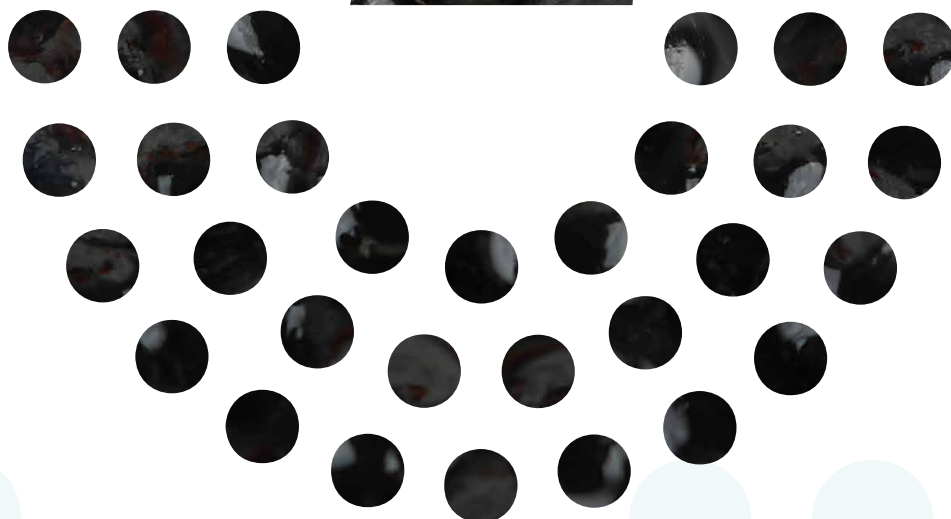




An Amiantit Company

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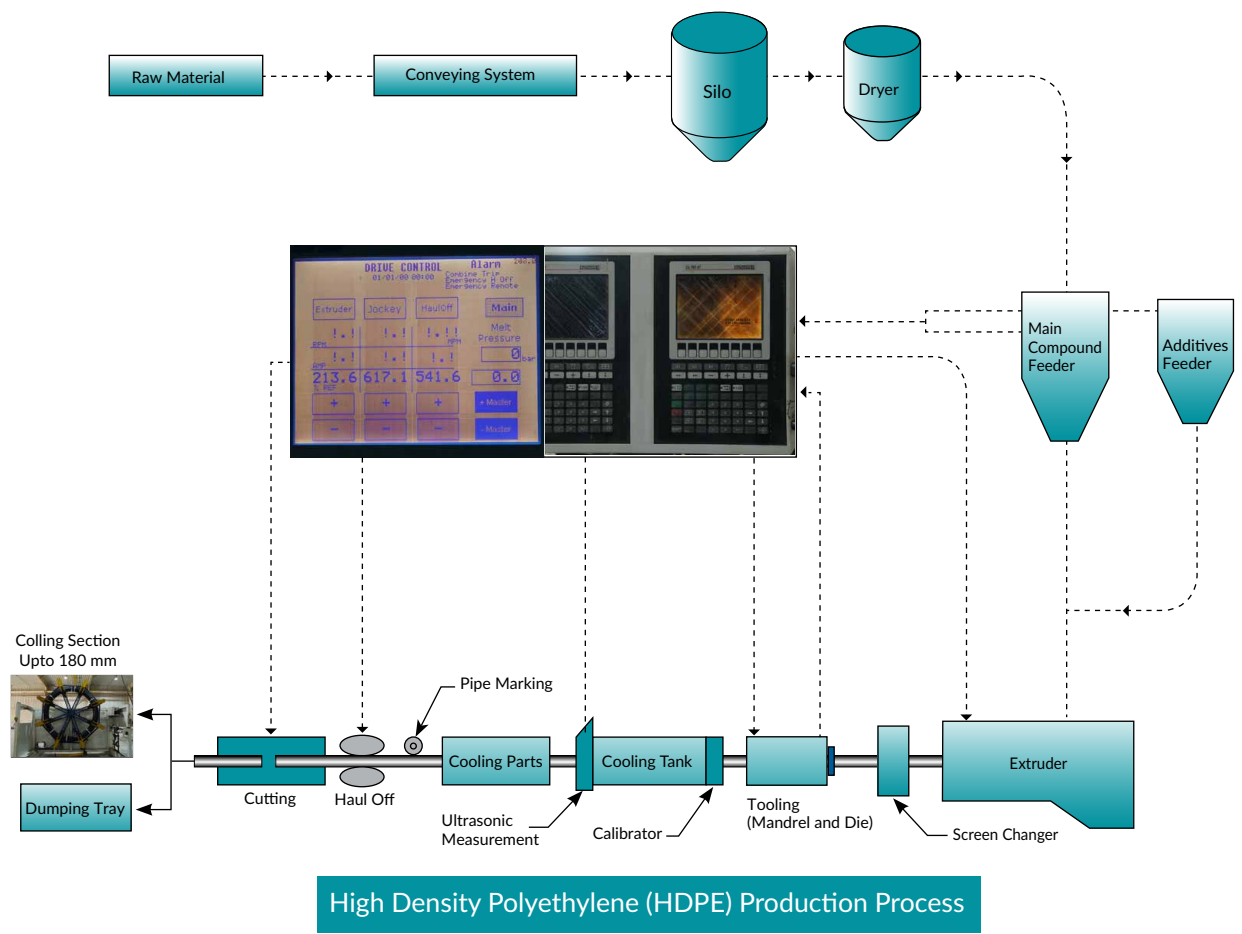
Poly Pipe Manufacturing Co. (APPCO)

Introduction

The world’s infrastructure is aging, with millions of kilometers of gas, water, and sewer pipes needing rehabilitation, especially in industrialized countries. In many developing nations, the challenge is different — they must still build their water infrastructure and carefully choose materials to avoid future problems. The major issue in aging systems is corrosion, which is irreversible. Internally, sewer pipes deteriorate due to sulphuric acid from the hydrogen sulphide cycle; externally, soil conditions and stray currents cause underground pipe corrosion, worsened by poorly drained soils and sulphate-reducing bacteria. These problems can be minimized or avoided by selecting corrosion-resistant materials, such as Amiantit Polyethylene APPCO pipes.

Production Process

APPCO operates a modern continuous extrusion process for manufacturing polyethylene pipes, including both High-Density Polyethylene (HDPE) and Medium-Density Polyethylene pipes, meeting ISO 4427 and DIN 8074 standards for water applications, and ISO 4473 and ASTM D2513 standards for gas applications. The process begins with drying raw HDPE granules to remove moisture. The granules are then fed into an extruder, which heats them to 180-200°C (356-392°F) to form the pipe. The extruded product is checked for impurities by a screen changer, and the die and mandrel shape the pipe’s diameter and dimensions. After shaping, the pipe is cooled in a calibration tank before final marking, cutting, or coiling.



Product Advantages

Feature	Benefits
High flexibility combined with high impact resistance	PE pipes can be supplied in coils up to 160 mm in diameter, reducing joints and site stress. They generate lower surge pressures than rigid pipes and are unaffected by soil settlement. The pipes are highly durable, with excellent resistance to impact, improper handling, and tearing, thanks to their low notch sensitivity.
Squeeze-off ability	With no damage to or effect on the pipe's short & long term properties
UV resistance	With no damage to or effect on the pipe's short & long term properties
High chemical and corrosion resistance	PE pipes do not rust or corrode, offering lower lifecycle costs and long life expectancy with minimal maintenance. They withstand aggressive soil conditions, groundwater, and a wide range of chemicals, as well as all natural gas constituents.
Non-toxic material	Approved for use in drinking water applications. Approved for food contact.
Abrasion resistance	HDPE pipes outperform conventional pipes, depending on the application, by a factor of 7
Low thermal conductivity	Thermal conductivity value of 0.4 W/m.°C
Excellent flow characteristics	Polyethylene pipes have a hydraulically smooth bore, with a Colebrook formula K value of 0.001 and a Hazen-Williams formula C value of 155.

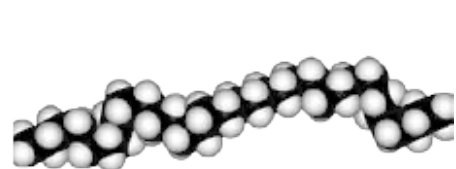
HDPE Pipes Applications

Hot & cold water system	Drinking potable water supply	Storm water drainage	Drainage of leachate systems
Land drainage	Irrigation	Industrial water	Chemical process piping
Fire fighting system	Domestic gas & oil pipe systems	Sewer & effluent treatment plants	Cable ducts (non-pressure pipes)
Water disposal	Sewer Network	Outfalls	Waste dams
Industrial Waste	Sand & slurry pumping	Outfalls	

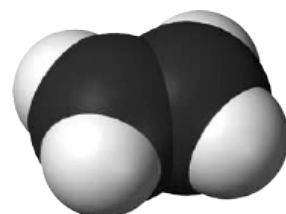
Product Characteristics

Molecular Structure

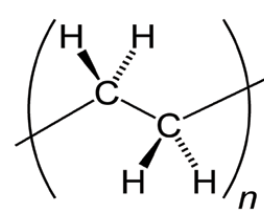
Polyethylene (PE) is a polymer consisting of long chains of the monomer ethylene C_2H_4 , also known as ethane. The molecules, which consist of two CH_2 groups, are connected by a double bond.



HDPE chain molecules



Single HDPE molecule



Chemical chart of HDPE

APPCO uses HDPE material with low branching and short side chains ("linear polyethylene"), resulting in higher crystallization, density, and improved material properties.

Polyethylene properties are mainly influenced by density, molecular weight, and molecular weight distribution. When density increases, the following properties also increase:

- Yield stress (tensile strength)
- Modulus of elasticity
- Hardness
- Solvent resistance
- Impermeability to gases and vapours

Raw Material Classifications

Polyethylene is classified mainly by density and branching, with its mechanical properties influenced by branching, crystal structure, and molecular weight. APPCO uses two specific PE classifications for its pipe production.

- HDPE (High density polyethylene)

HDPE, with a density of $\geq 0.941 \text{ g/cm}^3$, has low branching, resulting in stronger intermolecular forces and high tensile strength. Its structure is controlled by catalyst and reaction conditions, and it is also used in packaging.

Raw Material Colour

HDPE is naturally non-colored, but pre-compounded black and blue HDPE materials are recommended for pipe manufacturing. Other colors are available upon request.



Non-coloured HDPE granules



Coloured HDPE granules

Pipe color depends on the application: black and blue for potable water, yellow for gas, and other colors as required by local authorities.

Pipe Material Classification

High-density polyethylene (HDPE) pipe grade material is classified as PE 100, where the classification number represents 10 times the minimum required strength (MRS) of 10.0 MPa as shown in the following table

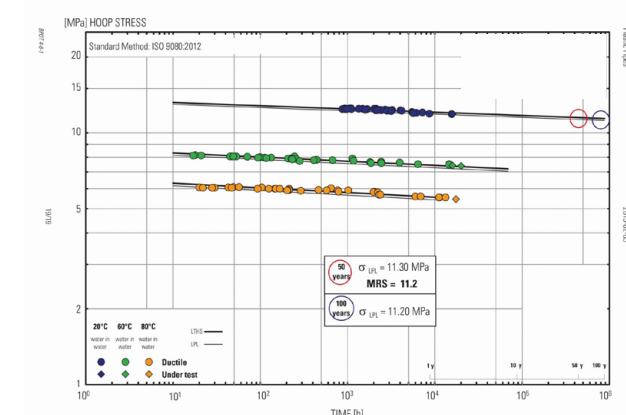
Classification of HDPE	Classification Number	MRS MPa
PE 100	100	10

Classification of HDPE material

Material Regression Curve

HDPE is naturally non-colored, but pre-compounded black and blue HDPE materials are recommended for pipe manufacturing. Other colors are available upon request.

Following SEM evaluation according to ISO/TR 9080 for HDPE material, the regression curve for PE 100 is shown in the following figure:



Material regression curve for PE 100

- Raw material technical data sheet
- Proof that the material is listed as PE 100 by third parties (e.g., the Plastic Pipe Institute's Technical Report TR #4 or RAL listing for HDPE material) must be provided
- A third-party long-term test report must confirm the MRS value and the raw material regression curve according to ISO/TR 9080
- For potable water applications, the material supplier and material code must be approved by organizations to confirm compliance with ANSI #61 (NSF and WRAS)
- Pre-compounded material includes UV stabilizers, color, antioxidants, and pigments

Product technical data PE100

Standard dimension ratio (SDR)																																			
7.4				9				11				13.6				17				21				26				33				41			
Nominal pressure (PN) bar																																			
PE 100		PN 25		PN 20		PN 16		PN 12.5		PN 10		PN 8		PN 6		PN 5		PN 4		Outside diameter OD(2)		Ovality(1)													
Pipe OD (mm)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)	Linear weight (kg/m)	Minimum WT (mm)	WT tolerance (mm)						
16	0.3	2.3	0.4	0.10	2.0	0.3	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.3	1.2							
20	0.3	3.0	0.4	0.16	2.3	0.4	0.13	2.3	0.3	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.3	1.2							
25	0.3	3.5	0.5	0.24	3.0	0.4	0.21	2.3	0.4	0.17	2.0	0.3	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	25.3	1.2							
32	0.3	4.4	0.6	0.39	3.6	0.5	0.33	3.0	0.4	0.28	2.4	0.4	0.23	2.0	0.3	0.19	-	-	-	-	-	-	-	-	-	-	32.3	1.3							
40	0.4	5.5	0.7	0.60	4.5	0.6	0.51	3.7	0.5	0.43	3.0	0.5	0.36	2.4	0.4	0.29	2.0	0.3	0.25	-	-	-	-	-	-	-	40.4	1.4							
50	0.4	6.9	0.8	0.94	5.6	0.7	0.79	4.6	0.6	0.67	3.7	0.5	0.55	3.0	0.4	0.45	2.4	0.4	0.37	2.0	0.3	0.31	-	-	-	-	50.4	1.4							
63	0.4	8.6	1.0	1.48	7.1	0.9	1.26	5.8	0.7	1.05	4.7	0.6	0.87	3.8	0.5	0.72	3.0	0.4	0.58	2.5	0.4	0.49	-	-	-	-	63.4	1.5							
75	0.5	10.3	1.2	2.10	8.4	1.0	1.77	6.8	0.8	1.47	5.6	0.7	1.24	4.5	0.6	1.01	3.6	0.5	0.82	2.9	0.4	0.67	-	-	-	-	75.5	1.6							
90	0.6	12.3	1.4	3.02	10.1	1.2	2.56	8.2	1.0	2.13	6.7	0.8	1.77	5.4	0.7	1.46	4.3	0.6	1.18	3.5	0.5	0.97	-	-	-	-	90.6	1.8							
110	0.7	15.1	1.7	4.52	12.3	1.4	3.80	10.2	1.1	3.16	8.1	1.0	2.63	6.6	0.8	2.17	5.3	0.7	1.78	4.2	0.6	1.43	-	-	-	-	110.7	2.2							
125	0.8	17.1	1.9	5.81	14.0	1.6	4.91	11.4	1.3	4.16	9.2	1.1	3.38	7.4	0.9	2.77	6.0	0.7	2.27	4.8	0.6	1.84	-	-	-	-	125.8	2.5							
140	0.9	19.2	2.1	7.30	15.7	1.7	6.15	12.7	1.4	5.11	10.3	1.2	4.24	8.3	1.0	3.48	6.7	0.8	2.84	5.4	0.7	2.32	-	-	-	-	140.9	2.8							
160	1.0	21.9	2.3	9.51	17.9	1.9	8.01	14.6	1.6	6.70	11.8	1.3	5.53	9.5	1.1	4.54	7.7	0.9	3.73	6.2	0.8	3.05	-	-	-	-	161.0	3.2							
180	1.1	24.6	2.6	12.02	20.1	2.2	10.14	16.4	1.8	8.47	13.3	1.5	7.02	10.7	1.2	5.74	8.6	1.0	4.68	6.9	0.8	3.79	-	-	-	-	181.1	3.6							
200	1.2	27.4	2.9	14.87	22.4	2.4	12.53	18.2	2.0	10.45	14.7	1.6	8.61	11.9	1.3	7.08	9.6	1.1	5.80	7.7	0.9	4.71	-	-	-	-	201.2	4.0							
225	1.4	30.8	3.2	18.79	25.2	2.7	15.87	20.5	2.2	13.23	16.6	1.8	10.93	13.4	1.5	8.98	10.8	1.2	7.33	8.6	1.0	5.91	-	-	-	-	226.4	4.5							
250	1.5	34.2	3.6	23.20	27.9	2.9	19.5	22.7	2.4	16.27	18.4	2.0	13.47	14.8	1.6	11.01	11.9	1.3	8.97	9.6	1.1	7.33	-	-	-	-	251.5	5.0							
280	1.7	38.3	4.0	29.09	31.3	3.3	24.51	25.4	2.7	20.40	20.6	2.2	16.87	16.6	1.8	13.83	13.4	1.5	11.32	10.7	1.2	9.14	-	-	-	-	281.7	5.8							
315	1.9	43.1	4.5	36.82	35.2	3.7	31.01	28.6	3.0	25.82	23.2	2.5	21.39	18.7	2.0	17.51	15.0	1.6	14.23	12.1	1.4	11.64	9.7	1.1	9.40	7.7	0.9	7.53							
355	2.2	48.5	5.0	46.69	39.7	4.1	39.38	32.2	3.4	32.77	26.1	2.8	27.12	21.1	2.3	22.29	16.9	1.8	18.07	13.6	1.5	14.72	10.9	1.2	11.89	8.7	1.0	9.58							
400	2.4	54.7	5.6	59.30	44.7	4.6	49.95	36.3	3.8	41.61	29.4	3.1	34.38	23.7	2.5	28.17	19.1	2.1	23.04	15.3	1.7	18.66	12.3	1.4	15.14	9.8	1.1	12.14							
450	2.7	-	-	-	50.3	5.2	63.25	40.9	4.2	52.69	33.1	3.5	43.55	26.7	2.8	35.69	21.5	2.3	29.14	17.2	1.9	23.59	13.8	1.5	19.07	11.0	1.2	15.31							
500	3.0	-	-	-	55.8	5.7	77.94	45.4	4.7	65.01	36.8	3.8	53.74	29.7	3.1	44.09	23.9	2.5	35.95	19.1	2.1	29.10	15.3	1.7	23.52	12.3	1.4	19.06							
560	3.4	-	-	-	-	-	50.8	5.2	81.45	41.2	4.3	67.43	33.2	3.5	55.24	26.7	2.8	44.99	21.4	2.3	36.48	17.2	1.9	29.60	13.7	1.5	23.73								
630	3.8	-	-	-	-	-	57.2	5.9	103.19	46.3	4.8	85.22	37.4	3.9	69.96	30.0	3.1	56.83	24.1	2.6	46.22	19.3	2.1	37.34	15.4	1.7	30.02								

- [1] Ovality tolerances calculated as per ISO 11922-1 Grade N
- [2] OD tolerances calculated as per ISO 11922-1 grade B (0.006 DN, rounded up to the next greater 0.1 mm with minimum value of 0.3 mm and max 4.0 mm.
- [3] Thickness tolerances calculated as per ISO 11922-1 grade V (0.1WTmin +0.1) mm rounded up to the next 0.1 mm.
- [4] The weight calculated with average density of 0.955 g/cm.

Pipe wall thickness/weight/tolerances

HDPE pipes steel backing rings for stub flanges

(AS PER DIN STANDARD) EN-1092-1 DIN-2577, PN10/16										(AS PER ANSI CLASS 150 B16.5)								
PIPE OD (mm)	Backing ring size (mm)	Pressure PN (Bar)	OD of backing ring (mm)	ID (mm)	PCD (mm)	Bolt hole dia. (mm)	No. of bolts	Bolt size	Torque value (N.mm)	Thickness (mm)	External dia. (mm)	ID (mm)	PCD (mm)	Bolt hole dia. (mm)	No. of bolts	Bolt size (inches)	Torque value (N.mm)	Galvanized steel (thickness) mm
20	15	16	95	28	65	14	4	M12	15	12	90	32	60.5	16.0	4	1/2	15	11.1
25	20	16	105	34	75	14	4	M12	15	14	98	37	70.0	16.0	4	1/2	15	12.7
32	25	16	115	42	85	14	4	M16	15	16	108	44	79.5	16.0	4	1/2	15	14.3
40	32	16	140	51	100	18	4	M16	25	18	117	52	89.0	16.0	4	1/2	25	17.5
50	40	16	150	62	110	18	4	M16	35	18	127	62	98.5	16.0	4	1/2	35	17.5
63	50	16	165	78	125	18	4	M16	35	18	152	78	120.5	20.0	4	5/8	35	19.0
75	65	16	185	92	145	18	8	M16	40	18	178	92	139.5	20.0	4	5/8	40	22.3
90	80	16	200	108	160	18	8	M16	40	20	191	108	152.0	20.0	4	5/8	40	23.9
110	100	16	220	128	180	18	8	M16	40	20	229	128	190.5	20.0	8	5/8	40	23.9
125	100	16	220	135	180	18	8	M16	45	20	254	140	216.0	23.0	8	3/4	40	23.9
140	125	16	250	158	210	18	8	M16	50	24	254	158	216.0	23.0	8	3/4	50	23.9
160	150	16	285	178	240	22	8	M20	60	24	279	178	241.0	23.0	8	3/4	60	25.4
180	150	16	285	188	240	22	8	M20	60	24	279	195	241.0	23.0	8	3/4	60	25.4
200	200	16	340	235	295	22	12	M20	70	24	343	235	298.5	23.0	8	3/4	70	28.4
225	200	16	340	238	295	22	12	M20	70	24	343	240	298.5	23.0	8	3/4	70	28.4
250	250	16	405	288	355	26	12	M24	100	30	406	290	362.0	26.0	12	7/8	100	30.2
280	250	16	405	294	355	26	12	M24	100	30	406	300	362.0	26.0	12	7/8	100	30.2
315	300	16	460	338	410	26	12	M24	110	34	483	345	432.0	26.0	12	7/8	110	31.8
355	350	16	520	376	470	26	16	M24	160	42	535	376	476.0	29.0	12	1	160	35.0
400	400	16	580	430	525	30	16	M27	170	46	600	430	540.0	29.0	16	1	170	36.6
450	500	16	715	517	650	33	20	M30	190	45	635	480	578.0	32.0	16	1.1/8	190	39.6
500	500	16	715	535	650	33	20	M30	190	45	700	533	635.0	32.0	20	1.1/8	190	43.0
560	600	16	840	618	770	36	20	M33	220	50	750	590	692.0	34.9	20	1.1/4	220	46.0
630	600	16	840	645	770	36	20	M33	220	50	815	660	750.0	35.0	20	1.1/4	220	47.8

Support Distance of HDPE Pipes (PE100)

SIZE	SDR 26	SDR 21	SDR 17	SDR 13.6	SDR 11	SDR9
20	0.5	0.5	0.6	0.6	0.6	0.7
25	0.5	0.6	0.7	0.7	0.7	0.8
32	0.6	0.7	0.8	0.8	0.9	0.9
40	0.7	0.9	0.9	1.0	1.0	1.1
50	0.9	1.0	1.0	1.1	1.2	1.2
63	1.0	1.2	1.2	1.3	1.4	1.4
75	1.1	1.3	1.4	1.5	1.5	1.6
90	1.3	1.5	1.6	1.7	1.7	1.8
110	1.5	1.7	1.8	1.9	2.0	2.1
125	1.6	1.8	2.0	2.1	2.2	2.3
140	1.7	2.0	2.1	2.2	2.4	2.5
160	1.9	2.2	2.3	2.5	2.6	2.7
200	2.2	2.5	2.7	2.9	3.0	3.2
225	2.4	2.7	2.9	3.1	3.3	3.4
250	2.6	3.0	3.1	3.3	3.5	3.7
280	2.8	3.2	3.4	3.6	3.8	4.0
315	3.0	3.4	3.7	3.9	4.1	4.3
355	3.3	3.7	4.0	4.2	4.4	4.7
400	3.5	4.0	4.3	4.5	4.8	5.0
450	3.8	4.4	4.7	4.9	5.2	5.5
500	4.1	4.7	5.0	5.3	5.6	5.9
560	4.4	5.1	5.4	5.7	6.0	6.0
630	4.8	5.5	5.8	6.2	6.5	6.8

- ! Note:
- 1. All distance are quoted in meters.
 - 2. These distances should not be used for gravity pipelines.



High Density Polyethylene Pipe Installed for Sea Water

Excellent Flow Characteristics

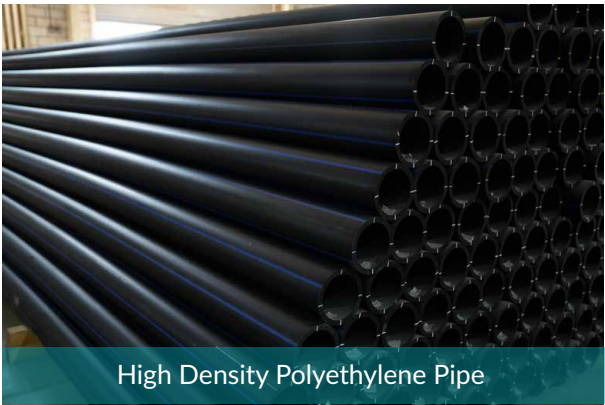
Polyethylene’s smooth surface allows smaller pipes to carry the same flow at the same pressure, with less drag, minimal turbulence, and excellent resistance to scaling and pitting, maintaining hydraulic performance over its service life

Overall Service (Design) Coefficient (C) or Safety Factor

The “C” coefficient (>1) accounts for service conditions and component properties beyond the lower confidence limit. ISO 12162 sets a minimum safety factor of 1.25 for water applications and 2 for gas applications (ISO 4437) in polyethylene pipes

UV Resistance

HDPE material offers excellent long-term weather resistance. With 2–2.5% carbon black content, it blocks UV rays, allowing pipes to be stored or used outdoors for years without degradation or extra protection



High Density Polyethylene Pipe

Abrasion Resistance

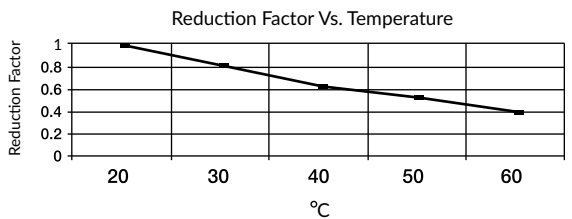
HDPE pipes offer superior abrasion resistance compared to steel, cement, and PVC, making them a longer-lasting and more cost-effective solution for conveying abrasive slurries at velocities up to 3 m/s

Thermal Expansion & Contraction

Polyethylene has a higher thermal expansion coefficient (1.8×10^{-4} mm/mm°C) than most piping materials, but generates lower thermal stresses due to its low elasticity and stress relaxation capability

Reduction Factor

The lifespan and performance of HDPE pipes are influenced by working pressure and temperature. At high temperatures and pressures, the following reduction factor in the lifespan of HDPE pipes will apply:



Chemical Resistance Data

Polyethylene pipes are highly resistant to a wide range of chemicals, do not degrade in soil, and do not support microbial growth. Chemical resistance depends on temperature and concentration. HDPE performs optimally up to 40°C; however, in environments with high temperature and pressure, the following reduction factor in the lifespan of HDPE Pipe will apply:

Chemical	20°C	60°C	Chemical	20°C	60°C
Acrylic emulsions	S	S	Coconut of alcohols	S	S
Aluminum Chloride	S	S	Copper Chloride sat	S	S
Aluminum Chloride con	S	S	Copper Cyanide sat	S	S
Aluminum Fluoride con	S	S	Copper Fluoride	S	S
Aluminum Sulfate con	S	S	Copper Nitrate sat	S	S
Ammonia 100% dry gas	S	S	Copper Sulfate d	S	S
Ammonium Carbonate	S	S	Copper Sulfate sat	S	S
Ammonium Chloride sat	S	S	Cuprous Chloride sat	S	S
Ammonium Fluoride 20%	S	S	Cyclohexanone	U	U
Ammonium Metaphosphate sat	S	S	Dextrin sat	S	S
Ammonium Persulfate sat	S	S	Dextrose sat	S	S
Ammonium Sulfate sat	S	S	Disodium Phosphate	S	S
Ammonium Sulfide sat	S	S	Diethylene Glycol	S	S
Ammonium Thiocyanate sat	S	S	Emulsions Photographic	S	S
Aniline 100%	S	NA	Ethyl Chloride	O	U
Antimony Chloride	S	S	Ferric Chloride sat	S	S
Barium Carbonate sat	S	S	Ferric Nitrate sat	S	S
Barium Chloride	S	S	Ferrous Chloride sat	S	S
Barium Sulfate sat	S	S	Ferrous Sulfate	S	S
Barium Sulfide sat	S	S	Fluoboric Acid	S	S
Benzene Sulfonic Acid	S	S	Fluorine	S	U
Bismuth Carbonate sat	S	S	Fluosilicic Acid 325	S	S
Black Liquor	S	S	Fluosilicic Acid conc	S	S
Borax Cold sat	S	S	Formic Acid 20%	S	S
Boric Acid d	S	S	Formic Acid 50%	S	S
Boric Acid 10%	S	S	Formic Acid 100%	S	S
Bromine Liquid 100%	O	U	Fructose sat	S	S
Butanediol 10%	S	S	Fuel oil	S	U
Butanediol 60%	S	S	Glycol	S	S
Butanediol 100%	S	S	Glycolic acid 30%	S	S
Butyl Acetate 100%	O	U	Hydrobromic acid 30%	S	S
Calcium Bisulfide	S	S	Hydrocyanic acid sat	S	S
Calcium Carbonate sat	S	S	Hydrochloric Acid 30%	S	S
Calcium Chlorate sat	S	S	Hydrofluoric Acid 40%	S	S
Calcium Hypochlorite Bleach	S	S	Hydrofluoric Acid 60%	S	S
Calcium Nitrate 50%	S	S	Hydrogen 100%	S	S
Calcium Sulfate	S	S	Hydrogen Bromide 10%	S	S
Carbon Dioxide 100% dry	S	S	Hydrogen Chloride Gas dry	S	S
Carbon Dioxide 100% wet	S	S	Hydroquinone	S	S
Carbon Dioxide 100% cold sat	S	S	Hydrogen Sulfide	S	S
Carbon Disulphide	NA	U	Hypochlorous Acid conc	S	S
Carbon Monoxide	S	S	Lead Acetate sat	S	S
Chlorine liquid	O	U	Magnesium carbonate sat	S	S
Chlorosulfonic Acid	U	U	Magnesium Chloride sat	S	S
Chromic Acid 50%	S	O	Magnesium Hydroxide sat	S	S
Cider	S	S	Magnesium Sulfate sat	S	S

Chemical	20°C	60°C	Chemical	20°C	60°C
Mercuric Chloride	S	S	Sodium Acetate sat	S	S
Mercuric Cyanide sat	S	S	Sodium Benzoate 35%	S	S
Mercurous Nitrate sat	S	S	Sodium Bisulfate sat	S	S
Methyl Ethyl Ketone 100%	U	U	Sodium Bisulfite sat	S	S
Methyl Bromide	O	U	Sodium Borate	S	S
Methylsulfuric Acid	S	S	Sodium Bromide Oil sol	S	S
Methylene Chloride 100%	U	U	Sodium Carbonate conc	S	S
Nickel Chloride sat	S	S	Sodium Carbonate	S	S
Nickel Citrate Conc	S	S	Sodium Chlorate sat	S	S
Nickel Sulfate sat	S	S	Sodium Chloride sat	S	S
Nicotinic Acid	S	S	Sodium Cyanide	S	S
Nitric Acid <50%	S	S	Sodium Dichromate sat	S	S
Nitrobenzene 100%	U	U	Sodium Ferricyanide sat	S	S
Oleum conc	U	U	Sodium Ferro cyanide	S	S
Oxalic Acid d	S	S	Sodium Fluoride sat	S	S
Oxalic Acid sat	S	S	Sodium Nitrate	S	S
Petroleum Ether	U	U	Sodium Sulfate	S	S
Phosphoric Acid 0-30%	S	S	Sodium Sulfide 20% to sat	S	S
Phosphoric Acid 90%	S	S	Sodium Sulfite sat	S	S
Photographic Solutions	S	S	Stannous Chloride sat	S	S
Potassium Bicarbonate sat	S	S	Stannic Chloride sat	S	S
Potassium Borate 1%	S	S	Starch Solution sat	S	S
Potassium Bromate 10%	S	S	Sulfuric Acid <50%	S	S
Potassium Bromide sat	S	S	Sulfuric Acid 96%	O	U
Potassium Carbonate	S	S	Sulfuric Acid 98% conc	O	U
Potassium Chlorate sat	S	S	Sulfurous Acid	S	S
Potassium Chloride sat	S	S	Tannic Acid 10%	S	S
Potassium Chromate 40%	S	S	Tetralin	U	U
Potassium Cyanide sat	S	S	Tetrahydrofuran	O	O
Potassium Ferri/Ferro Cyanide	S	S	Tichloroacetic Acid	S	S
Potassium Fluoride	S	S	Trisodium Phosphate sat	S	S
Potassium Nitrate sat	S	S	Urea	S	S
Potassium Perborate sat	S	S	Urine	S	S
Potassium Perchlorate 10%	S	S	Wetting Agents	S	S
Potassium Permangante 20 %	S	S	Xylene	U	U
Propargyl Alcohol	S	S	Zinc Chloride sat	S	S
Propylene Glycol	S	S	Zinc Sulfate sat	S	S
Propargyl Alcohol	S	S			
Potassium Sulfate conc	S	S			
Potassium Sulfide conc	S	S			
Potassium Sulfite conc	S	S			
Potassium Persulfate sat	S	S			
Sea Water	S	S			
Shortening	S	S			
Silicic Acid	S	S			

Legend:

S: Satisfactory
O: Some Attack
U: Unsatisfactory
NA: no Data Available
d: Diluted
Conc.: Concentrated
sat: Saturated
sol: Solution

Product Range

1. Pipes

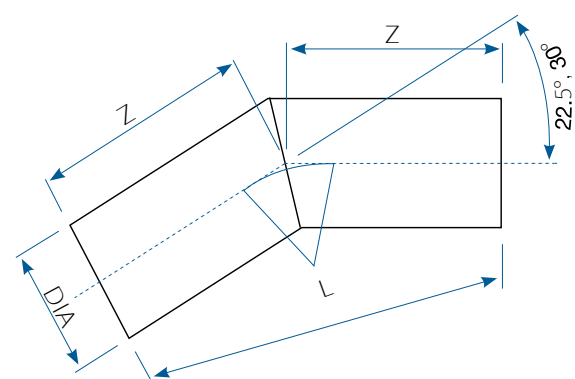
APPCO has four production lines and can supply an extensive range of pipes, as well as an outstanding range of fittings and accessories. The product range includes:

- PE solid wall pipes are standard rated up to 16 bar and can reach 32 bar for specific requirements
- Pipes with an outside diameter between 16 mm and 630 mm
- 12-meter standard pipe length
- Diameters of up to 160 mm can be supplied on coils

2. Fitting and Accessories

Fittings are available as injection-moulded, electrofusion, segment-welded or compression mechanical coupling parts and include:

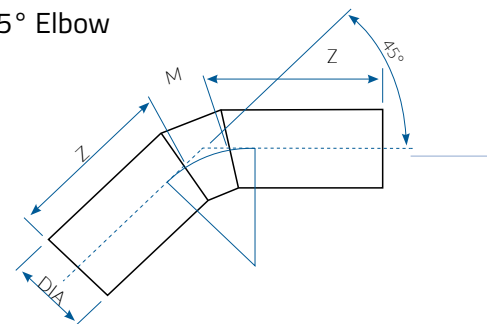
- Tees/ reduced tees wyes (45°, 60°)
- Bends/ elbows
- Reducers
- Flanges connections
- Saddles / tapping tees/ valves
- Cross X



2.1 Segment Welded Fittings

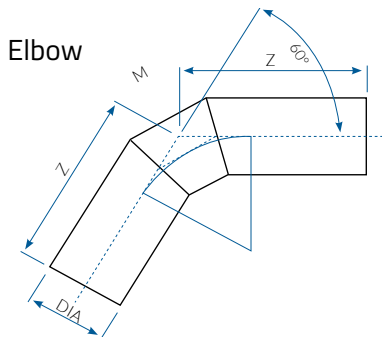
22.5°, 30° elbow

45° Elbow



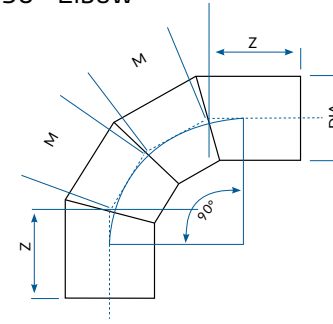
OD (mm)	Z (mm)	M (mm)	Laying length (mm)
110	269	72	610
125	275	81	631
140	281	90	652
160	289	102	680
180	297	114	708
200	305	127	737
225	315	142	772
250	325	157	807
280	337	175	848
315	351	197	898
355	642	221	1504
400	660	248	1567
450	680	279	1638
500	700	309	1708
560	723	346	1793
630	751	388	1891

60° Elbow



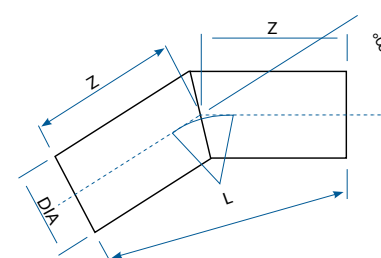
OD (mm)	Z (mm)	M (mm)	Laying length (mm)
110	269	93	631
125	275	105	655
140	281	117	679
160	289	133	711
180	297	149	743
200	305	165	775
225	315	185	815
250	325	205	855
280	337	228	901
315	351	256	957
355	642	288	1571
400	660	324	1643
450	680	364	1723
500	700	404	1803
560	723	452	1899
630	751	508	2011

90° Elbow



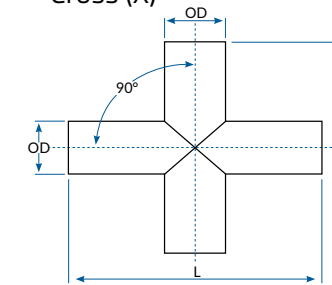
OD (mm)	Z (mm)	M (mm)	Laying length (mm)
110	269	93	362
125	275	105	380
140	281	117	398
160	289	133	422
180	297	149	446
200	305	165	470
225	315	185	500
250	325	205	530
280	337	228	565
315	351	256	607
355	642	288	930
400	660	324	984
450	680	364	1044
500	700	404	1104
560	723	452	1175
630	751	508	1259

30° elbow



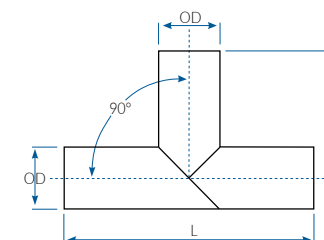
OD (mm)	Z (mm)	Laying length (mm)
110	269	538
125	275	550
140	281	562
160	289	578
180	297	594
200	305	610
225	315	630
250	325	650
280	337	673
315	351	701
355	642	1283
400	660	1319
450	680	1359
500	700	1399
560	723	1447
630	751	1503

Cross (X)



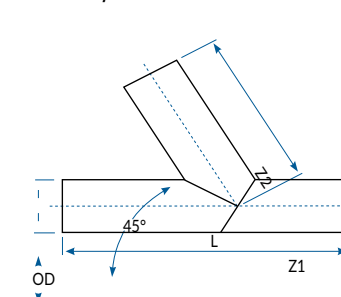
OD (mm)	Z (mm)	L (mm)
110	340	680
125	350	700
140	350	700
160	360	720
180	370	740
200	380	760
225	400	800
250	400	800
280	420	840
315	440	880
355	730	1460
400	750	1500
450	780	1560
500	800	1600
560	830	1660
630	870	1740

Equal Tee



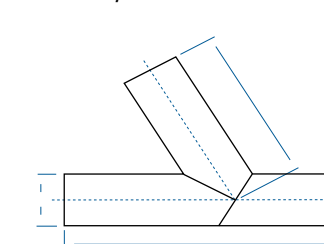
OD (mm)	Z (mm)	L (mm)
110	340	680
125	350	700
140	350	700
160	360	720
180	370	740
200	380	760
225	400	800
250	400	800
280	420	840
315	440	880
355	730	1460
400	750	1500
450	780	1560
500	800	1600
560	830	1660
630	870	1740

45° Wye



OD (mm)	Z2 (mm)	Z1 (mm)	Laying length (mm)
110	577	282	859
125	588	286	874
140	599	290	889
160	613	296	909
180	627	302	929
200	642	307	949
225	660	315	974
250	678	322	1000
280	700	330	1030
315	725	340	1065
355	1252	652	1904
400	1284	665	1949
450	1320	679	1999
500	1356	693	2050
560	1400	711	2110
630	1450	731	2181

60° Wye



OD (mm)	Z2 (mm)	Z1 (mm)	Laying length (mm)
110	458	282	739
125	467	286	753
140	476	290	766
160	487	296	783
180	499	302	801
200	511	307	818
225	525	315	840
250	540	322	862
280	558	330	888
315	578	340	918
355	1016	652	1668
400	1043	665	1707
450	1072	679	1751
500	1101	693	1795
560	1137	711	1847
630	1178	731	1908

Electro Fusion Fittings and Adapters

EF Coupling	EF End Cap	EF Service Tee Set valued	EF Service Tee Set flat with clamps
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10
EF End 90° Elbow	EF End 45° Elbow	EF Concentric Reducer	EF Equal Tee
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10
EF Service Tee Set Flat	EF Repair Adapter		
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10		

Injection Moulded Fittings

90° Elbow	60° Elbow	Steel Flange (Backing Ring)	Bland Steel Flange
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10
45° Elbow	End Cap	Welded Steel Transition Adapter	Transition Adapter Female
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10
Equal Tee	Reducer Tee	Transition Adapter Male	
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10	
Reducer	Flange Adapter		
			
Pressure rating: SDR11 PN16 & SDR17 PN10	Pressure rating: SDR11 PN16 & SDR17 PN10		

Compression Fittings PE100 SDR11 PN16

Coupling		Reducing Coupling	
			
OD20 mm up to OD110 mm		OD20 x 25 mm up to OD110 x 90 mm	

Flange Adapter (Stub Flange)		End Cap	
			
OD20 mm up to OD630 mm		OD20 mm up to OD315 mm	

Male Adapter		Female Adapter	
			
D20 mm x 1/2" up to OD110 mm x 4"		OD20 mm x 1/2" up to OD110 mm x 4"	

Reducing Tee		Repair Slip Coupling	
			
OD20 x 16 x 20 mm up to OD110 x 90 x 110 mm		OD40 mm up to OD110 mm	

Equal Tee		Elbow 90° AND 45°	
			
OD20 mm up to OD110 mm		OD20 x 25 mm up to OD110 x 90 mm	

Female Tee With Peg Fitting		90° Elbow With Lateral Threaded Female Take Off	
			
OD32 mm x 3/4" x 32 mm		OD25 mm x 25 mm x 1/2"	

Tee With Threaded Female Take Off		Tee With Threaded Female Take Off	
			
OD20 mm x 1/2" up to OD110 mm x 4"		OD20 mm x 1/2"x20 mm up to OD110 mm x4"x110 mm	

90° Tee With Increased Take Off		Universal Transition Coupling	
			
OD20 x 25 x 20 mm up to OD40 x 50 x 40 mm		OD15 x 25 mm up to OD34 x 32 mm	

Male Adaptor With Brass Threaded Insert	Female Adaptor With Brass Threaded Insert
	
OD20 mm x 1/2" up to OD63 mm x 2"	OD20 mm x 1/2" up to OD63 mm x 2"

Clamp Saddle	Double Clamp Saddle
	
OD25 mm x 1/2" up to OD125 mm x 3"	OD25 mm x 1/2" up to OD125 mm x 2"

Clamp Saddle with Reinforcing Ring	Double Clamp Saddle with Reinforcing Ring
	
OD25 mm x 1/2" up to OD125 mm x 3"	OD25 mm x 1/2" up to OD125 mm x 2"

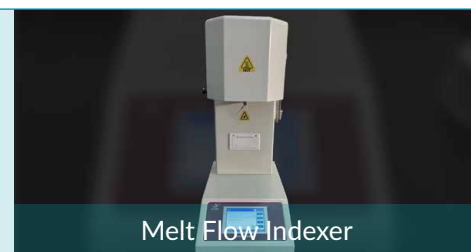
Clamp Saddle with Reinforcing Ring PN 16	Double Clamp Saddle with Reinforcing Ring PN 16
	
OD25 mm x 1/2" up to OD110 mm x 2"	OD25 mm x 1/2" up to OD110 mm x 2"



Quality Control

QC Test Method With Reference Standards

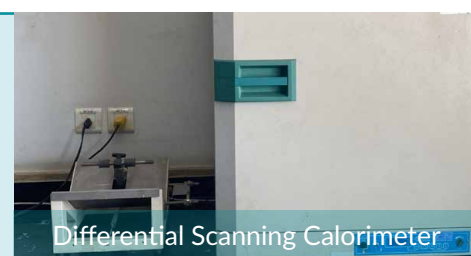
Property : Melt mass flow rate (MFR)
Reference test : ISO 1133
Standard value : 0.27 ± 0.068 change in MFR value caused by processing, between the measured value for material from the pipe and the measured value for the compound, must not be greater than $\pm 25\%$.
Equipment:



Property :Density
Reference test : ISO 1183
Standard value : Density shall fall within PE material density range (≥ 0.94).
Equipment:



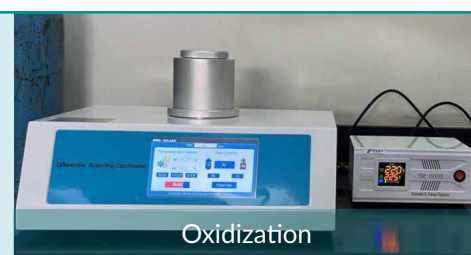
Property : Longitudinal reversion (shrinkage)
Reference test : ISO 2505-1
Standard value : Longitudinal reversion (shrinkage) shall be $\leq 3\%$.
Equipment:



Property :Tensile test
Reference test : ISO 6259 1.3
Standard value : Elongation at break must be
Equipment:



Property : Thermal stability oxidation induction time (OIT)
Reference test : ISO / TR 10837
Standard value :O.I.T. must be when tested at 210 C
Equipment:



Property : Carbon black content
Reference test : ISO 6964
Standard value : The content of carbon black shall be $2.25 \pm 0.25\%$ by mass
Equipment:



Property : Dispersion of carbon black
Reference test : ISO 11420
Standard value : Carbon black dispersion must be $\leq$ Grade 3 as per ISO 4427 requirements, and appearance rating must not be inferior to micrograph B1 in annex B of ISO 11420
Equipment:



Property : Hydrostatic strength
Reference test : ISO 1167
Standard value : More than 100 hours, @ 20°C on stress level: 12.4 MPa for PE 100 9 MPa for PE 80
More than 165 hours, @ 80°C on stress level: 5.5 MPa for PE 100 4.6 MPa for PE 80
Equipment:



Property : Wall thickness and outside diameter measurement
Reference test : ISO 3126
Standard value : Wall thickness must confirm to 11922 (Grade – T Tolerance for minimum wall thickness up to 16 mm) and (Grade – U tolerance for wall thicknesses exceeding 16 mm). OD must confirm to ISO 11922 grade – B
Equipment:



Underground Installations

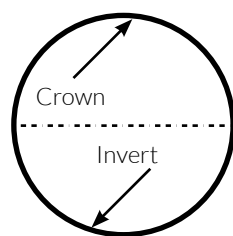
Polyethylene pipe systems are designed for faster, easier, and more cost-effective installation, factoring in both maintenance and system costs

Polyethylene's lightness, flexibility, durability, and secure jointing make it ideal for modern pipeline construction and rehabilitation, offering simple and economical solutions

A key advantage of polyethylene is that pipes can be butt-fused or electrofusion-jointed into continuous lengths without thrust blocks, making them ideal for modern installation techniques

Trenching & bed preparation

Installing PE systems requires minimal trench width, reducing labor, waste removal, reinstatement costs, and the need for imported backfill



Pipe orientation

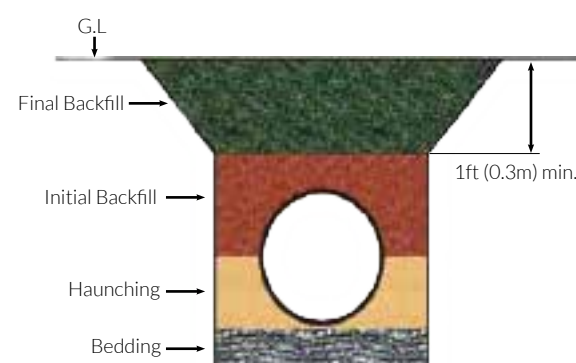
Trench dimensions depend on pipe diameter, jointing method, and site conditions. A minimum cover depth of 900 mm is recommended, with trench width at least the pipe's outside diameter plus 250 mm for proper side fill compaction

Trench construction & dimensions

PE pipes can be laid directly on the trench bottom if the soil is uniform, soft, fine-grained, and free of hard objects, ensuring continuous support along the pipe's length

In other cases, If excavation soil is unsuitable, the trench should be deepened to allow for a bedding layer of imported granular material like 5–10 mm gravel, coarse sand, or a sand-gravel mix, all requiring minimal compaction

Unless specified, For most pressurized systems, precise trench bottom leveling is unnecessary, but gravity systems require even grading. Narrow-bucket excavators are ideal for trenching, with pipes positioned and backfilled after installation



Trenching bed layers

Backfilling

Unless specified otherwise, excavated material can be reused and compacted in layers up to 150 mm thick, with heavy compaction equipment used only after the fill exceeds 300 mm over the pipe crown

For aboveground installations, please contact the APPCO technical department

Pipe Joining

APPCO thermoplastic pipe can be jointed using different methods. This includes jointing by:

- Butt-fusion welding
- Electrofusion welding
- Compression coupling
- Flange connection

Butt-fusion welding process

Polyethylene pipes can be joined by butt welding, depending on the project, though there are limitations regarding diameter and wall thickness

Butt welding can be applied to diameters between 50 mm and 1600 mm, with wall thicknesses from 5 mm to 100 mm, in accordance with the DVS 2207 standard

Attention should be paid to the following points when connecting PE pipes using the butt-welding method:

- The temperature the welding environment should not be below 5° C or above 35° C
- The wall thickness of the pipes to be connected must be equal; if there is any difference, then such difference must not exceed 10 %
- The pipe ends are secured by clamps, with the loose pipe placed in the movable hydraulic part of the welding machine



HDPE Pipe Welding Process

- Secure the longitudinal movement of the free pipe by using adjustable rollers



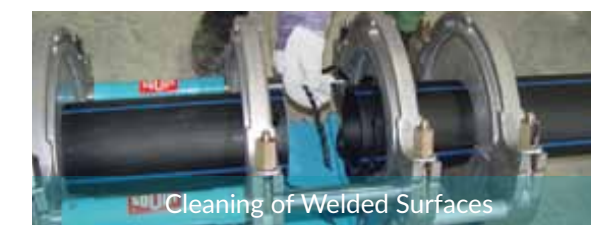
Adjusting Rollers

- Before welding, surfaces must be scraped with a planer to remove oxidation and ensure full contact between the welding surfaces



Oxidation Removal

- After scraping, the welding surface must be kept clean, and pipe ends should be cleaned again if re-soiled, requiring another scraping



Cleaning of Welded Surfaces

- Place the heating element (200° C - 220° C) between the pipe ends, maintain hydraulic pressure during heating, and remove the element within the release time



HDPE Pipe Heating

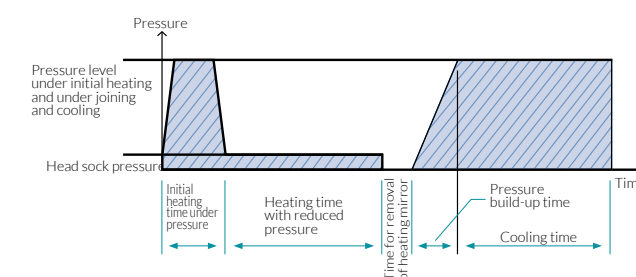


Illustration of the details during the welding

- 8 Once the bead forms, the cooling period begins, and the connection pressure values must be kept equal during cooling



Pipe welding calculation formula:

$$A_{\text{pipe}} = \frac{d_a^2 - d_i^2}{4} \times \quad (\text{mm}^2)$$

Welded compression force calculation

$$F = P_{\text{Specific}} \times A_{\text{Pipe}} \quad (\text{N})$$

veya $dm \times \quad \times s \quad (\text{mm}^2)$

Symbol	Definition
A_{pipe}	Pipe welding area
d_a	Outer diameter
d_i	Inner diameter
dm	Middle diameter
	Pressure surge
P_{Specific}	PE = 0.15 N/mm ² PP = 0.10 N/mm ²

Symbol definition

Pipe wall thickness (mm)	Welding pressure 0.15 N/mm ² Bead height (mm)	Heat time 0.02 N/mm ² (sec)	Heating element remove time (sec)	Pipe connection pressure operation time (minutes)	Cooling time (minutes)
.....4.5	0.5	45.0	5.0	5.0	6.0
4.5.....7.0	1.0	45.0.....70.0	5.0.....6.0	5.0.....6.0	6.0.....10.0
7.0.....12.0	1.5	70.0.....120.0	6.0.....8.0	6.0.....8.0	10.0.....16.0
12.0.....19.0	2.0	120.0.....190.0	8.0.....10.0	8.0.....11.0	16.0.....24.0
19.0.....26.0	2.5	190.0.....260.0	10.0.....12.0	11.0.....14.0	24.0.....32.0
26.0.....37.0	3.0	260.0.....370.0	12.0.....16.0	14.0.....19.0	32.0.....45.0
37.0.....50.0	3.5	370.0.....500.0	16.0.....20.0	19.0.....25.0	45.0.....60.0
50.0.....70.0	4.0	500.0.....700.0	20.0.....25.0	25.0.....35.0	60.0.....80.0

Optimum welding times of HDPE pipes at 20°C environmental temperature

Electrofusion welding process

Electrofusion welding of polyethylene pipes follows DVS 2207 standards. It allows joining pipes with different wall thicknesses using lightweight machines that adjust welding parameters and fill joints if needed

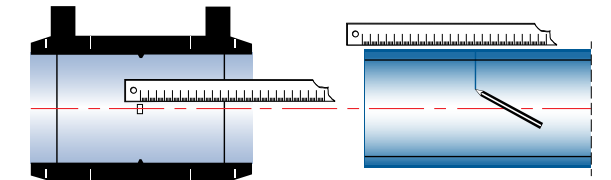
In the electrofusion welding process, pipes made from the same raw material can be joined. The following steps must be completed before welding:

- 1 The solution flow speed for HDPE electrofusion connections is 1.7–0.3 g/10 min (190°C/5 kg). Pipes and fittings must have melt flow rates within this range. Only pipes with matching melt flow rates should be welded
- 2 The area in which welding is to take place must be weather-proofed. (For example, protected from snow, rain, wind, effective sunlight, etc.)
- 3 The temperature of the welding environment must be between 5° C and 50° C
- 4 All welding parameters are controlled by the machine; the operator only needs to scan the barcode (from the code card with the coupling) for automatic setup
- 5 The pressure test (as per DIN 1/4279) must start at least one hour after welding and full cooling. Apply 1.5 × PN pressure; if it does not drop, the test is passed



The electrofusion welding procedure is as follows:

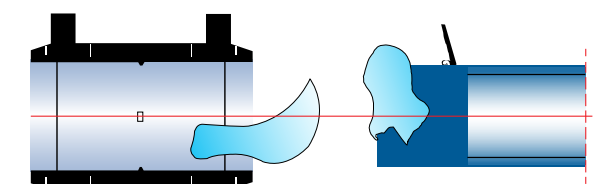
- 1 The entry limit is marked on the pipe. The properly cut and smooth pipe edges must be inserted up to the 'pipe leaning limit' (the limit to which the pipes can lean)



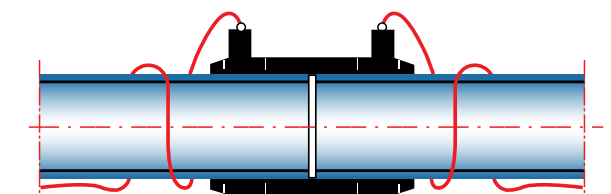
- 2 The surface to be welded must be cleaned and any surface oxidation must be scraped off to welding



- 3 At the welding station, unpack the pieces to be welded. Clean all electrofusion surfaces on both pipe and fitting with industrial alcohol, and avoid touching them afterward



- 4 Secure the electrofusion welding ends, ensuring they are aligned straight with the pipe and facing upwards. Then, place the welding machine sockets at the weld ends for preparation



Compression Coupling Joint

Pipes are joined with a coupling adaptor. After cutting the pipe vertically, it is inserted into the coupling up to the raised point. Bolts are tightened by hand; for diameters ≥ 40 mm, a special wrench is used. This method is not recommended for pipes > 110 mm

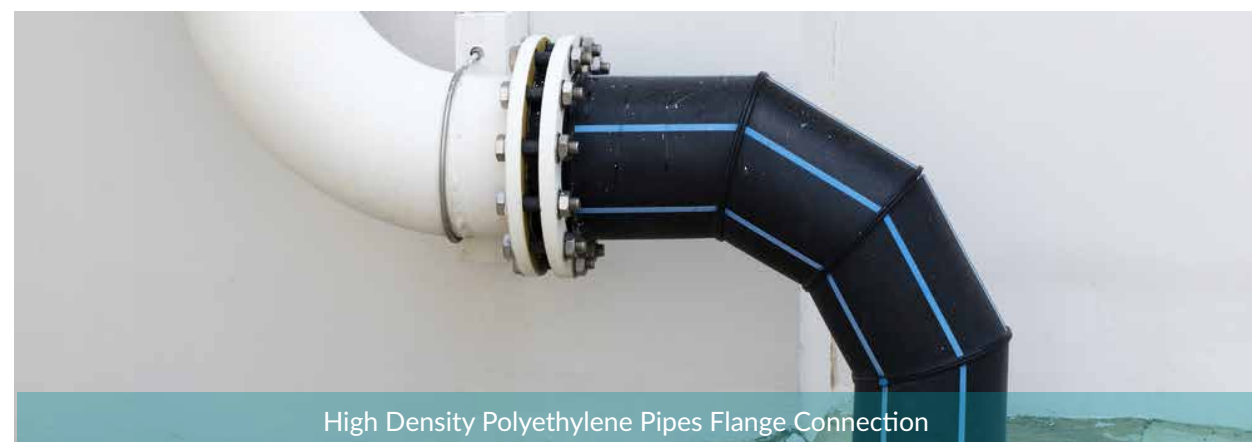
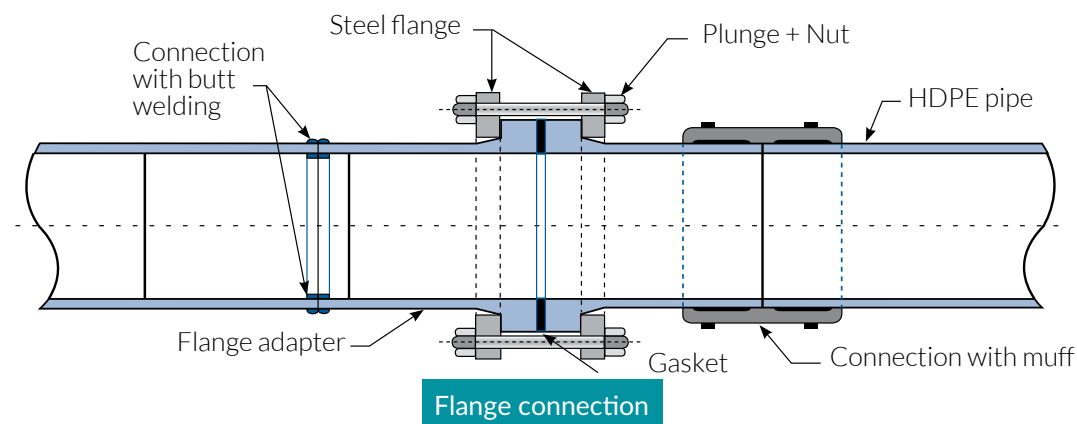


Coupling Adaptor

Flange Connection

A flange joint is used to connect PE pipes with steel pipes, valves, pumps, condensers, or other materials, and where future dismantling may be needed. Steel rings, flange/backing rings, and flange adaptors are used.

Stub ends are attached to both ends of PE pipes and connected using bolts and nuts. Bolts should be tightened in alternate rows, not circularly, and pipelines must not be pulled during tightening to avoid overloading structural elements



High Density Polyethylene Pipes Flange Connection

Handling and Storage

Polyolefin materials are flexible, lightweight and easy to handle. Nevertheless, care should be taken not to cause scuffing or gouging of the surface

Straight Lengths and Bundles

Pipes should be transported on flatbed vehicles free of sharp objects. When lifting bundles by crane, use wideband slings (not chains or hooks). For lengths over 6 meters, use load-distributing beams spaced evenly

Allow slight bending of pipe bundles during loading/unloading. Use a forklift for 6-meter bundles; longer lengths require a side loader with four forks or a crane with a load-distributing beam. Skid timbers and rope slings can help with site unloading



Sample of large diameter coil truck loading

Coils

Small coils

Small coils of pipe strapped onto pallets are easily handled by forklift. Large coils of 125 mm to 180 mm pipe will require lifting individually by forklift and can be lifted as shown in the following figures:



Pallet off-loading

Releasing coils

Coiled pipes are under high tension and must be properly strapped. Always restrain the pipe end when releasing. For coils with OD over 63 mm, use an uncoiling stand to prevent sudden strap release

For outer bands with additional strapping of individual layers:

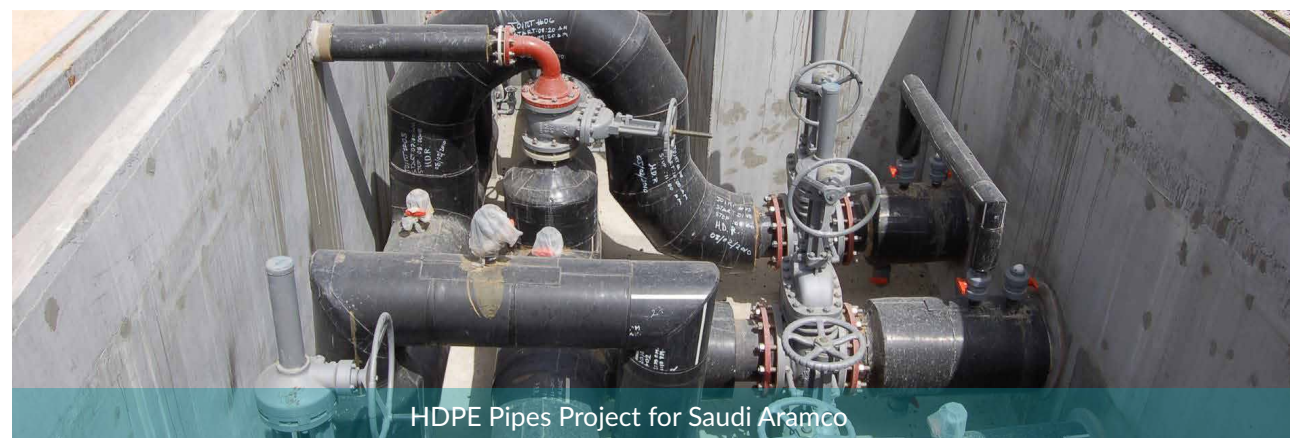
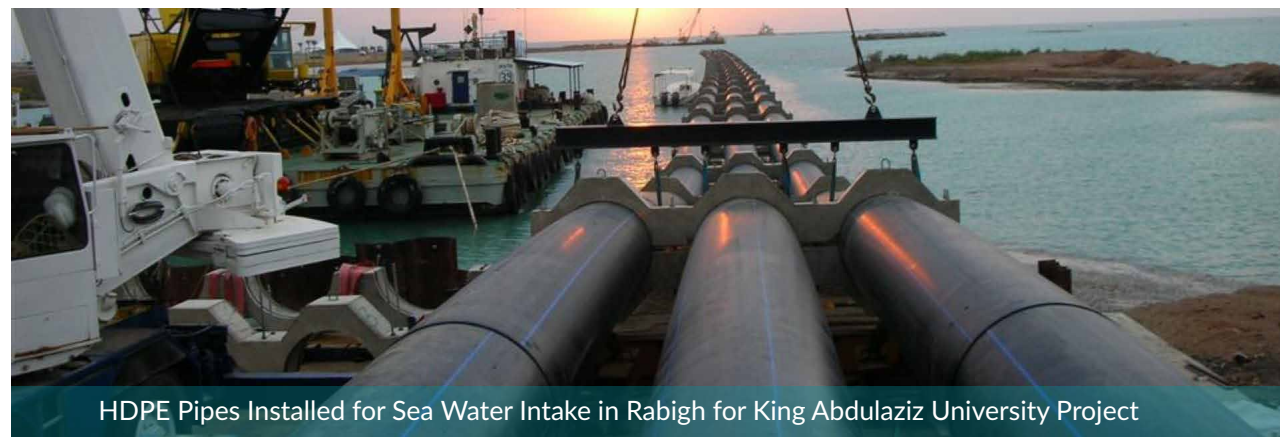
- Do not remove any of these bands until the pipe is required for installation
- Remove them carefully, from the outmost layer first, so that only the length of pipe needed immediately is released
- Successive layers can be released by removing banding as the pipe is drawn away from the coil

Never:

- Drag or roll individual pipes or bundles
- Throw or drop the pipe or fitting from the delivery vehicle
- Use metal slings, hooks, or chains when handling vehicle
- Expose pipes or fittings to prolonged sunlight
- Stack more than three metres or three bundles high
- Place pipes or fittings in contact with lubricant or hydraulic oils, gasoline, solvents or other aggressive materials

Always:

- Examine the pipes carefully before installation and any damaged pipes
- Store pipes on flat, firm ground which is able to withstand the weight of the pipes and the lifting apparatus
- Stack the heaviest pipe at the bottom
- Secure the load to prevent slippage—PE pipes are smooth, so use equipment rated for their weight.
- Always avoid excessive stacking heights and stack pipes in straight rows to prevent distortion
- Unload one pallet, bundle, or strip load layer at a time, releasing straps only when unloading that bundle or layer
- Keep pipes/fittings away from sharp objects and use wide, non-metallic slings
- Exercise special care when handling pipes in wet conditions, as they may become slippery
- Always keep protective packaging intact until pipes/fittings are needed for use
- Keep pipes/fittings away from intense heat, except when jointing



Notes: _____



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