Afri Piping Systems (Pty) Ltd

HDPE Manual

INDEX

WHO ARE WE?

Afripipes was established in 2007 bringing with it a new level of innovation and expertise in the manufacturing of HDPE Sub Duct & Multi Duct extrusions for the Telecommunication industry.

Our African footprint has evolved by supplying major network service providers throughout Africa, Middle East and the Indian Ocean islands.

With manufacturing operations in South Africa, Kenya, Dubai and an associate company manufacturing large Bore uPVC & HDPE Pipes and Fittings in Mauritius, we are able to support our customers on a regional basis.

Afripipes Kenya has become a recognized manufacturer of HDPE PE100 Water pipes, supplying high quality piping solutions into the East Africa infrastructure market.
Afripipes Kenya is committed to manufacture and supply quality products to our customers. Our operation manufactures Telecommunication Ducts and PE100 Water Pipes according to specific ISO product specifications at our accredited ISO9001-2015 QMS (Quality Management System facility).

OUR KENYAN VISION

To be the supplier of choice for supplying quality infrastructure product solutions to the Civil industry

OUR VALUES

Our values evolve around a commitment of high standards and passion towards our customers as well as being innovative within our market segments.

We ensure integrity and honesty when we promote our value proposition to all our stake holders and recognize people development within our business as a key factor to our sustainable growth plans.

COMMITMENT TO QUALITY

Afri Piping Systems Kenya is committed to manufacture and supply quality products to our customers.

Our operation manufactures Telecommunication Ducts and PE100 Water Pipes according to specific ISO product specifications at our accredited ISO9001 QMS facility.

Engineers, Stakeholders & Contractors invest in water Pipelines and Telecommunication Distribution Networks that consumers rely on.

It is imperative that products accredited with specific quality standards are manufactured in a recognized Quality Management System (QMS).

Standards and regulating authorities are there to protect the consumers by testing products and by certifying products to make sure they are compliant, ultimately providing assurance of quality and long-term product performance.

Afripipes Kenya quality product offering combined with our value-added services comprising of product training, on-site support, ensure that the best QMS practice is implemented, thus safeguarding the quality of product installations.

Afripipe (Afriblue) Water pipe are manufactured from 100% HDPE Virgin Material Procured from reputable polymer manufacturers.

We follow stringent procedures by ensuring the correct raw material is used for our extrusion processes which is manufactured according to the ISO4427 specification.

Afripipes Quality control starts from raw material been tested at our modern on-site Laboratory and further tests are conducted during manufacturing and batch testing after completion of production shifts.

Further quality and specification testing are conducted in accordance to ISO 4427 standards which includes some of the following tests: Melt Flow Index, Elongation tests, Crush & Impact tests, Hydrostatic test are conducted in a water tank over a stipulated period of time to test the strength of the pipe.
Each test is measured by certified calibrated equipment and documented according to ISO9001-2015 QMS processes.

Delivering superior piping solutions with Quality workmanship and excellent service capabilities

Constant improvement of a quality culture across all business operations

Satisfying customer demands for quality, timely delivery and competitive pricing

Compliance with best professional practice in health, safety and environment

QAS INTERNATIONAL
ISO 9001:2015
REGISTERED COMPANY
Certificate No. KY1289

HDPE PIPE APPLICATIONS

HDPE for Civils: HDPE is widely used in water mains and reticulation systems in municipal applications as well as for gas distribution, sewerage, effluent and wastewater.

HDPE for Mining: HDPE pipe can be used for a variety of above and below ground installations in mining operations, including water transfer, coal washing, treatment and recovery of mining minerals as well as slurry lines to convey suspended solid matter in quarries.

HDPE for Industrial: As a result of its corrosion and abrasion resistant properties, HDPE is ideal for transporting aggressive fluids in applications such as sewer effluent control and water purification, and the conveyance of chemicals and hazardous waste in industrial plants.

HDPE for Agriculture: HDPE pressure pipes are specified for use in irrigation systems and water supply schemes to provide high performance and a long-life expectancy.

BENEFITS AND FEATURES

- Low mass: Easy handling and easy to transport
- Excellent corrosion resistance: Long and efficient service life
- Good chemical resistance: Wide variety of Applications
- Flexibility: Easy installation
- Long lengths available: Fewer joints
- Good abrasion resistance: Can be used to pump slurries
- Good UV resistance: Can be used in exposed locations
- Low friction losses: Lower pumping costs
- Several jointing methods: Wide variety of applications
- Extensive range of fittings: Wide variety of Installations
- Good impact strength and flexible structure: Resistance to strikes and breakings and absorbs some degree of extensions

PHYSICAL PROPERTIES

High Density Polyethylene (HDPE) is a thermoplastic material which is supplied by the manufacturer in a 'ready to use' pelletised form. The continual development and improvements in the plastic technology resulted in important progress in raw materials production. High performing PE100 3rd generation material has been produced since 1999. HDPE has a high resistance to chemicals, no corrosion and high abrasion resistance as well absorbing some degree of ground movement. Life time of minimum 50 years under normal operating conditions.

	PE 100
Sizes Pressure Classes Design Stress	20 - 250mm 10 - 20 BAR 8.0 MPa
Lengths	20 to 63mm supplied in 100-meter coils 75 - 110mm supplied in 50m coils 125 - 250mm supplied in 6 or 12m straight lengths
Pipe Ends/Jointing	Plain-ended, joined with either compression, electrofusion or butt-weld fittings. Alternatively, with Tak Stubs, Victaulic Stubs or Flange and Stub.

DESIGN STRESS AND SAFETY FACTORS

Safety factors take into account handling conditions, service conditions and other circumstances not directly considered in the design. In terms of ISO 4427 the minimum safety factor is 1.25. This factor, when applied to the Minimum Required Strength (MRS), for the particular material classification (e.g. PE 80, PE100), gives the maximum allowable hydrostatic design stress for the designated material.

Designation of Material	MRS at 50 years and 20°C- Mpa	Maximum allowable hydrostatic design stress, Q-Mpa	Design coefficient, C
PE 100	10	8	1.25

TEMPERATURE CONSIDERATIONS

The Maximum Allowable Operating Pressure (MAOP) of a polyethylene pipe system is influenced by the temperature of the pipe wall. The nominal pressure rating assigned to EN 12201-2 pipe equates to performance at 20˚C, i.e. PN10 pipe is cable of withstanding a MAOP of 10 bar pressure when operating continuously at 20˚C for minimum of 50 years. However, as the temperature of the pipe wall increases, the MAOP of the pipe is reduced progressively – in other words the pipe system is re-rated with increasing temperature.

Temperature /Pressure Derating	
Temperature of Fluid in pipe °C	**Derating factor apply to Maximum working pressure**
0 – 20	0.1
20 – 25	0.9
25 – 30	0.8
30 – 35	0.7
35 – 40	0.6
40 – 45	0.5
45 - 50	0.4

HDPE Pipe is not recommended in applications where the fluid temperature exceeds 60°

Effect on Pressure

Pressure de-rating factors should be applied to HDPE pipes when operating temperatures rise above 20°C. The de-rating factors above are applicable to HDPE and it is important to take into account even 1°C increase in

temperature as this has an effect on the lifetime of the pipeline. At lower temperatures from 0°C to 20°C, the pressure handling capability does increase but it is recommended that this be ignored. With low temperatures, it is unlikely for water freezing inside an HDPE pipe, nonetheless it is recommended that the pipeline system be protected against freezing to obviate flow restrictions.

Effect on Dimensions

Due to the relatively high co-efficient of expansion and contraction, it is necessary to make allowance for this in any design and installation which is exposed to wide variations of temperature. HDPE pipes will expand or contract by 0.2mm per meter per °C rise or fall in temperature. A 30°C temperature rise will therefore cause a 36mm expansion of a 6-meter pipe.

Expansion and Contraction

All plastics have a high co-efficient of expansion and contraction, several times those of the metals. This must be allowed for in any installation by the use of expansion joints, expansion loops etc.

Material	Co-efficient of expansion (K-l)
MPVC	8×10^{-5}
HDPE	20×10^{-5}
LDPE	20×10^{-5}
Steel	1.2×10^{-5}
Copper	2.0×10^{-5}

COMPARISON WITH OTHER PLASTIC MATERIALS

Properties	HDPE	PP	PVC	PVC-C	PB
Surface feel	Waxy	Waxy	Smooth	Smooth	Waxy
Appearance (Water pipes)	Black	Pale Grey beige	Blue	Grey beige	Black
Sound produced when dropped	Medium clatter	High clatter	High clatter	High clatter	Dull Thud
Combustibility and appearance of flame	Bright flame: drops continued to burn after falling	Bright flame: drops continued to burn after falling	Carbonizes in flame extinguishes away from flame	Carbonizes in flame: extinguishers away from flame	Bright flame: drops continue to burn after falling
Odour of smoke after flame is extinguished	Like candles	Like resin	Pungent like hydrochloric acid	Pungent like hydrochloric acid	Like candles but more acrid than HDPE
Nail test (impression made by fingernail)	Impression possible	very light impression possible	impression not possible	impression not possible	impression easily produced
Special features					
Floats in water	Yes	Yes	No	No	Yes
Notch sensitivity	No	Slight	Yes	Yes	Yes
Weather resistance	Stabilized, good	Stabilized, good	Stabilized, good	Stabilized, good	Stabilized, good
Method of permanent jointing	Fusion	Fusion	Solvent cement	Solvent cement	Fusion
Suitable for mechanical jointing	Yes	Yes	Yes	Yes	Yes
Stress crack sensitivity with regard to jointing with safe media, e.g. water	Some	Slight	None	None	None
Linear expansion mm/m/°C	0.2	0.15	0.08	0 .07	0.12
Thermal conductivity kcal/mh°C	0.4	0.19	0 .14	0.14	0.2
Specific heat kcal/mh°C	0.42	0.4	0.23	0.23	0.47
Specific weight kg/cm	0.955	0.905	1.42	1.5	0.92

Tensile style strength at 20°C kp/cm^2	240	320	550	550	200
Modulus of elasticity at 20°C kp/cm^2	8000	15,000	30,000	30,000	5000

TABLE OF PHYSICAL PROPERTIES

The properties given below are for HDPE grades use in manufacture pipe it should be noted that many of these properties are relative to temperature and the duration of stress application

Property		Value	Unit	Test Method	Test Specimen
Density at 23°C		0.958	g/cm^3	ISO 1138	10mm x 10mm x 4mm
Viscosity Number		38061	ml/g	ISO 1628-3	0.1% solution of granules in decahydronaphthalene
Melt flow right	MFR 190/5	0.3259	g/10min	ISO 1133	Granules sample weight 3g to 6g
	MRF 190/21.6	6.5	g/10min		
Tensile Properties	Yield Stress	26	N/mm^2	ISO 527 Test Rate 50mm/min	ISO 3167, 4mm thick (test specimen no.3, 4mm thick according to DIN 53455
	Enlonggation at Yield Stress	10	%	ISO 527 Test Rate 50mm/min	
	Tensile modulus of Elasticity (secant between 0.05 & 0.25% strain)	900	N/mm^2	ISO 527	
	Tensile Creep Modulus (1-hour value)	650	N/mm^2	ISO 899 Test load 2N/mm^2	
	Tensile Creep Modulus (1000-hour value)	350	N/mm^2		
Flexural Properties	Flexural Creep Modulus (1 min value)	1100	N/mm^2	DIN 54825-Z4 ob=2N/mm^2	110mm x 10mm x 4mm loaded flat
	Flexural Stress (3.5% deflection)	20	N/mm^2	ISO 178 Test Rate 2 mm/min	80mm x 10mm x 4mm
Stiffness in Torsion		180	N/mm^2	DIN 53477	60mm x 6.35mm x 3mm
Hardness	Ball Indentation Hardness	41	N/mm^2	ISO 239 part 1 Test Load 132N	4mm sheet
	Shore Hardness (3 sec value)	61	~	ISO 868	6mm sheet
	Shore Hardness (15 sec value)	59	~		
Notched Impact Strength acN, (test specimen from compression moulded sheet)	At 23°C	20	kJ/m^2	ISO 179/1eA	80mm x 10mm x 4mm
	At -30°C	10	kJ/m^2		
Vicat softening Point VST/B/50		67	°C	ISO 306	4mm sheet
Oxidation Induction time	200°C in O_2	≥=60	min	ISO TR 10837	granules

Chemical Resistance

PE shows high resistance to chemical attacks with its non-polar structure like high molecular weighted hydrocarbons. PE cannot be decayed, worn out, or weakened mechanically, by electrical or chemical reactions. PE shows high resistance to acids, alkaline solutions, solvents, alcohol and water, and low resistance against oxidants acids, ketones, aromatic hydrocarbons and chloral hydrocarbons. Level of chemical resistance, depends on chemicals concentration, temperature and working pressure. These three specifications determine the pipe's life.

The Stress Regression Line

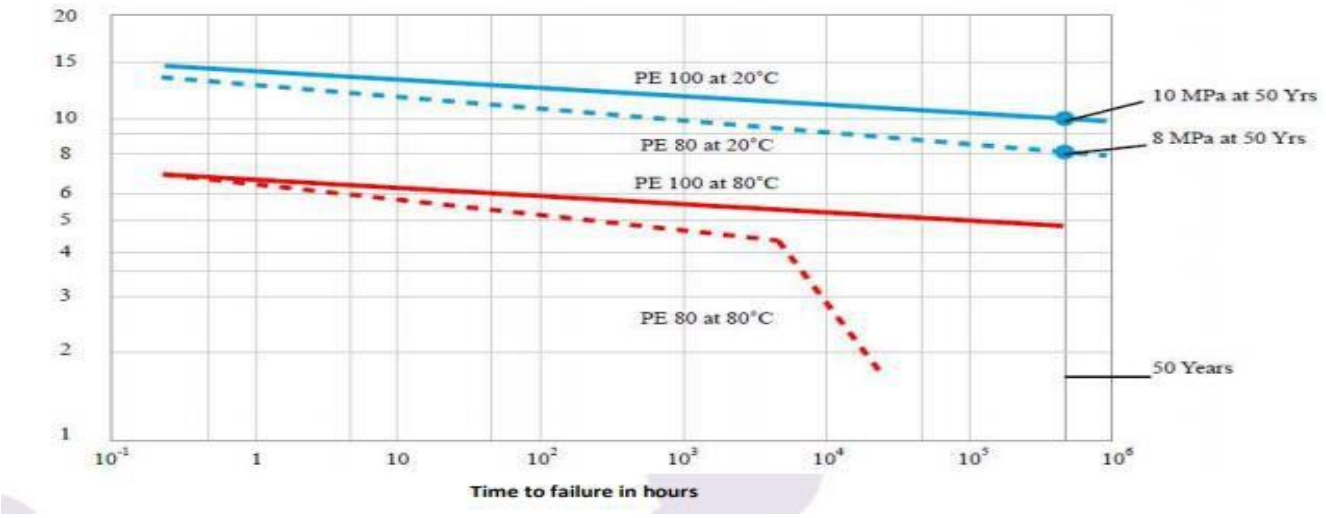
The traditional method of portraying the primary mechanical property of HDPE, tensile strength, is by means of a graph of log stress vs. log time to failure. This is known as the stress regression line. It is a plot of the circumferential hoop stress in the wall of the pipe (from internal pressure) against time to failure.
Numerous actual test results, measured at 20°C and 60°C, over a range of times up to 10,000 hours, are plotted on a log scale and a regression line is calculated to fit this data. The resultant regression line is then extrapolated to 50 years (438,000 hours). The method of calculation is an internationally accepted procedure described in ISO/TR 9080. The required values of stress and time are specified in ISO 4427.

The internationally accepted method for calculating circumferential hoop stress is derived from Barlow's formula and is as follows:

$$\sigma = p\,(d - t)/2t$$

where: p = internal pressure (MPa)
t = minimum wall thickness (mm)
d = mean external diameter (mm)
σ = circumferential hoop stress in wall of pipe (MPa)

The Stress Regression Line for HDPE is given below



Note: Principal stress/time curves for PE 80 and PE 100 pipes at 20°C and 80°C. The standard curve for HDPE Type 2 at 80°C (acc. to DIN 8075) is shown in comparison. The minimum required strength (MRS) at 20°C and 50 years is 10 MPa for PE 100 and 8 MPa for PE 80 giving the design stress 8 MPa and 6 MPa respectively

PIPE DIMENSIONS

PE100 - OD: WALL THICKNESS: MASS | SANS ISO 4427 SPECIFICATION | MATERIAL DENSITY 0.958 g/cm^3																			
PE100 (8 MPa) ISO 4427			PN 10				PN 12.5				PN 16				PN 20			
Standard Dimension Ratio			SDR 17				SDR 13.6				SDR11				SDR 9			
OD			WALL THICKNESS				WALL THICKNESS				WALL THICKNESS				WALL THICKNESS			
MIN	AVE	MAX	MIN	AVE	MAX	MASS	MIN	AVE	MAX	MASS	MIN	AVE	MAX	MASS	MIN	AVE	MAX	MASS
mm	Afri	mm	mm	Afri	mm	kg/m	mm	Afri	mm	kg/m	mm	Afri	mm	kg/m	mm	Afri	mm	kg/m
20.0	20.15	20.3	--	--	--	--	--	--	--	--	2.0	2.15	2.3	0.116	2.3	2.50	2.7	0.133
25.0	25.15	25.3					2.0	2.15	2.3	0.149	2.3	2.50	2.7	0.170	3.0	3.20	3.4	0.211
32.0	32.15	32.3	2.0	2.15	2.3	0.194	2.4	2.60	2.8	0.231	3.0	3.20	3.4	0.279	3.6	3.85	4.1	0.328
40.0	40.20	40.4	2.4	2.60	2.8	0.294	3.0	3.25	3.5	0.361	3.7	3.95	4.2	0.431	4.5	4.80	5.1	0.511
50.0	50.20	50.4	3.0	3.20	3.4	0.453	3.7	3.95	4.2	0.550	4.6	4.90	5.2	0.668	5.6	5.95	6.3	0.792
63.0	63.20	63.4	3.8	4.05	4.3	0.721	4.7	5.00	5.3	0.876	5.8	6.15	6.5	1.056	7.1	7.55	8.0	1.265
75.0	75.25	75.5	4.5	4.80	5.1	1.018	5.6	5.95	6.3	1.241	6.8	7.20	7.6	1.475	8.4	8.90	9.4	1.777
90.0	90.30	90.6	5.4	5.75	6.1	1.463	6.7	7.10	7.5	1.778	8.2	8.70	9.2	2.137	10.1	10.70	11.3	2.563
110.0	110.35	110.7	6.6	7.00	7.4	2.177	8.1	8.60	9.1	2.634	10.0	10.55	11.1	3.169	12.3	13.00	13.7	3.809
125.0	125.40	125.8	7.4	7.85	8.3	2.777	9.2	9.75	10.3	3.394	11.4	12.05	12.7	4.111	14.0	14.80	15.6	4.926
140.0	140.45	140.9	8.3	8.80	9.3	3.487	10.3	10.90	11.5	4.250	12.7	13.40	14.1	5.124	15.7	16.55	17.4	6.171
160.0	160.50	161.0	9.5	10.05	10.6	4.551	11.8	12.45	13.1	5.547	14.6	15.40	16.2	6.725	17.9	18.85	19.8	8.036
180.0	180.55	181.1	10.7	11.30	11.9	5.756	13.3	14.05	14.8	7.041	16.4	17.30	18.2	8.500	20.1	21.20	22.3	10.167
200.0	200.60	201.2	11.9	12.55	13.2	7.103	14.7	15.50	16.3	8.635	18.2	19.20	20.2	10.482	22.4	23.60	24.8	12.572
225.0	225.70	226.4	13.4	14.15	14.9	9.009	16.6	17.50	18.4	10.966	20.5	21.60	22.7	13.268	22.4	23.60	24.8	12.572
250.0	250.75	251.5	14.8	15.60	16.4	11.040	18.4	19.40	20.4	13.508	22.7	23.90	25.1	16.317	27.9	29.34	30.8	19.557

The High-Density Polyethylene Pipes (HDPE) manufactured by Afripipes Kenya are manufactured to, and carry the ISO 4427 mark of approval.
Afripipes HDPE pipe are manufactured with PE100 material with different pressure ratings reflecting the minimum and maximum wall thickness according to the ISO 4427 table as per the Pipe Dimensions Table.
Standard dimension ratio (SDR) is a method of rating a pipe's durability against pressure. The standard dimension ratio describes the correlation between the pipe dimension and the thickness of the pipe wall.
Common nominations are SDR11, SDR13.6 and SDR17.
Pipes with a lower SDR can withstand higher pressures.

PIPE COIL DIMENTIONS

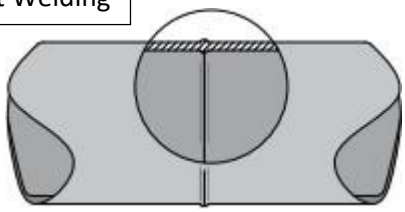
		Coil Dimensions				
		I.D	O. D		Width (W)	
	SDR's	mm	mm	mm	mm	mm
OD		Coil Length - metres				
mm		50/100mm	50m	100m	• 50m	50m
20	9/ 11/13.6	600	n/a	860	n/a	180
25	9/11/13.6/17	600	n/a	890	n/a	200
32	9/11/13.6/17	700	n/a	1090	n/a	220
40	9/11/13.6/17	700	n/a	1090	n/a	220
50	9/11/13.6/17	1300	1410	1560	150	220
63	9/11/13.6/17	1300	1780	1960	190	280
75	9/11/13.6/17	1300	1780	1960	190	280
90	9/11	2500	3100	3300	270	360
90	13.6/17	1800	2360	2540	360	450
110	9/11	2500	3160	n/a	330	n/a
110	13.6/17	2500	2860	n/a	400	n/a

JOINTING METHODS OF HDPE

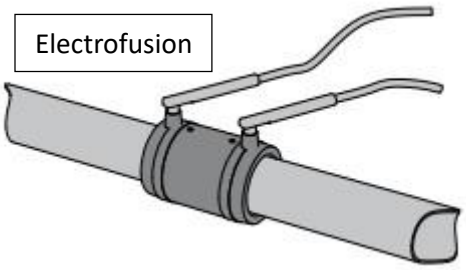
One of the advantages of HDPE pipes is the fact that a wide variety of jointing systems is available to suit a whole range of applications. The jointing systems can be divided into permanent jointing and detachable jointing. The schematic below illustrates the available systems.

Permanent Jointing

Butt Welding

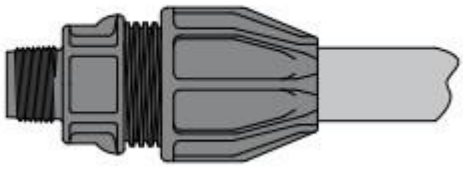


Electrofusion

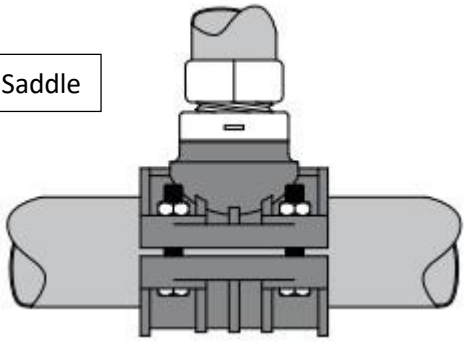


Non-Permanent (detachable) jointing

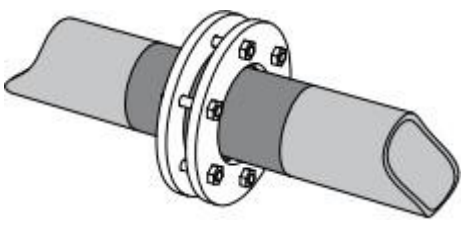
Compression Fittings



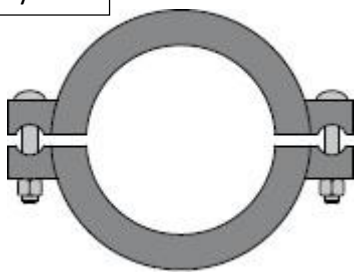
Saddle



Flanging



TAK system



COMPRESSION FITTINGS

Fields of application

Compression fittings and clamp saddles are designed specifically for connecting polyethylene pipe with an outside diameter of 20mm – 110mm. They are fully compatible with all PE100 pipes complying with, ISO 4427, They are normally used to convey drinking water and fluids at pressures up to 16 bars for generic applications.

Standards

Fittings and saddles: Complying with UNI9561, UNI9562, DIN8076-3, ISO14236, ISO13460

Threads: Complying with ISO7/1, DIN2999, BS21

Flanges: Complying with UNI2278, DIN8063

Operating Temperatures

Fittings and clamp saddles are not suitable for use with hot water for the limits dictated by the use of polyethylene pipes. The fitting and clamp saddles can withstand temperatures below 0°C. The table below shows the maximum operating pressure during continuous operation (FPA) with changes in temperature if the liquid conveyed is water, in compliance with EN805, EN 12201, and IOS13761, for values falling within the set range, a linear interpolation can be obtained.

Operating T (°C)	20°	25°	30°	35°	40°	45°
PFA (bar)	16	14.9	13.9	12.8	11.8	10.8
PFA (bar)	10	9.3	8.7	8	7.4	6.7

Product Specification

	Body A (Black) Nut B Clinching ring C Blocking Bush D O ring Gasket E	• Poly propylene blocks copolymer (PP-B) of exceptional mechanical properties even at high temperature. • Polypropylene with dye master of high stability to UV rays and solidity to heat (8 grades according to standard DIN54004) • Polyacetal resin (POM) with high mechanical resistance and hardness. • Polypropylene • Special Elastomic acrylonitrile rubber (NBR) for alimentary use

PRODUCT RANGE

Straight Coupler	Size	Reduced Coupler	Size	End Plugs	Size
	20 25 32 40 50 63 75 90 110		40 x 32 50 x 40 63 x 40 63 x 50 75 x 50 75 x 63 90 x 63 90 x 75 110 x 90		20 25 32 40 50 63 75 90 110
Equal Tee	**Size**	**Elbow**	**Size**	**Ball Valve**	**Size**
	20x20 x20 25x25x25 32x32x32 40x40x40 50x50x50 63x63x63 75x75x75 90x90x90 110x110x110		20x20 25x25 32x32 40x40 50x50 63x63 75x75 90x90 110x110		20 25 32 40 50 63
Male Adaptor	**Size**	**Female Adaptor**	**Size**	**Saddle**	**Size**
	20 x ½ 25 x ¾ 25 x 1 32 x ½ 32 x ¾ 32 x 1 32 x 1¼ 40 x 1 40 x 1¼ 40 x 1½ 50 x 1¼ 50 x 1½ 50 x 2 63 x2 75 x 2½ 90 x 3 110 x 4		20 x ½ 25 x ¾ 25 x 1 32 x ½ 32 x ¾ 32 x 1 32 x 1¼ 40 x 1 40 x 1¼ 40 x 1½ 50 x 1¼ 50 x 1½ 50 x 2 63 x2 75 x 2½ 90 x 3 110 x 4		50 x ½ 50 x ¾ 50 x 1 63 x ½ 63 x ¾ 63 x 1½ 75 x 1 75 x 2 90 x 1

Additional product sizes and fitting types are available on request

Jointing instructions

20mm – 63mm

		
1. Cut the pipe squarely using special pipe cutting tool or circular band saw. It is advisable to use a guide box to secure a square cut	2. Eliminate any burrs and bevel the end of the pipe to assure easy assembly and to prevent damage to the fitting gasket. The outer surface of the pipe must be free from imperfection or indentations where the body of the fitting makes contact with the pipe.	3. Unscrew the blue nut and put it onto the pipe following by the white clamping ring. Make sure the clamping ring is in the correct position, with largest diameter facing the fitting.
		
4. Press the pipe axially into the fitting, past the gasket until it touches the internal register inside the fitting body	5. Tighten the ring nut with a torque wrench. The ring must be tight, but it does not need to reach the end of the fitting body	6. Apply lubricant onto the rubber seal to help ease the pipe into the fitting

75mm – 110mm

			
1. Cut at 90° the pipe extremity to be connected and eliminate possible flashes	2.Unscrew of 3-4 turns the fitting nut and make sure that the O ring and the blocking bush are in the highlight position	3.Insert the pipe into the fitting till reaching the three ribs in the inside of the wall of the body	4.Screw the nut up to the end using a belt or chain wrench

ELECTROFUSION

Electrofusion is safe and presents high performance. In this method of jointing, the most important aspects are the preparation and assembly geometry. Another issue to take care is the welding energy.
Plain pipes are joined by means of electrofusion (EF) fitting incorporating an electrical heating coil which when electrically activated for the appropriate time by electrofusion welding machine, melts the surface of the pipe & fitting together resulting in complete fusion of the pipe and electrofusion fitting.

There is a barcode label on each of the EF fittings. This label includes fusion parameters (such as welding voltage and duration). Fusion parameters are transferred to the machine from this label either manually or by using the barcode reader.

Advantages of electrofusion
• Simple process capable of producing consistent joints
• Process is entirely contained, reducing the risk of joint contamination
• Compact design for confined spaces
• Process allows repair without the need to remove pipes
• Barcoding system with on board memory
• Comprehensive product range (tees, bends, couplers, stub ends, reducer, transition fittings etc.)
• One machine covering complete range
• EF is accepted as a safe, easily assembling system for pressured fluids by today's gas and water network infrastructure

Causes of failures in Electrofusion
• Not scraping and cleaning the pipe
• Incorrect voltage from the generator
• Incorrect sizes of the pipe and fitting
• Movement during fusion
• Pipe excessively oval
• Too much pressure on the aligner
• Contamination or dirt on pipe or fitting
• Incorrect entering of the time into the welding machine
• Electrical interruption

CAUTION: This procedure should only be carried out by the personnel who have electrofusion welding training. A protection tent shall be used against bad weather conditions and excess sunlight. If the welding and installation are not carried out in accordance with this instruction, there shall be no guarantee by the manufacturer.

Electrofusion Product Range

EF Elbow 45 ° SDR11	Size	EF Straight Coupler SDR11	Size	EF Tapping Saddle SDR11	Size	
	20 32 40 50 63 75 90 110 125 140 160		20 32 40 50 63 75 90 110 125 140 160 200		63x63 63x50 63x40 63x32 63x25 63x20 75x63 75x50 75x40 75x32 75x25 75x20 90x63	90x50 90x40 110x63 110x50 110x40 110x32 110x25 110x20 125 x63 125x50 140x63 140x50 160x63
EF Elbow 90° SDR11	**Size**	**EF 90°Equal Tee SDR11**	**Size**	**EF Tapping Saddle Valve SDR11**	**Size**	
	20 32 40 50 63 75 90 110 125 140 160		20 32 40 50 63 75 90 110 125 140 160		63x63 63x50 63x40 63x32 63x25 63x20 75x63 75x50 75x40 75x32 75x25 75x20 90x63	90x50 90x40 90x32 110x63 110x50 110x40 110x32 110x25 110x20 125x63 125x50 140x63 160x63
EF Reducing Coupler SDR11	**Size**	**EF Reducing Tee SDR11**	**Size**		**Size**	
	25x20 32x25 32x20 40x32 50x40 50x32 63x50 63x40 63x32 75x63 90x63 110x90 75x63 90x63 110x90 110x63 125x90 160x110		50 x 40 63 x50 63 x40 63x32 75 x63 90x 63 110 x90 110 x63 125 x110 125 x 90 125 x63 160 x 110 160 x 90 160 x 63 180 x 125		63x63 63x32 75x63 75x32 90x63 110x63 110x32 125x63 125x32	125x32 140x43 140x32 160x63 160x32 180/200x63 180/200x32 225/250x63

BUTT WELDING

Butt-fusion jointing is a thermofusion process which involves the simultaneous heating of the ends of two components which are to be joined until a melt state is attained on each contact surface. The two surfaces are then brought together under controlled pressure for a specific cooling time and homogeneous fusion is formed upon cooling. The resultant joint is resistant to end thrust and has comparable performance under pressure to the pipe.
This method of jointing requires an electrically heated plate to raise the temperature of the pipe ends to the required fusion temperature and is used for PE100 grades of material for pipe of size 32mm and above of the same Standard Dimension Ratio (SDR). When joining pipes using butt-fusion techniques, the heater plate temperatures are the same for PE100, 195ºC to 200ºC.

Quality of butt welding directly depends on operator's ability, quality of equipment, and to supervise who is responsible from related standards. The process should be observed carefully from the beginning till the end.
Before starting butt welding process it is important to check and verify all parameters. Every operator should be knowledgeable and certified to do the weld.

Equipment

- ✓ Generator to supply power to the heater plate, trimmer and hydraulic pump
- ✓ Butt-fusion machine fitted with the correct size clamp shells, trimmer, heater plate, hydraulic pump.
- ✓ Pipe support rollers
- ✓ Welding tent & cleaning material, lint free cotton cloth or paper towel
- ✓ External/Internal debeading tool
- ✓ Bead gauge, Digital thermometer with surface probe to check heater plate.
- ✓ Pipe end covers
- ✓ Baseboard
- ✓ Pipe cutters
- ✓ Indelible marker pen
- ✓ Timer

Jointing Method

Pre-Welding Checks

Before commencing a welding operation check that:

- ➢ There is sufficient fuel for the generator to complete the joint and that it is functioning correctly before it is connected to the machine.
- ➢ The trimming tool and hydraulic pump are in working order.
- ➢ The heater plate is clean and residues from previous welds have been removed.
- ➢ A tent is available to provide shelter during welding.
- ➢ The machine is complete and undamaged.
- ➢ You know the correct welding parameters for the machine and pipe being welded.
- ➢ The heater plate is at the correct temperature. (Connect the heater plate to the power supply and retain for at least 20 minutes inside the thermally insulated guard). To remove dirt deposits the heater plate may be washed, when cold, with copious quantities of clean water at the start of the jointing session. Only clean, lint free materials must be used to clean the plate. To remove grease and oily films the plate may be wiped with lint free material dampened by a suitable solvent, e.g. Isopropanol.
- ➢ Check that the pipes and/or fittings to be jointed are of the same size, SDR and material.

Dummy Welds

Even though washing may remove large deposits of dirt, very fine particles of dust may still remain on the heater plate. To remove such dust, it is necessary to make a dummy joint at the start of each jointing session, whenever the plate has been allowed to cool below 180°C, or at a change of pipe size. Two dummy joints will be made if the pipe size is greater than 180mm. A dummy joint can be made using pipe off cuts of the same size, SDR and material as the pipe being installed, it is not necessary to actually make a joint. The procedure can be discontinued after the full heat cycle.

Manual Welding

Procedure

- Place the pipes in the clamps with the ends against the trimming tool and with the pipe markings aligned.
- Align and level the components using the support rollers.
- Tighten the pipe clamps to grip and re-round the pipes.
- Cover the free ends of the pipes to prevent cooling of the plate by internal draughts. Switch on the trimming tool and close the clamps slowly so that the pipe ends are moved against the trimming tool until continuous shavings are cut from each surface.
- Keep the trimming tool turning whilst opening the clamps to avoid steps on the trimmed surfaces.
- Remove the trimming tool taking care not to touch the trimmed ends. Remove loose shavings from the machine and component ends.
- Check that both surfaces are completely planed. If they are not, then repeat the trimming process.
- Close the clamps and check that there is no visible gap between the trimmed faces.
- The maximum permitted outsider diameter mismatch is: 1.0mm for pipe sizes 90mm to 315mm 2,0mm for pipe sizes 316mm to 800mm,
- If the mismatch is greater than these values, then the pipe must be realigned and re-trimmed.
- Open and then close the clamps and note the drag pressure needed to move the pipes together using the hydraulic system.
- Remove the heater plate from its protective cover. Check that it is clean and up to temperature.
- Place the heater plate in the machine and close the clamps so that the surfaces to be joined are touching the plate.
- Using the hydraulic system apply the pressure previously determined.
- Maintain the applied pressure until the pipe begins to melt and a uniform bead of 2-3mm is formed on each end.
- After the initial bead up, the pressure in the hydraulic system shall be released so that the pressure gauge registers between zero and the drag pressure so as to control the bead growth during the heat soak time.
- Check that the pipe does not slip in the clamps.
- The pipe ends must maintain contact with the heater plates.
- When the heat soak time is completed, open the clamps and remove the heater plate ensuring that the plate does not touch the melted surfaces.
- Immediately close the clamps (within 8 to 10 seconds of removing the plate) and bring the melted surfaces together at the previously determined pressure.
- Maintain the required pressure for the minimum cooling time as indicated in the table.
- After this time the assembly can be removed from the machine but should not be handled for a further period equal to the cooling times given on page 9.
- Examine the joint for cleanliness and uniformity and check that the bead width is within the specified limits.
- Remove the external bead and if required the internal beads using suitable debeading tools.

- The beads and joint shall be numbered/coded using an indelible marker pen.
- Twist the beads at several positions. If the bead is seen to split at any point, then the joint must be cut out from the pipeline and remade. If a similar defect re-occurs, cease all further jointing until the equipment has been thoroughly cleaned, examined and new trial joints were made and shown to be satisfactory.

Caution

- *Do not touch the prepared surfaces.*
- *Drag pressure is the minimum gauge pressure required to overcome the sliding frictional drag on the rams due to the operation of the machine and the weight of the pipes/fittings being jointed,*
- *The drag pressure (in bar) must be assessed accurately prior to making each fusion joint and must be added to the basic ram pressure values shown on the machine. (When fully automatic machines are used this operation will normally be carried out automatically.)*

Buttweld Product Range

Bend 90 ° SDR 17 & 11	Size	Equal Tee SDR 17 & 11	Size	Reduder Concentric SDR 17 & 11	Size		
	20 32 40 50 63 75 90 110 125 140 160 180 200 225 250		20 32 40 50 63 75 90 110 125 140 160 200 225 250		*25x20 *32x20 *32x25 40x20 40x25 40x35 50x25 50x32 50x40 63x32 63x40 63x50 75x32 75x40 75x50 75x63 90x50	90x63 90x50 90x63 90x75 110x50 110x63 110x75 110x90 125x63 125x75 125x90 125x110 140x75 140x90 140x110 140x125 160x90	160x110 160x125 160x140 180x90 180x110 180x125 180x140 180x160 200x140 200x160 200x180 225x140 225x160 225x180 225x200

End cap SDR17 & 11	Size	Adaptors Female Tread SDR 17 & 11	Size	Adaptors Male Tread SDR 17 & 11	Size	Unions SDR 17 & 11	Size
	20 32 40 50 63 75 90 110 125 140 160 180 200 225		25 x ½ 25 x ¾ 32 x ½ 32 x ¾ 32 x 1 40 x ¾ 40 x 1 40 x 1¼ 50 x ½ 50 x 1 50 x 1¼ 50 x 1½ 63 x2 75 x 2½		25 x ½ 25 x ¾ 32 x ½ 32 x ¾ 32 x 1 40 x ¾ 40 x 1 40 x 1¼ 50 x ½ 50 x 1 50 x 1¼ 50 x 1½ 63 x2 75 x 2½		20 32 40 50 63 75 90 110

**No available in SDR 17*

FABRICATED FITTINGS AND FLANGES

Pipe fittings can be manufactured from HDPE pipe in a wide variety of sizes & pressure classes but mostly from 75mm OD upwards & PN 6 or higher. The fittings can be plain ended (for butt welding, electrofusion fittings or compression fittings) or have stubs fitted for flanges or Tech Clamps. Permissible working pressure is 60% of class pipe used to fabricate fitting, e.g.: 10 bar pipe produces a 6-bar fabricated fitting.

Flange Dimensions

Pipe size in mm	BS 10 Table D					
	Diamentions in mm				Bolts	
	D	D1	B	PCD	No.	Size
20	95.0	30	5	66.7	4	M12
25	101.6	38	5	73.0	4	M12
32	114.3	45	5	82.6	4	M12
40	120.6	52	6	87.3	4	M12
50	133.3	63	6	98.4	4	M12
63	152.4	78	8	114.3	4	M16
75	165.1	92	8	127.0	4	M16
90	184.1	110	10	146.0	4	M16
110	215.9	135	10	177.8	4	M16
125	254.0	149	10	209.6	8	M16
140	254.0	167	13	209.6	8	M16
160	279.4	190	13	235.0	8	M16
180	285.0	188	13	235.0	8	M16
200	336.6	236	13	292.0	8	M16
225	369.0	236	13	323.9	8	M16
250	406.4	280	16	355.6	8	M20

Handling and Storage

All piping materials should be examined during transportation and after transportation. The supplier should be notified about any defect products as soon as possible.

In order to store pipes properly, a levelled surface capable of carrying the full load should be provided, necessary handling should be used and stacking heights should be kept to a minimum. A safe area is needed for the manoeuvre of vehicles. If the pipes are stored in a pyramid shape, the pipes at the bottom sides may be subject to deformation and pyramid stacks should not exceed 1.2 meters in height. For providing hygiene during the storage, open ends of the pipes should be covered against materials (Soil, stone etc.) penetration.

As Black HDPE pipe attracts a high concentration of heat during the day, caution should be exercised when handling the pipe. The same applies when HDPE is wet, the pipe is inclined to become very slippery when handled.

Transportation

Before loading HDPE pipe, the loading surface should be smooth and free of sharp objects. Sharp objects must be kept away from HDPE pipes during transportation. Straps made of polypropylene or nylon is recommended when off loading or loading HDPE pipe.

Disclaimer

Whilst every care has been taken in the preparation of this manual, neither Afripipes/Afri Piping Systems can be held liable for any errors in this publication. It should also be noted that this manual is intended for reference only. No Liability will be entertained in this regard.