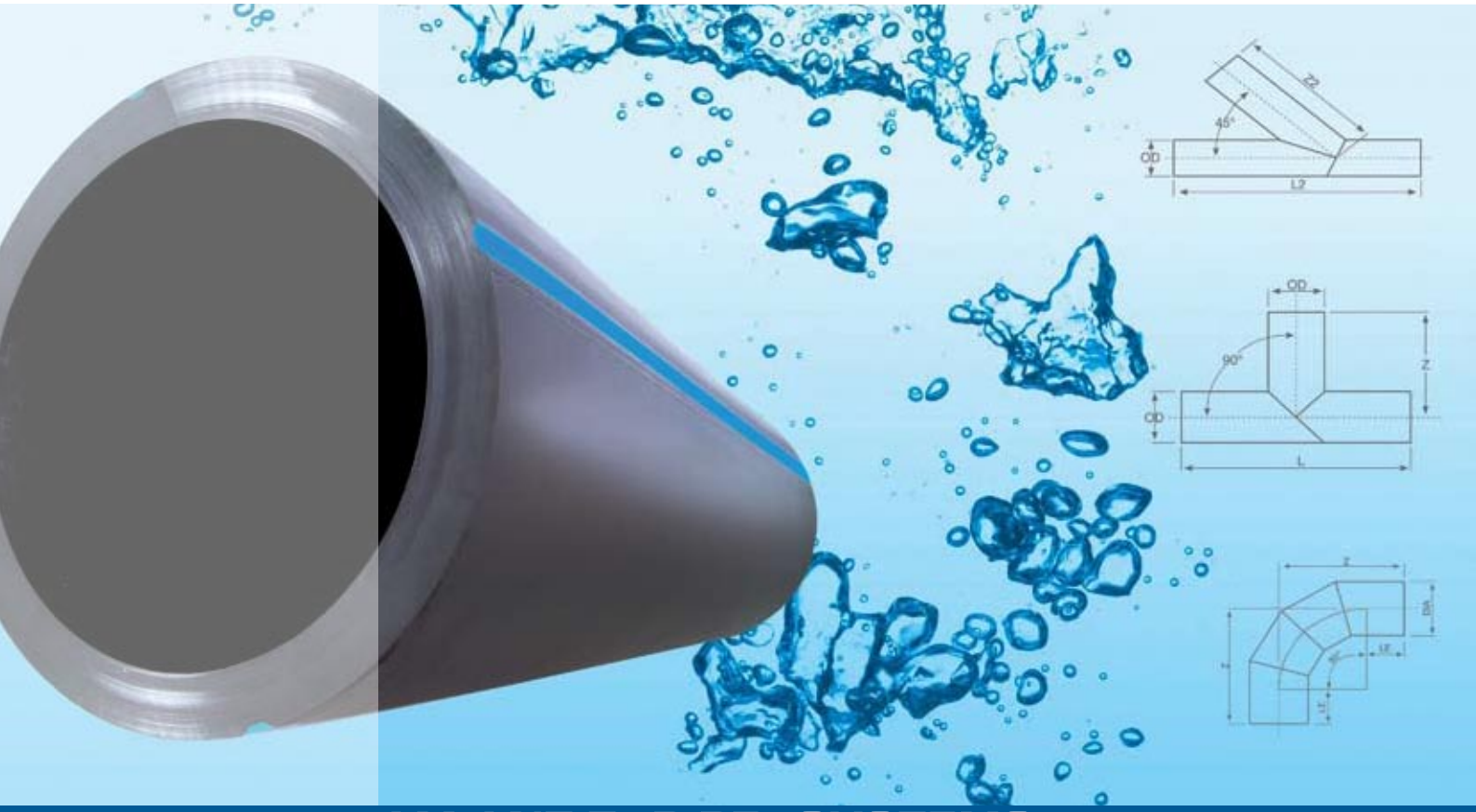
AMIANTIT

APPSCo Amiantit

Amiantit Polyolefin Piping Systems Co.

Product Guide for HDPE/MDPE Pipe Systems



AMIANTIT PIPE SYSTEMS

1 General

Amiantit Group of Companies

The Amiantit Group is a leading global industrial organization which manufactures high-quality pipe systems and researches, develops, owns and licenses advanced pipe technologies; it also provides water management services. The Group supports global infrastructure development projects and delivers to municipal, industrial, agricultural and energy markets worldwide.

Amiantit has a presence in more than 70 countries, including almost 30 wholly-owned or joint-ventured manufacturing facilities in the Middle East, Europe, Latin America, North Africa, The Far East, Central Asia, the Indian Subcontinent and Africa. Amiantit's manufacturing capabilities are supported by technology companies and sales offices across the globe.

Other members of the Group are predominantly limited liability companies, owned by the Amiantit Group in varying percentages, which operate under individual commercial registrations.

Amiantit Polyolefin Piping Systems Co.

APPSCO Amiantit Polyolefin Piping Systems Company (APPSCo) is a member of the Amiantit Group of Companies and started full commercial production in 2002. The company manufactures High Density Polyethylene (HDPE) solid wall pipe for pressure applications (with diameters ranging from 16mm to 630mm) and polypropylene. In addition to this, APPSCo has the in-house capabilities to produce all types of related fittings, in order to provide its customers with complete piping systems and solutions. APPSCo, constructed on a 100,000 m^2 site in Al-Khumra, South Jeddah, Saudi Arabia, uses the most advanced and up-to-date extrusion technology to ensure consistent high-quality products - with an annual capacity over 16,000 tons - while the plant is able to increase its capacity in accordance with market demand and requirements.

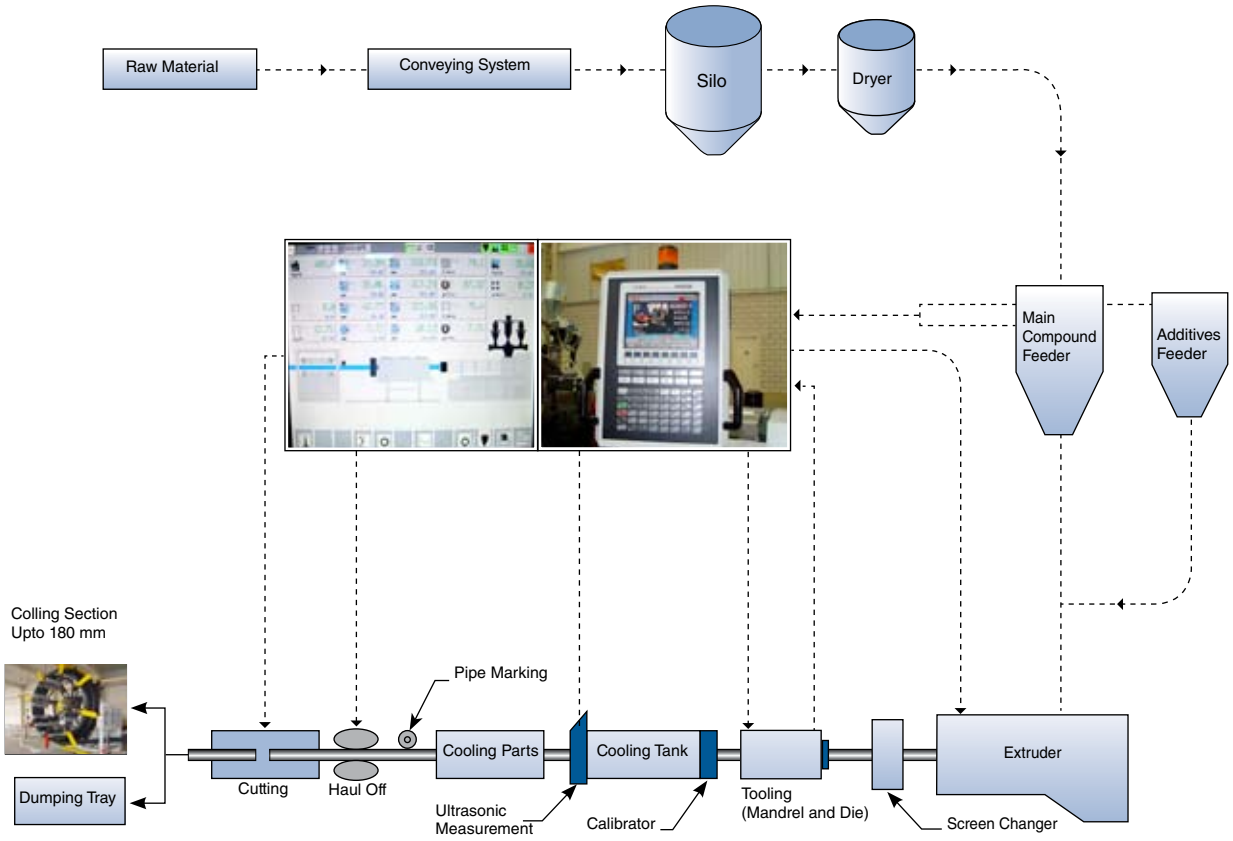
2 Introduction

The world's infrastructure is ageing. Millions of kilometres of gas, water and sewer pipe need rehabilitation. The predicament is a worldwide problem in industrial countries, although this is not the case in many developing countries, where an ageing infrastructure is not a problem. A water infrastructure does not exist and it remains to be constructed. But these nations are facing other, difficult decisions about how to build and what materials to use in order to avoid what has happened in the more developed countries.

The main problem encountered in ageing structures is corrosion. And corrosion is not a reversible process. Internally unprotected sewer pipes are rapidly deteriorating due to the presence of sulphuric acid in sanitation (sewerage) systems, which is generated through the hydrogen sulphide cycle. Externally, soil conditions and stray electrical currents deteriorate underground pipes. Metallic pipes corrode when placed in poorly-drained soils with low resistivity. The presence of sulphate-reducing bacteria accelerates this corrosion. These problems can be significantly reduced, if not eliminated, by careful selection of pipe materials, which should have corrosion-resistance protection. The remedy to this situation is very simple: Amiantit Polyolefin APPSCO pipes.

3 Production Process

APPSCO is equipped with a modern continuous extrusion process polyethylene pipe-manufacturing facility. APPSCO is capable of producing both High Density Polyethylene (HDPE) and Medium Density Polyethylene (MDPE) pipes in accordance with ISO 4427, DIN 8074 for water applications and ISO 4473, ASTM D2513 for gas applications - and any other standard required by the customers. The production process starts with the raw material, which can be either virgin HDPE or MDPE and is in the form of granules. These are set to dry in the dryer in order to evaporate any water or moisture that has condensed on the raw material granules. This is then transported to the main hopper system, which doses the measured, weighed raw material into the extruder. The extruder heats the raw material to a temperature of between 180 and 200°C (356-392° F) which is the idle temperature for extrusion and shaping of HDPE/MDPE. This is then ejected from the extruder in a continuous pipe shape to the screen changer. The screen changer examines the extruded product for impurities and removes them accordingly. Once the product has been extruded and cleansed of any impurities, the die and mandrel section takes place. In this section both the diameters and standard pipe dimensions are set, the die shapes the pipe diameter and the mandrels set the standard pipe dimensions (SPD). When the product has taken its final shape, it moves to the cooling & vacuum tanks. In the cooling tank the pipes are calibrated and cooled down for the final stage. The final stage consists of marking, cutting or possibly coiling the pipes.



4 Product Advantages

Feature	Benefits
High flexibility combined with high impact resistance	Can be supplied as coils of up to 160 mm (external pipe diameter). Coils reduce the number of joints and stress to the site. Under the same conditions, PE pipe develops much lower surge pressures than rigid pipes. Unaffected by soil settlement. High tenacity and anti-impact intensity. Excellent resistance against inappropriate handling with low notch sensitivity and high tear resistance
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	Does not rust or corrode scaling and corrosion by electrolytic actions. Lower life cycle cost, long life expectancy. Very low maintenance. Withstands aggressive soil conditions, ground water. Suitable for use with a broad range of chemicals. Resistance to 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	Polyolefin pipes have a hydraulically smooth bore. In the Colebrook formula K is equal to 0.001; in the Hazen-Williams formula C is equal to 155.

5 Product Characteristics

5.1 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.

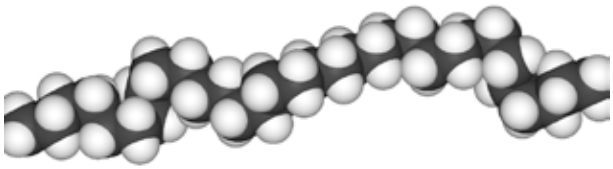


Figure 5-1 HDPE, MDPE Chain Molecules

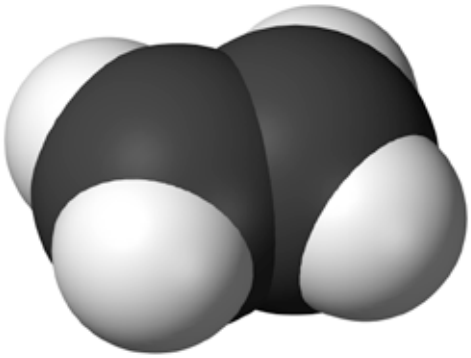


Figure 5-2 Singe HDPE, MDPE Molecule

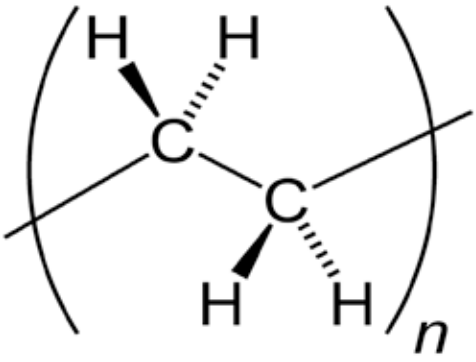


Figure 5-3 Chemical Chart of HDPE, MDPE

The HDPE (High Density Poly-Ethylene) and MDPE (Medium Density Poly-Ethylene) pipe grade material that APPSCO uses has a low degree of branching, with short side chains ("linear polyethylene"). The short side chain allows higher crystallisation, thus resulting in higher density and better material properties.

The properties of polyethylene are primarily determined by density, molecular weight and molecular weight distribution. The material properties vary in accordance with density. When density increases, the following properties also increase:

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

5.2 Raw Material Classifications

Polyethylene is classified into several different categories, based mostly on its density and branching. The mechanical properties of PE depend significantly on variables such as the extent and type of branching, the crystal structure and the molecular weight. Below is a clarification of only the two classifications of PE that Appsco uses for producing its pipes

- *HDPE (High Density Polyethylene)*
  HDPE is characterized by a density of greater than or equal to 0.941 g/cm3.It has a low degree of branching and thus stronger intermolecular forces and tensile strength. The lack of branching is ensured by an appropriate choice of catalyst and reaction conditions. HDPE is also used in packaging products.

- *MDPE (Medium Density Polyethylene)*
  MDPE is defined by a density range of 0.926– 0.940 g/cm3. It has good shock and drop resistance properties and is less notch sensitive than HDPE. Its stress cracking resistance is better than that of HDPE. This yields a better gas hammer effect than HDPE. MDPE is typically used in gas pipes, fittings and screw closures.

5.3 Raw Material Colour

HDPE and MDPE basic materials are classified as a non-coloured material. Pre-compounded, coloured HDPE or MDPE materials from the supplier are recommended for the manufacturing of pipes; HDPE is available in black, blue, and MDPE is available in yellow.

Figure 5-4 Non-coloured HDPE/MDPE granules

Figure 5-5 Coloured HDPE/MDPE granules

Pipe colour is dictated by the applications for which they are to be used Black and blue coloured pipes are for potable water applications and yellow are for gas applications. Other pipe colours are possible depending on the relevant water/district authority requirements.

5.4 Pipe Material Classification

High density polyethylene (HDPE) pipe grade material is classified as PE 100 and PE 80. The classification number for a thermoplastic material is 10 times the minimum required strength of the material (MRS) as shown in the following table ➡

Classification of HDPE	Classification Number	MRS MPa
PE 80	80	8
PE 100	100	10

Table 5-1 Classification of HDPE Material

5.5 Material Regression Curve

The material regression curve shows the material strength in relation to the time at various temperatures (20℃, 60℃ and 80℃).

Following the SEM-evaluation according to ISO/TR 9080 for the HDPE material, the regression curves of both PE 100 and PE 80 material is as shown in the following figures: ⬇

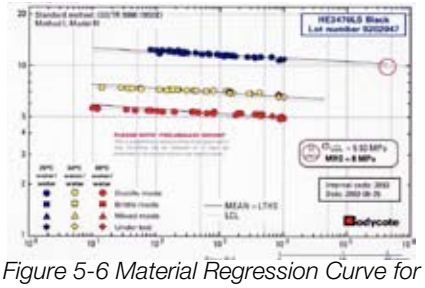


Figure 5-6 Material Regression Curve for PE 80

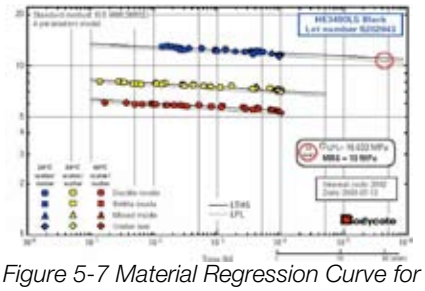


Figure 5-7 Material Regression Curve for PE 100

! Note:

The points below need to be considered / submitted by the pipe manufacturer in order to confirm the right material to be used:

- Raw Material Technical Data Sheet.
- Proof of the material having been listed as PE 100 or PE 80, by third parties (e.g. the Plastic Pipe Institute – Listing in technical report TR # 4, or Ral listing for HDPE material).
- Third Party Long Term Test Report to show MRS value and the raw material regression curve as per ISO/TR 9080.
- In the case of potable water, the material supplier and material code need to be approved by organizations to in order to confirm their compliance with ANSI # 61 (NSF and WRAS).
- UV stabilizers, colour, antioxidants and pigments are included in the pre-compounded material.

6 Product Range

6.1 Pipes

APPSCO 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 pipe from gravity up to 16 bars as a standard rating and up to 32 bars on specific standard requirements.
- Pipes with an outside diameter of between 16 - 630mm.
- 12-meter standard pipe length
- Diameters of up to 160mm can be supplied on coils.

Solid Wall Pipes-PE80-PE100																															
Series		2.5		3.2		4		5		6.3		8		10		12.5		13.3	
SDR		6		7.4		9		11		13.6		17		21		26		27.6	
PN Bar		PE 80 - 25.6 bar	PE 100 - 32 bar	PE 80 - 20 bar	PE 100 - 25 bar	PE 80 - 16 bar	PE 100 - 20 bar	PE 80 - 12.5 bar	PE 100 - 16 bar	PE 80 - 10 bar	PE 100 - 12.5 bar	PE 80 - 8 bar	PE 100 - 10 bar	PE 80 - 6.3 bar	PE 100 - 8 bar	PE 80 - 5 bar	PE 100 - 6.3 bar	PE 80 - 4.8 bar	PE 100 - 6 bar
OD		Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m	Nominal W.T mm	Nominal Weight Kg/m
20		3.400	0.168	2.800	0.152	2.300	0.122	1.900	0.098										
25		4.200	0.261	3.400	0.225	2.800	0.186	2.300	0.156	1.900	0.131								
32		5.400	0.429	4.400	0.362	3.600	0.305	3.000	0.252	2.400	0.212	1.900	0.171						
40		6.700	0.666	5.500	0.566	4.500	0.477	3.700	0.401	3.000	0.331	2.400	0.269	2.000	0.216				
50		8.400	1.033	6.800	0.888	5.600	0.742	4.600	0.623	3.700	0.511	3.000	0.421	2.400	0.341	2.000	0.287	1.900	0.273
63		10.500	1.645	8.600	1.396	7.000	1.185	5.800	0.990	4.700	0.818	3.800	0.671	3.000	0.537	2.500	0.451	2.300	0.417
75		12.500	2.332	10.200	1.989	8.400	1.670	6.900	1.384	5.600	1.160	4.500	0.947	3.600	0.767	2.900	0.624	2.800	0.603
90		15.000	3.358	12.200	2.853	10.000	2.409	8.200	2.002	6.700	1.666	5.300	1.364	4.300	1.100	3.500	0.904	3.300	0.854
110		18.400	5.008	14.900	4.277	12.300	3.587	10.000	2.985	8.100	2.464	6.500	2.037	5.300	1.656	4.300	1.326	4.000	1.266
125		20.900	6.469	16.900	5.507	13.900	4.639	11.400	3.866	9.200	3.180	7.400	2.598	6.000	2.131	4.900	1.722	4.600	1.653
140		23.400	8.115	19.000	6.923	15.600	5.825	12.800	4.826	10.300	3.988	8.300	3.263	6.700	2.666	5.400	2.170	5.100	2.054
160		26.700	10.590	21.700	9.028	17.800	7.592	14.600	6.336	11.800	5.220	9.500	4.268	7.700	3.500	6.200	2.846	5.800	2.670
180		30.000	13.394	24.400	11.411	20.000	9.593	16.400	8.009	13.300	6.618	10.600	5.407	8.600	4.400	7.000	3.565	6.600	3.416
200		33.400	16.528	27.100	14.116	22.300	11.875	18.200	9.876	14.800	8.131	11.800	6.681	9.600	5.456	7.700	4.420	7.300	4.199
225		37.500	20.940	30.500	17.854	25.000	15.029	20.500	12.513	16.600	10.326	13.300	8.464	10.800	6.905	8.700	5.555	8.200	5.306
250		41.700	25.824	33.800	22.030	27.800	18.496	22.800	15.401	18.400	12.720	14.800	10.390	12.000	8.457	9.700	6.889	9.100	6.543
280		46.700	32.405	37.900	27.632	31.200	23.235	25.500	19.303	20.600	15.950	16.500	13.051	13.400	10.663	10.800	8.601	10.200	8.214
315		52.500	41.130	42.600	34.980	35.000	29.398	28.700	24.449	23.200	20.207	18.600	16.539	15.000	13.432	12.200	10.940	11.500	10.331
355		59.200	52.239	48.000	44.371	39.500	37.363	32.300	31.026	26.200	25.623	20.900	21.029	17.000	17.055	13.700	13.859	12.900	13.173
400		66.700	66.323	54.100	55.817	44.500	47.406	36.400	39.408	29.500	32.522	23.600	26.620	19.100	21.716	15.400	17.569	14.500	16.685
450				60.900	70.643	50.000	60.011	41.000	49.944	33.100	41.190	26.500	33.736	21.500	27.499	17.400	22.220	16.400	21.101
500				67.600	87.214	55.600	73.985	45.500	61.605	36.800	50.880	29.500	41.693	23.900	33.965	19.300	27.417	18.200	26.035
560						62.300	92.451	51.000	77.211	41.200	63.801	33.000	52.205	26.700	42.502	21.600	34.404	20.300	32.702
630								57.300	97.798	46.400	80.668	37.100	66.155	30.000	53.728	24.300	43.586	22.900	41.323

Table 6-1 Standard pipe weight and dimension

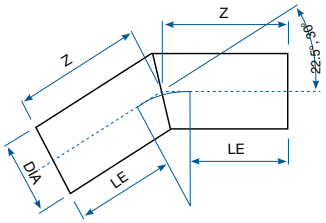
6.2 Fitting and Accessories

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

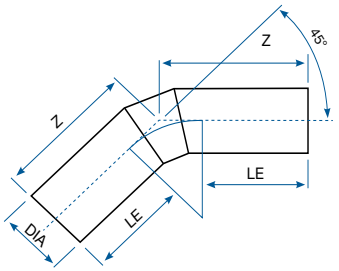
6.2.1 Segment Welded Fittings

22.5° , 30° Elbow



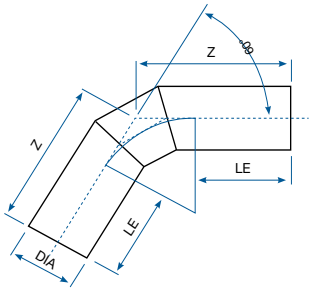
OD (mm)	Z (mm)	Laying Length (mm)
110	269	269
125	275	275
140	281	281
160	289	289
180	297	297
200	305	305
225	315	315
250	325	325
280	337	337
315	351	351
355	642	642
400	660	660
450	680	680
500	700	700
560	723	723
630	751	751

45° Elbow



OD (mm)	E (mm)	M (mm)	Laying Length (mm)
110	269	72	341
125	275	81	356
140	281	90	371
160	289	102	391
180	297	114	411
200	305	127	432
225	315	142	457
250	325	157	482
280	337	175	512
315	351	197	548
355	642	221	863
400	660	248	908
450	680	279	959
500	700	309	1009
560	723	346	1069
630	751	388	1139

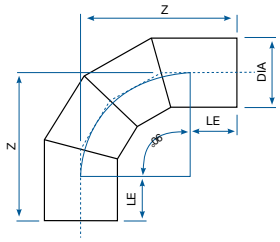
60° Elbow



OD (mm)	E (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

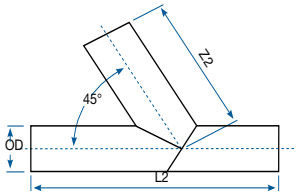
90° Elbow

OD (mm)	E (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



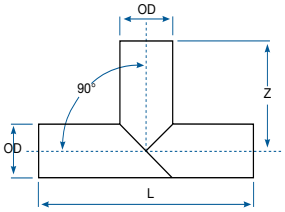
45° Wye

OD (mm)	E (mm)	M (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



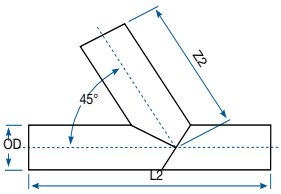
Equal Tee

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



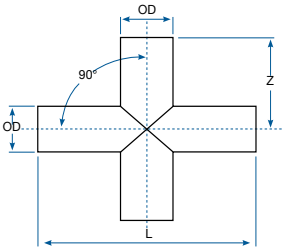
60° Wye

OD (mm)	E (mm)	M (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



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



6.2.2 Electro Fusion Fittings and Adapters

EF Coupling	EF End Cap
	
Pressure rating: SDR 11 PN16 and SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

EF End 90° Elbow	EF End 45° Elbow
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

EF Concentric Reducer	EF Equal Tee
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

EF Service Tee Set Flat	EF Repair Adapter
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

EF Service Tee Set Valued	EF Service Tee Set Flat with Clamps
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

6.2.3 Injection Moulded Fittings

90° Elbow	60° Elbow
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

45° Elbow	End Cap
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

Equal Tee	Reducer Tee
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR 17 PN10

Reducer	Flange Adapter
	
Pressure rating: SDR 11 PN16 & SDR 17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

Steel Flange (Backing Ring)	Bland Steel Flange
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

Welded Steel Transition Adapter	Welded Steel Transition Adapter Transition Adapter Female
	
Pressure rating: SDR 11 PN16 & SDR17 PN10	*Pressure rating:* SDR 11 PN16 & SDR17 PN10

Transition Adapter Male

Pressure rating: SDR 11 PN16 & SDR17 PN10

6.2.4 Compression Fittings PE100 SDR11 PN16

Coupling OD20 mm up to OD 110 mm	**Reducing Coupling** OD20 x 25 mm up to OD 110 x 90 mm
	

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

Male Adaptor D20 mm x 1/2" up tOD 110 mm x 4"	**Female Adaptor** OD20 mm x 1/2" up to OD 110 mm x 4"
	

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

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

Female Tee With Peg Fitting OD32 mm x 3⁄4" x 32 mm	**90° Elbow With Lateral Threaded Female Take Off** OD25mm x 25mm x 1⁄2"
	

Tee With Threaded Female Take Off OD20 mm x 1⁄2" up to OD110 mm x 4"	**Tee With Threaded Female Take Off** OD20 mm x1/2"x20 mm up to OD110 mm x4"x110mm
	

90° Tee With Increased Take Off OD20 x 25 x 20 mm up to OD40 x 50 x 40 mm	**Universal Transition Coupling** OD15 x 25 mm up to OD 34 x 32 mm
	

Male Adaptor With Brass Threaded Insert OD20 mm x 1/2" up to OD63 mm x2"	**Female Adaptor With Brass Threaded Insert** OD20 mm x 1/2" up to OD63 mm x2"
	

Clamp Saddle OD25mm x 1/2" up to OD125mm x 3"	**Double Clamp Saddle** OD25mm x 1/2" up to OD125mm x 2"
	

Clamp Saddle With Reinforcing Ring OD25mm x 1/2" up to OD125mm x 3"	**Double Clamp Saddle With Reinforcing Ring** (OD25mm x 1/2" up to OD125mm x 2")
	

Clamp Saddle With Reinforcing Ring PN 16 bar OD25mm x 1/2" up to OD110mm x 2"	**Double Clamp Saddle With Reinforcing Ring PN 16 bar** OD25mm x 1/2" up to OD110mm x 2"
	

7 Quality Control

7.1 QC Test Method With Reference Standards

Property : Melt Mass Flow Rate (MFR)

ReferenceTest : 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 ± 25%.

Equipment:

Property : Longitudinal Reversion (shrinkage)

ReferenceTest : ISO 2505-1

Standard Value : Longitudinal Reversion (shrinkage) shall be ≤ 3%.

Equipment:

Property : Thermal Stability Oxidation Induction Time (OIT)

ReferenceTest : ISO / TR 10837

Standard Value : O.I.T. must be ≥ 20 minutes when tested at 210 C

Equipment:

Property : Density

ReferenceTest : ISO 1183

Standard Value : Density shall fall within PE material density range (≥0.94).

Equipment:

Property : Tensile Test

ReferenceTest : ISO 6259 1.3

Standard Value : Elongation at break must be ≥ 350%

Equipment:

Property : Carbon Black Content

ReferenceTest : ISO 6964

Standard Value : The content of carbon black shall be 2.25 ± 0.25% by mass

Equipment:

Property : Dispersion of Carbon Black

ReferenceTest : ISO 11420

Standard Value : Carbon black dispersion must be ≤ 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

ReferenceTest : 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

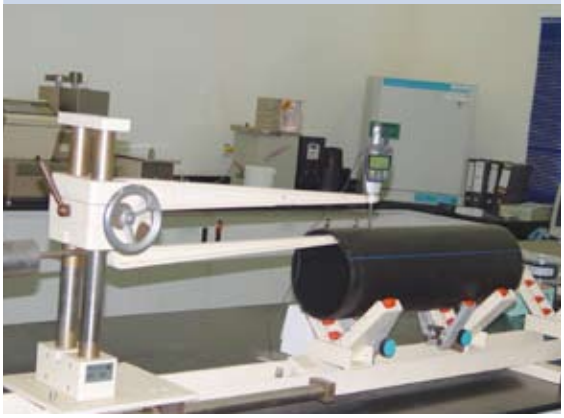
Equipment:

Property : Wall Thickness and outside Diameter Measurement

ReferenceTest : ISO 3126

Standard Value : Wall thickness must confirm to 11922 (Grade – T Tolerance for minimum wall thickness up to 16mm) and (Grade – U Tolerance for wall thicknesses exceeding 16mm)OD must confirm to ISO 11922 Grade – B

Equipment



Property : Environmental Stress Cracking Resistance

ReferenceTest : ASTM D 1693

Standard Value : Condition A – More than 2000 H

Equipment:

7.2 Certifcates and Approvals

APPSCO pipe systems have been tested and approved for the conveyance of drinking water and meet the criteria of many of the world's leading authorities and testing institutes, including:

- NSF certificate for drinking water applications, in compliance with NSF/ANSI 61 standard. NSF Certificate # 1S731-01
- Health effects testing (Test report by NSF) Standard: 261 – DWA Std. 61 (Drinking water system components – health effects) 1st Test report # PM04475
- 2nd Test report # PM04475 WRAS (Water Regulations Advisory Scheme) certificate for passing full tests in respect of effect on water quality – in accordance with BS 6920. Certificate # CR/JC - Test Report 253K
- Black-coloured polyethylene pipe and fittings are for cold water and hot water up to 50 C and are ISO 9001/2000 certified.

Materials Certificate # 145281 laboratory Attestation Certificate showing the capability to perform all the required testing in connection with the incoming raw materials, in process inspections, and HDPE finished product pipes in accordance with the relevant standards, namely:

- ISO 4427
- ISO 1133
- ISO 1183
- ISO 11420
- ISO/TR 10837
- ISO 2505
- ISO 1167
- ISO 6259

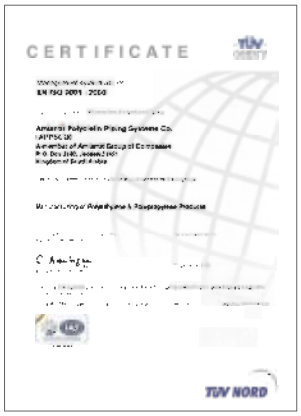
An Inspection Certificate, issued by a well-known third party, confirming that the procedure mentioned in the test method (for all the tests available in our laboratory testing facility) is followed.

- Certificate #: SAR.R.4.03.299.AC01
- Bodycote Testing Test Reports for burst testing as per ASTM D 1599
- To pass the requirement at the following temperatures 30 C, 40 C, 45 C, 50 C, 55 C, and 60 C, Polyethylene raw materials are delivered with a vendor certification demonstrating their compliance with APPSCO quality requirements.In addition, all raw materials are sample-tested prior to use. These tests ensure that the pipe materials comply with the specifications stated.

Cert. 7-1 Material Certification from Attestion

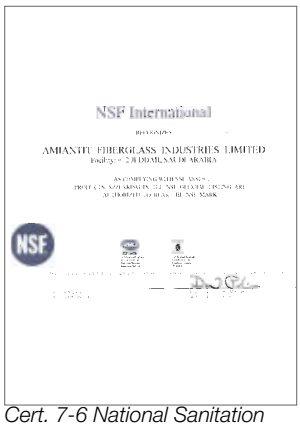
Cert 7-2 Testing methods according to SASO certification from TÜV

Cert. 7-3 Burst testing report from Bodycote



Cert. 7-4 ISO 9001 certification from TÜV

Cert. 7-5 Water quality test and report from WARS



Cert. 7-6 National Sanitation Foundation certification

8 Underground Installations

Polyolefin pipe systems are designed to make installation quicker, easier and more cost-effective. Installation is as much a part of the costing equation as ease of maintenance and the cost of the pipe system itself.

Polyolefin's great advantages in terms of installation are its lightness and flexibility, coupled with its durability and totally secure jointing methods. For all modern pipe-laying techniques, whether in rehabilitation work or the construction of new pipelines above or below ground level, Polyolefin systems usually provide the simplest, most economical solution. And indeed, rehabilitation techniques which rely on polyethylene's unique properties have been developed.

A major advantage of PE is that pipe lengths can be butt-fused or electrofusion-jointed to form a continuous string of pipe and there is normally no need for thrust blocks. This, together with the material's inherent flexibility, makes polyethylene ideally suited to a full range of new and innovative installation techniques

8.1 Trenching and bed preparation

Installation of PE/PP systems requires minimal trench width; therefore considerable savings can be made in terms of both reduced labour costs and less waste spoil to be removed from site. Additionally, it cuts reinstatement costs and requires smaller quantities of imported backfill.

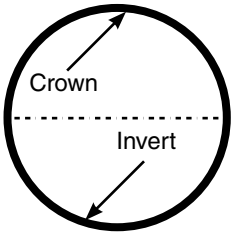


Figure 8-1 Pipe Orientation

The dimensions of a trench-line opening are normally governed by the pipe diameter, the jointing method and site conditions. The normal minimum depth of cover for mains should be 900mm from ground level to the crown of the pipe. Trench width should be as narrow as possible, but typically not less than the outside diameter of the pipe, plus 250mm to allow for correct compaction of side fill unless specialized narrow trenching techniques are used.

8.2 Trench construction and dimensions

In some instances, it may be acceptable to lay PE pipe directly on the bottom of the trench - but only where the soil is uniform, relatively soft and fine-grained – and free from any large flints, stones, or other hard objects that may cause point loading on the pipe. The trench bottom should be brought to an even finish, providing consistent support for pipes along their whole length.

In other cases, the trench should be cut to a depth that will allow for the necessary thickness of selected bedding material below the bottom of the pipe. If soil from the excavation is unsuitable, granular material should be imported. Gravel or broken stone graded between five and ten millimetres in size provides suitable bedding, since it requires minimal compaction. Coarse sand, a sand and gravel mix, or gravel smaller than 20mm are also all acceptable straight from the trench.

Unless specified, accurate levelling of the trench bottom is unnecessary for most pressurized systems. The slope should be graded evenly in gravity flow systems. Excavators with narrow buckets are best suited to conventional trenching methods. Pipes are located by being lifted into the correct position. After installation, the ground can be backfilled and consolidated.

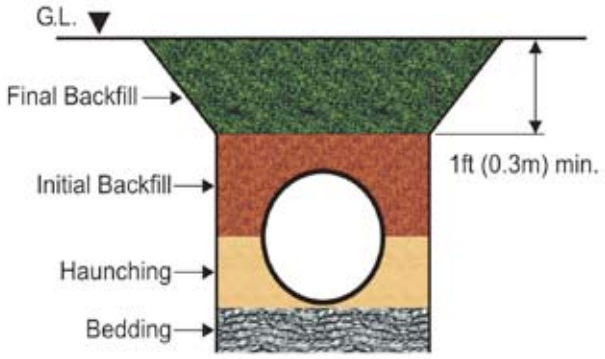


Figure 8-2 Trenching bed layers

8.3 Backfilling

Unless special procedures apply, suitable excavated material may be returned to the trench and compacted in layers of an appropriate thickness, as specified in the specification, but not exceeding a layer height of 150mm. Heavy compaction equipment should not be used until the fill over the crown of the pipe is more than 300mm.

For aboveground installations, please contact the APPSCO Technical Department.

9 Pipe Joining

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

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

9.1 Butt-fusion welding process

Polyethylene Pipes may be produced, to be connected by means of the butt welding method, depending on the project. However there are limitations for using this jointing system, with regard to both diameter and wall thickness (figure 9-1) ⬇.

Connection by this welding method can be applied to diameters of between 50 mm and 1600 mm; and in relation to the diameter, to wall thicknesses from 5 mm to 100 mm. The butt-welding process is carried out in accordance with the DVS 2207 standard.

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

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

4. Secure the longitudinal movement of the free pipe by using adjustable rollers.

5. Prior to the welding process, welding surfaces must be scraped (using the planer by fixing it between the two ends to be welded), any oxidation removed and the welding surfaces must come into complete contact..

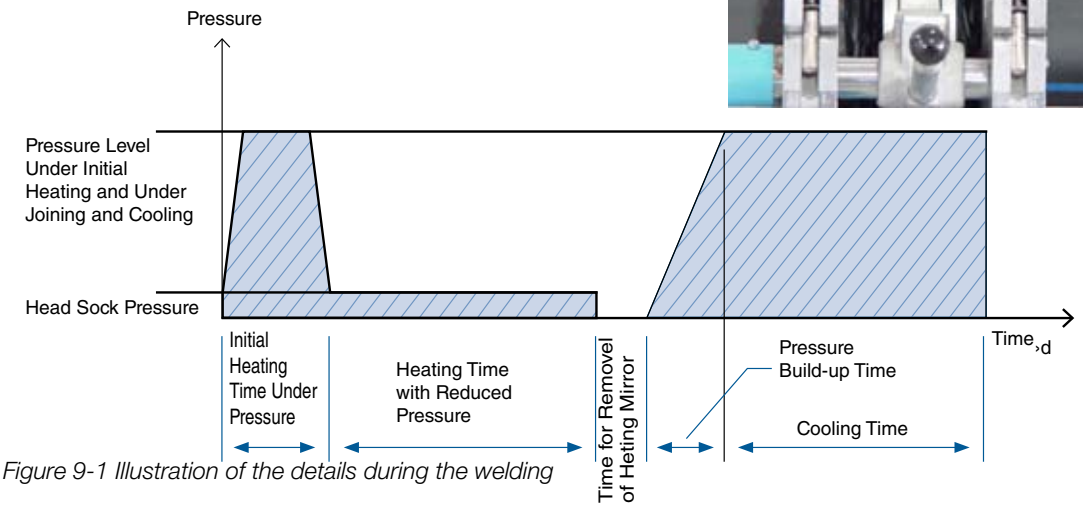
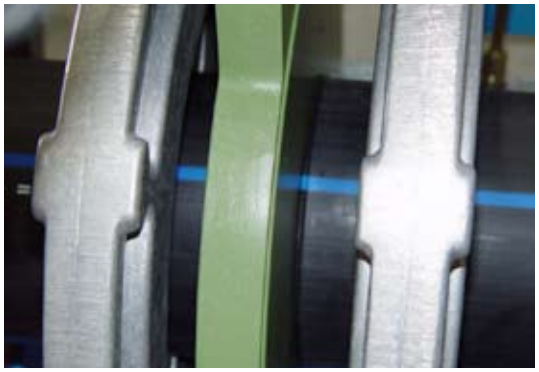


Figure 9-1 Illustration of the details during the welding

6 Once the welding surface has been scraped, it must be protected from dirt and the pipe ends need to be cleaned. If there is any re-soiling, the scraping process must be repeated.

7 Fix the heating element, (temperature 200°C-220°C),between the two pipe ends, keep the same hydraulic pressure for the duration of the heating up time, and then remove the heating element within a timeframe equal to the release time.



8 After this the bead will start forming, and then the cooling period will begin. During the weld cooling period, the connection pressure values of the pipes must be kept equal.

Pipe welding calculation formula:

$$A_{pipe} = \frac{\left(da^2 - di^2 \right) \times \pi}{4} \left(mm^2 \right)$$

Welded compression force calculation

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

veya $\approx dm \times \pi \times s \ (mm^2)$

Symbol	Definition
A_{pipe}	Pipe welding area
da	Outer diameter
di	Inner diameter
dm	Middle diameter
F	Pressure surge
$P_{Specific}$	PE = 0.15 N/mm^2 PP = 0.10 N/mm^2

Table 9-2 Symbol definition

Pipe wall thickness (mm)	Welding Pressure 0.15 N/mm2 Bead Height (mm)	Heat Time 0.02 N/mm2 (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

Table 9-1 Optimum welding times of HDPE Pipes at 20°C Environmental Temperature

9.2 Electrofusion welding process

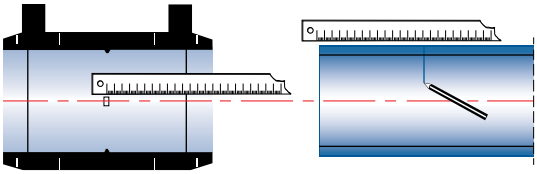
Electrofusion welded joints of polyethylene pipes are made in accordance with international standard DVS 2207. Welding pipes with two different wall thicknesses are possible using this welding method. The electrofusion welding machines used for welding are light; they also facilitate welding with various welding parameters, and filling of the welding made, if necessary.

Using the electrofusion welding process, pipes made of the same raw material may be welded. The steps below must be followed before starting electrofusion welding:

1. The solution flow speed for HDPE electrofusion connection is 0.3.....1.7 gr/10 min (190° C/5kg). The solution flow speeds of pipes to be welded and the muff should be between these values. Pipes with the same solution flow speed may 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. As all welding parameters are controlled by the site machine; the operator needs only to present the barcode (on the code card supplied with the coupling) to the machine's reader and the machine setting will be done automatically.
5. The pressure test must be initialized at least one hour after the welding process is finished, once the pipes are completely cooled. The pressure test is done in accordance with DIN 4279/1.To commence this procedure 1.5 x PN. pressure is applied to the welded pipes. If this pressure value does not decrease,then the test has been passed.

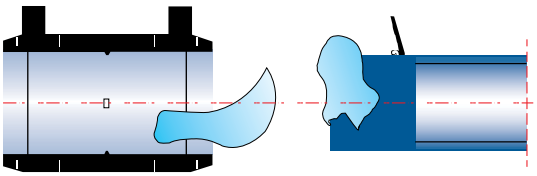
The electrofusion welding procedure is as follows:

1. The entry limit is marked on the pipe, with the pipe edges to be welded – properly cut and smooth – placed inside the piece to be welded up to the 'pipe leaning limit' (i.e. the limit to which the pipes can lean).

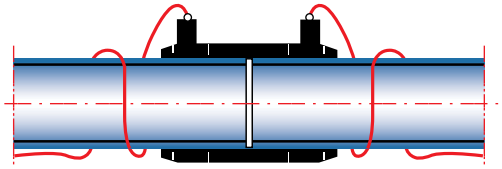


2. The surface to be welded must be cleaned and any surface oxidation must be scraped offor to welding.

3. The pieces to be welded must be unpacked at the welding station. All electrofusion surfaces to be welded, on both pipe and fitting, must be cleaned with industrial alcohol, and once cleaned, they must not be touched.



4 The electrofusion welding ends must be secured, once it has been checked that they are in a straight line with the pipe, with their ends facing upwards. The welding machine sockets are placed at the weld ends and prepared for welding.



5 Once the 'ready' has been displayed by the machine, the welding process will start when the barcode is presented to the machine's reader, or when the welding parameters are entered manually. Generally, welding machines display the welding time and voltage on the monitor.

9.3 Compression Coupling Joint

The pipes are connected to each other by means of coupling adaptor. Having been cut vertical to its axis, the pipe is inserted into the coupling up to the raised point. When both pipes are in position, the bolts are tightened by hand and the connection thus achieved. If the pipe diameter is 40 mm or higher, the bolts should be tightened using a special wrench rather than by hand. This joining method is not recommended for pipes with diameters exceeding 110mm.

9.4 Flange Connection

A flange joint connection is used for combining PE pipes with equipment such as steel pipes, valves, pumps, and condensers. It is also used in cases where the pipeline needs to be dismantled at a later stage, or for connecting PE pipes to different pipe materials. Steel rings, the flange/ backing ring, and the flange adaptor are shown in figure 9-2 ⬇.

Stub ends are fixed on both ends of the PE pipes and connected with bolts and nuts. Do not torque the bolts in circular order, but in alternate rows. Do not pull on the pipelines while tightening the bolts, in order to prevent causing an overload on the structural elements that guide the pipes.

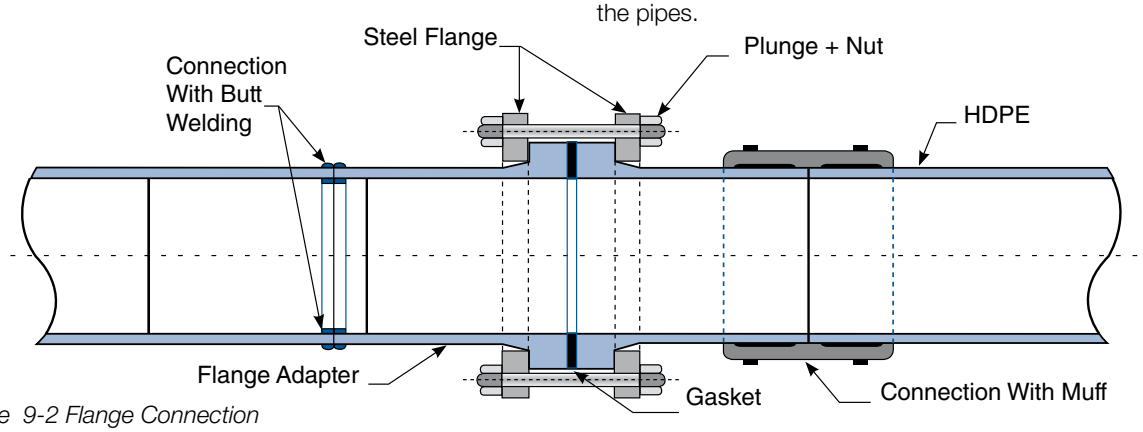


Figure 9-2 Flange Connection

10 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.

10.1 Straight Lengths and Bundles

- A flatbed vehicle, free from sharp objects and projections, should be used for the transportation of pipe systems. When lifting pipe bundles by crane, wideband slings should be used; do not use chains or hooks. For lengths of over 6 metres, load distributing beams should be inserted, spaced at equal distances.
- Allow for a certain amount of deflection or slight bending of pipe bundles when loading or unloading Six metre bundles may be handled using a forklift, but longer lengths should be moved using a side loader of four supporting forks or by a crane with a load-distributing beam. Individual lengths should be handled in a similar way. Skid timbers and rope slings can be used to ease unloading on site.

10.2 Coils

- *Small coils:*

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

Figure 10-1 Pallet off-loading

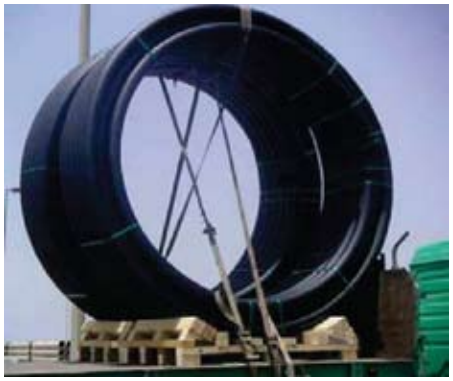


Figure 10-2 sample of Large diameter coil truck loading

Figure 10-3 Illustrates lifting the coiled pipes with a crane and straps

- *Releasing coils:*
  Pipes held in coils are under high tension and must be strapped accordingly. These can be hazardous if released incorrectly, particularly if the end of the pipe is not kept restrained at all times. It is most important to read and understand the following guidelines before attempting to release coils. When uncoiling coiled pipes with an OD of more than 63 mm, care must be taken to prevent the straps being released suddenly, and the use of an uncoiling stand is recommended.

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.
- 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.
- Anchor the load securely to prevent slippage. (As PE pipes have very smooth inner and outer surfaces. Be sure the unloading equipment is rated to handle the weight of the pipe).
- Avoid excessive stacking heights and stack pipes in straight rows. Pipes can become distorted if they are not stored properly.
- Unload one pallet, bundle, or strip load layer at a time. Truck straps securing a bundle or strip load layer should be released when that bundle or layer is to be unloaded.
- Keep pipe/fittings well away from sharp objects. Use wide, non-metallic slings.
- Exercise special care when handling pipes in wet conditions, since they may become slippery.
- Keep protective packaging intact until the pipes/fittings are required for use.
- Keep pipes/fittings away from intense heat, except when jointing.
- Allow for some bending deflection when pipes are loaded and unloaded. Lifting points should be evenly spaced.

Note :

Note :

Utmost Care has been taken to ensure that all the contents of this brochure are accurate. However, Amiantit and its subsidiaries do not accept responsibility for any problems which may arise as a result of errors in this publication. Therefore customers should make inquiries into the potential product supplier and convince themselves of the suitability of any products supplied or manufactured by Amiantit and/or its subsidiaries before using them.

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