5.97	0.603	5.352	5.00	0.491	5.589	4.16
8	8.63	1.233	6.016	12.51	0.959	6.597	10.12	0.785	6.967	8.48	0.639	7.275	7.05
10	10.75	1.536	7.494	19.42	1.194	8.218	15.70	0.977	8.678	13.16	0.796	9.062	10.93
12	12.75	1.821	8.889	27.31	1.417	9.747	22.08	1.159	10.293	18.51	0.944	10.748	15.38
14	14.00	2.000	9.760	32.93	1.556	10.702	26.63	1.273	11.302	22.32	1.037	11.801	18.54
16	16.00	2.286	11.154	43.01	1.778	12.231	34.78	1.455	12.916	29.15	1.185	13.487	24.22
18	18.00	2.571	12.549	54.43	2.000	13.760	44.02	1.636	14.531	36.89	1.333	15.173	30.65
20	20.00	2.857	13.943	67.20	2.222	15.289	54.34	1.818	16.145	45.54	1.481	16.859	37.84
22	22.00	3.143	15.337	81.32	2.444	16.818	65.75	2.000	17.760	55.10	1.630	18.545	45.79
24	24.00	3.429	16.731	96.77	2.667	18.347	78.25	2.182	19.375	65.58	1.778	20.231	54.49
26	26.00	3.714	18.126	113.57	2.889	19.876	91.84	2.364	20.989	76.96	1.926	21.917	63.95
28	28.00	4.000	19.520	131.72	3.111	21.404	106.51	2.545	22.604	89.26	2.074	23.603	74.17
30	30.00				3.333	22.933	122.27	2.727	24.218	102.47	2.222	25.289	85.14
32	32.00				3.556	24.462	139.12	2.909	25.833	116.58	2.370	26.975	96.87
34	34.00				3.778	25.991	157.05	3.091	27.447	131.61	2.519	28.661	109.36
36	36.00				4.000	27.520	176.07	3.273	29.062	147.55	2.667	30.347	122.60
42	42.00							3.818	33.905	200.84	3.111	35.404	166.88
48	48.00										3.556	40.462	217.96

Pipe sizing per ASTM F714 (> 4") and ASTM D3035 (≤ 3"). Pressure Class calculations based on Water applications at 73F. Average ID is approximate. Weights calculated based on PPI TR-7.

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Municipal and Industrial Sizing Chart - HDPE

HDPE - IPS Sizing		DR 17			DR 21			DR 26			DR 32.5		
Pressure Class		125 psi			100 psi			80 psi			63 psi		
Pipe Size	Actual OD	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight	Min. Wall	Avg. ID	Weight
in.	in.	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft	in.	in.	lb/ft
2	2.375	0.140	2.079	0.43									
3	3.50	0.206	3.064	0.94	0.167	3.147	0.77						
4	4.50	0.265	3.939	1.55	0.214	4.046	1.27	0.173	4.133	1.04	0.138	4.206	0.84
6	6.63	0.390	5.803	3.36	0.316	5.961	2.75	0.255	6.089	2.25	0.204	6.198	1.81
8	8.63	0.508	7.554	5.69	0.411	7.759	4.67	0.332	7.926	3.81	0.266	8.067	3.07
10	10.75	0.632	9.409	8.83	0.512	9.665	7.24	0.413	9.873	5.91	0.331	10.049	4.77
12	12.75	0.750	11.160	12.43	0.607	11.463	10.19	0.490	11.710	8.31	0.392	11.918	6.71
14	14.00	0.824	12.254	14.98	0.667	12.587	12.28	0.538	12.858	10.02	0.431	13.087	8.09
16	16.00	0.941	14.005	19.57	0.762	14.385	16.04	0.615	14.695	13.09	0.492	14.956	10.56
18	18.00	1.059	15.755	24.77	0.857	16.183	20.30	0.692	16.532	16.57	0.554	16.826	13.37
20	20.00	1.176	17.506	30.58	0.952	17.981	25.07	0.769	18.369	20.45	0.615	18.695	16.50
22	22.00	1.294	19.256	37.00	1.048	19.779	30.33	0.846	20.206	24.75	0.677	20.565	19.97
24	24.00	1.412	21.007	44.03	1.143	21.577	36.10	0.923	22.043	29.45	0.738	22.434	23.76
26	26.00	1.529	22.758	51.67	1.238	23.375	42.36	1.000	23.880	34.57	0.800	24.304	27.89
28	28.00	1.647	24.508	59.93	1.333	25.173	49.13	1.077	25.717	40.09	0.862	26.174	32.34
30	30.00	1.765	26.259	68.80	1.429	26.971	56.40	1.154	27.554	46.02	0.923	28.043	37.13
32	32.00	1.882	28.009	78.28	1.524	28.770	64.17	1.231	29.391	52.36	0.985	29.913	42.24
34	34.00	2.000	29.760	88.37	1.619	30.568	72.44	1.308	31.228	59.11	1.046	31.782	47.69
36	36.00	2.118	31.511	99.07	1.714	32.366	81.21	1.385	33.065	66.27	1.108	33.652	53.46
42	42.00	2.471	36.762	134.84	2.000	37.760	110.54	1.615	38.575	90.20	1.292	39.260	72.77
48	48.00	2.824	42.014	176.12	2.286	43.154	144.38	1.846	44.086	117.81	1.477	44.869	95.05
54	54.00	3.176	47.266	222.90	2.571	48.549	182.73	2.077	49.597	149.10	1.662	50.478	120.29
63	63.00				3.000	56.640	248.72	2.423	57.863	202.94	1.938	58.890	163.73

Pipe sizing per ASTM F714 (> 4") and ASTM D3035 (≤ 3"). Pressure Class calculations based on Water applications at 73F. Average ID is approximate. Weights calculated based on PPI TR-7.

HDPE Temperature Derate Pressure Chart

HDPE PE 4710 Design Pressure (psi)								
Operating Temperature								
Application	DR	73°F	90°F	100°F	110°F	120°F	130°F	140°F
Water, Brine, Alcohols, Glycols, and Dry Natural Gas (non 49CFR192 applications)	DR 7	333	300	267	237	210	190	167
	DR 9	250	225	200	178	158	143	125
	DR 11	200	180	160	142	126	114	100
	DR 13.5	160	144	128	114	101	91	80
	DR 17	125	113	100	89	79	71	63
	DR 21	100	90	80	71	63	57	50
	DR 26	80	72	64	57	50	46	40
	DR 32.5	63	57	51	45	40	36	32
2% or Greater Concentrations of Liquid Hydrocarbons or Other Solvating/Permeating Chemicals	DR 7	167	150	133	118	105	95	83
	DR 9	125	113	100	89	79	71	63
	DR 11	100	90	80	71	63	57	50
	DR 13.5	80	72	64	57	50	46	40
	DR 17	63	56	50	44	39	36	31
	DR 21	50	45	40	36	32	29	25
	DR 26	40	36	32	28	25	23	20
	DR 32.5	32	29	25	23	20	18	16

Design pressure is approximated and can change based on other considerable factors. This chart is not intended for design pressure of 49 CFR 192 for Federally Regulated natural gas pipelines. Temperature Compensation factor based on known PE 4710 material data points at 73°F and 140°F.

MODEL SPECIFICATION
PE 4710 HIGH DENSITY POLYETHYLENE (HDPE) PIPE, TUBING, FITTINGS AND
FUSION TOOLS ¾”-65”
Water/Wastewater Service, Distribution and Transmission

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification covers the material, joining, installation and quality assurance for HDPE pipe, tubing, fittings, machines and fusion tools for Water/Wastewater Service, Distribution and Transmission.
- B. All work performed shall be in accordance with approved engineering construction plans and under the guidance of a licensed professional engineer.
- C. All work performed shall be in accordance to all applicable standards and specifications listed herein and shall conform to all local, state, and federal codes. The reference standards utilized shall be of the latest edition and/or revision.
- D. All work performed shall be completed by an experienced, licensed, and bonded contractor that has a minimum of 5 years’ experience with HDPE water/wastewater service, distribution and/or transmission projects.
- E. All work performed shall be inspected by an Authorized Representative of the Project Owner and shall have the authority to halt construction if these specifications or any applicable standards herein are not being followed.

1.2 QUALITY ASSURANCE

- A. Qualification of Manufacturers
 - 1. The pipe, fitting and machine manufacturer shall be ISO Certified in accordance with the current edition of ISO 9001 and shall have manufacturing and quality control facilities that are capable of producing and assuring the quality of the pipe and fittings required by the specification herein.
- B. Qualification of Supplier
 - 1. The pipe, fitting, machine and fusion tool supplier shall have at least 10 years of experience distributing pipe, fitting, machine and tools and shall have extensive experience with state and local engineering firms, municipalities, and contractors.
- C. Markings
 - 1. Markings of pipe and fittings shall conform to applicable AWWA and ASTM standards listed herein and shall include the name of the manufacturer, material, size, DR, sizing convention, Pressure Class/Pressure Rating, production codes and time/date/location of manufacture for tracking and traceability.
- D. Product Inspection

1. The Customer or Authorized Customer's Representative reserves the right to conduct an in-plant inspection during, pre or post production of pipe, fittings and/or machines.
 - a. Any inspection results that do not meet the quality requirements per applicable and listed Reference standards listed herein shall result in rejection and be replaced at no cost to the Customer by the Manufacturer.
 2. The Customer or Authorized Customer's Representative may conduct additional testing of pipe, fitting, or machine at the Customer's expense upon delivery.
 - a. All retesting of pipe, fitting and machines shall be performed per applicable and listed Reference Specification herein.
 - b. Any retesting results that do not meet quality requirements per applicable and listed Reference Specification herein shall result in rejection and be replaced at no cost to the Customer by the Manufacturer.
- E. Transportation
1. Prevent damage to pipe, fitting, machine and tools during transportation, handling, and storage as recommended by the manufacturer. Pipe shall be transported using appropriate methods with intermittent checks to ensure proper stacking support and restraint.

1.3 JOINING

A. Fusion

1. Fusion between plain end pipe and/or fitting shall conform to ASTM F2620 for Butt, Saddle and Socket Fusion or ASTM F1290 for Electrofusion and Procedures recommended by the Pipe and/or Machine Manufacturer. Any modifications shall be approved by the Project Engineer on Record or his Approved Representative.
2. Butt Fusion of Unlike Wall Thickness shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than One (1) Standard DR.

B. Alternate Joining Method

1. Connections between plain end HDPE pipe and/or fitting or to alternate piping materials may be joined by means of the following:
 - a. Flange Adapter with Backup Ring
 - b. Mechanical Joint Adapter with Kit
 - c. Transition Fittings
 - d. Mechanical Couplings
2. Joining of Pipe and Fittings by the means of the Alternative Joining Method shall comply with the manufacturer's recommendation. Any modifications shall be approved by the Project Engineer on Record or his Approved Representative.
3. Bolt torque values for proper seating and long term sealing when utilizing mechanical flange connections shall conform to PPI-TN 38.

C. Fusion Joint Qualification

1. Destructive Joint testing

- a. Interval of testing shall be at the discretion of the Project Engineer or his Approved Representative.
- 2. Non-Destructive Joint testing
 - a. A datalogging device shall be used to record and document key parameters of the fusion process for real-time, post and historical analysis.
- 3. Hydrostatic Leak Test
 - a. Leak testing shall be performed as described in ASTM F2164: Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
- D. Machine Qualification
 - 1. Routine Machine Inspection
 - a. Machines and tools utilized to join pipe and/or fittings shall be routinely inspected, maintained and meet the manufacturers specification.
- E. Operator Qualification
 - 1. The fusion operator shall be thoroughly familiar with and trained per the applicable standards on the equipment being used to join pipe and/or fittings.
 - a. Fusion operator shall be able to provide evidence of fusion qualification training as requested by the project inspector, engineer, or owner.
 - 2. Operator training and training interval shall be completed in accordance to the following schedule:
 - a. Distributor Fusion Consultants 4 years
 - b. Contractor Operators 2 years
 - c. Agency Operators 2 years
 - 3. All Fusion Operator Training shall be instructed by a Fusion Consultant Trainer familiar with local, state and federal standards.

1.4 INSTALLATION

- A. General
 - 1. Installation and Operation of pipe, fitting and machine shall conform to the engineering plans, drawings, specifications, and manuals as advised by the Project Engineer on Record or his Approved Representative.
- B. Handling and Delivery
 - 1. Prevent damage to pipe, fitting and machine during transportation, handling, and storage as recommended by the manufacturer. Pipe, fitting, and machine shall be handled using appropriate and safe methods to insure the proper restraint and controlled movement.
- C. Burial
 - 1. Burial and Embedment techniques regarding including soil type and particle size shall be in accordance with ASTM D2774 and AWWA M55 or as advised by the Project Engineer on Record or his Approved Representative.
 - a. Pipe shall be laid on grade and on a stable foundation using preferably Class I material or per applicable specification. Excess groundwater shall be removed

from the trench before laying the foundation or bedding for the pipe. All ledge rock, boulders and large stones shall be removed.

- b. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.

C. Shear and Bending Loads

1. Connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls.
 - a. The area surrounding the connection shall be embedded in properly placed and compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads per ASTM D2774 and AWWA M55.

D. Safety

1. All necessary precautions shall be taken to ensure a safe working environment.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All materials in contact with potable water shall meet NSF/ANSI Standard 61.
- B. HDPE pipe and fittings shall be made in accordance to Iron Pipe Size (IPS) convention.
- C. Product substitution per commercial availability may be approved at the discretion of the Project Engineer on Record or his Approved Representative.

2.2 PIPE

- A. HDPE pipe shall be manufactured in accordance with AWWA C901 and ASTM D3035 for sizes 3/4” - 3” IPS diameters. Pipe sizes 4” IPS and larger shall be manufactured to the requirements of ASTM F714 and AWWA C906.
- B. HDPE pipe shall be manufactured from materials meeting the requirements of AWWA D3350 and listed in PPI -TR4.
 1. Black PE Material Shall Conform to ASTM3350 with a minimum Cell Classification listed of 445574C with a standard grade HDB rating of 1600 psi at 73°F.
 2. Gray PE Material Shall Conform to ASTM3350 with a minimum Cell Classification listing of 445574E with a standard grade HDB rating of 1600 psi at 73°F.
 3. PE Compound used in potable water service applications shall be classified as CC3 HDPE Material per ASTM D3350 and shall be Bi-Modal for pipe wall thicknesses up to 3”.
 4. Black HDPE pipe, except colored pipe with cell classification designation of “E”, shall include 2-3 percent carbon black for ultra-violet protection.
 5. HDPE Pipe shall utilize resin with a PENT Value of >10,000 hrs
 6. HDPE Pipe shall be made of virgin material and shall not contain recycled compound. Rework material generated in the manufacturer’s own plant may be blended with virgin resin of the same cell classification to manufacture new pipe.

- C. Markings of pipe shall conform to applicable AWWA and ASTM standards herein and shall include the name of the manufacturer, material, size, DR, sizing convention, Pressure Class/Pressure Rating, production codes and time/date/location of manufacture for tracking and traceability.
1. Stripes marked on pipe are OPTIONAL per intended application. STANDARD product is manufactured solid black with no stripes. OPTIONAL Gray color interior and/or exterior pipe may be utilized to help aid in inspection visibility.
 - a. Blue color stripes – Potable Water
 - b. Green color stripes/Gray Interior – Wastewater
 - c. Purple color stripes – Reclaimed Water
 - d. Red color stripes – Firewater/FM
- D. Acceptable HDPE pipe manufacturers
1. WL Plastics
 2. Performance Pipe
 3. JM Eagle
 4. Approved Equal

2.3 FITTINGS

- A. HDPE fittings shall be manufactured in accordance to AWWA C901 and ASTM D3261 and Electrofusion fittings shall comply with ASTM F1055.
1. Black PE Material Shall Conform to ASTM3350 minimum Cell Classification 445574C with a standard grade HDB rating of 1600 psi at 73°F.
 2. HDPE fittings and appurtenances shall have the same pressure rating as the pipelines to which they are attached. Any modifications shall be approved by the agency, Project Engineer or his Approved Representative.
 3. Fittings shall be Molded where commercially available.
- B. Each fitting shall be clearly labeled to identify its material code designation, size, DR and name of manufacturer.
- C. HDPE Flange Adaptors
1. Made with sufficient through-bore length to be clamped in a butt-fusion machine and fused directly to pipe or fittings. Short stub end flanges are not permitted.
 2. Faced with a concentric or spiral pattern for 1/8” full face gasket installations.
- E. Flange Adaptor Backing Rings
1. Epoxy Coated DR-7 Backing Rings shall be used for 2”-3”.
 2. Shall comply with AWWA C901 IPS pipe diameters and ASME 125/150.
 - a. The Contractor shall verify bolt patterns of Backing Rings and the mating flanges.
 3. Shall consist of convoluted ductile iron (ASTM A536 65-45-12).
 4. Shall be fusion-bonded epoxy coated per AWWA C116, except NSF-61 certification is not required.
 5. Bolting materials shall conform to Flange Bolting as Specified by the Agency.

E. Acceptable manufacturers

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Molded Fittings <ol style="list-style-type: none"> a. Performance Pipe b. Integrity Fusion Products c. AGRU America d. Georg Fischer/CP e. Nupi Elofit
 3. Electrofusion Fittings <ol style="list-style-type: none"> a. Integrity Fusion Products b. Plasson USA c. Strongbridge International d. Agru America e. Georg Fischer/CP f. Nupi Elofit | <ol style="list-style-type: none"> 2. Fabricated Fittings <ol style="list-style-type: none"> a. Harco Fittings b. Infinity Plastics c. Pipestar International (Sweeps) d. Georg Fischer/CP e. Approved Equal
 4. Flange Adaptor, Backing Ring and Transition Fittings <ol style="list-style-type: none"> a. Improved Pipe Products b. Integrity Fusion Products c. Harco Fittings d. Georg Fischer/CP e. Poly-Cam |
|---|--|

2.4 MACHINE

- A. Machines utilized to join and repair pipe and fittings shall be obtained from a manufacturer's approved machine supplier with at least 10 years of experience with state and local engineering firms, municipalities, and contractors
- B. Datalogging device shall be used to record and document fusion process 6"-65" in compliance with ASTM F3124.
 1. Information obtained from the Data Logging device shall include Time, Pressure, Temperature, Joint ID, Operator, and Pipe/Fitting sizes 6"-65".

2.5 STANDARDS AND REFERENCES

- A. HDPE pipe and fitting manufacturing, installation and fusion shall conform to the following standards as applicable and referenced herein. Unless otherwise noted, the most current revision of the listed standards shall apply.
 1. Pipe and Fitting
 - a. AWWA C901: Polyethylene (PE) Pressure Pipe and Fittings ¾"-3" (19 mm-76 mm), for Water Service
 - b. AWWA C906: Polyethylene (PE) Pressure Pipe and Fittings 4"-65" (100 mm-1,650 mm), for Waterworks
 - c. ASTM D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter ¾"-3" (19 mm-76 mm)
 - d. ASTM F714: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter 4"-65" (100 mm-1,650 mm)
 - e. NSF/ANSI 61: Drinking Water System Components – Health Effects
 - f. ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 - g. ASTM D3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic (Molded) Fittings for Polyethylene (PE) Plastic Pipe and Tubing

- h. ASTM F2206: Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, and Sheet, Plate or Block Stock
 - i. ASTM D2683: Standard Specification for Socket Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 - j. ASTM F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 - k. AWWA M55: PE Pipe–Design and Installation, Manual of Water Supply Practices
 - l. Plastics Pipe Institute (PPI) Handbook of Polyethylene Pipe
 - m. Pipe Chart, HDPE Potable Water Pipe PE 4710, P & F Distributors
2. Fusion
- a. ASTM F2620: Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
 - b. ASTM F3124: Standard Practice for Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
 - c. ASTM F1290: Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
 - d. PPI TR-33-12: Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
 - e. PPI, MAB-1-2015: MAB Generic Electrofusion Procedure for Field Joining of 12 Inch & Smaller Polyethylene (PE) Pipe
 - f. PPI, MAB-2-2017: MAB Generic Electrofusion Procedure for Field Joining of 14 Inch to 30 Inch Polyethylene (PE) Pipe

END OF SECTION