QUALITY
IS OUR
PROFESSION

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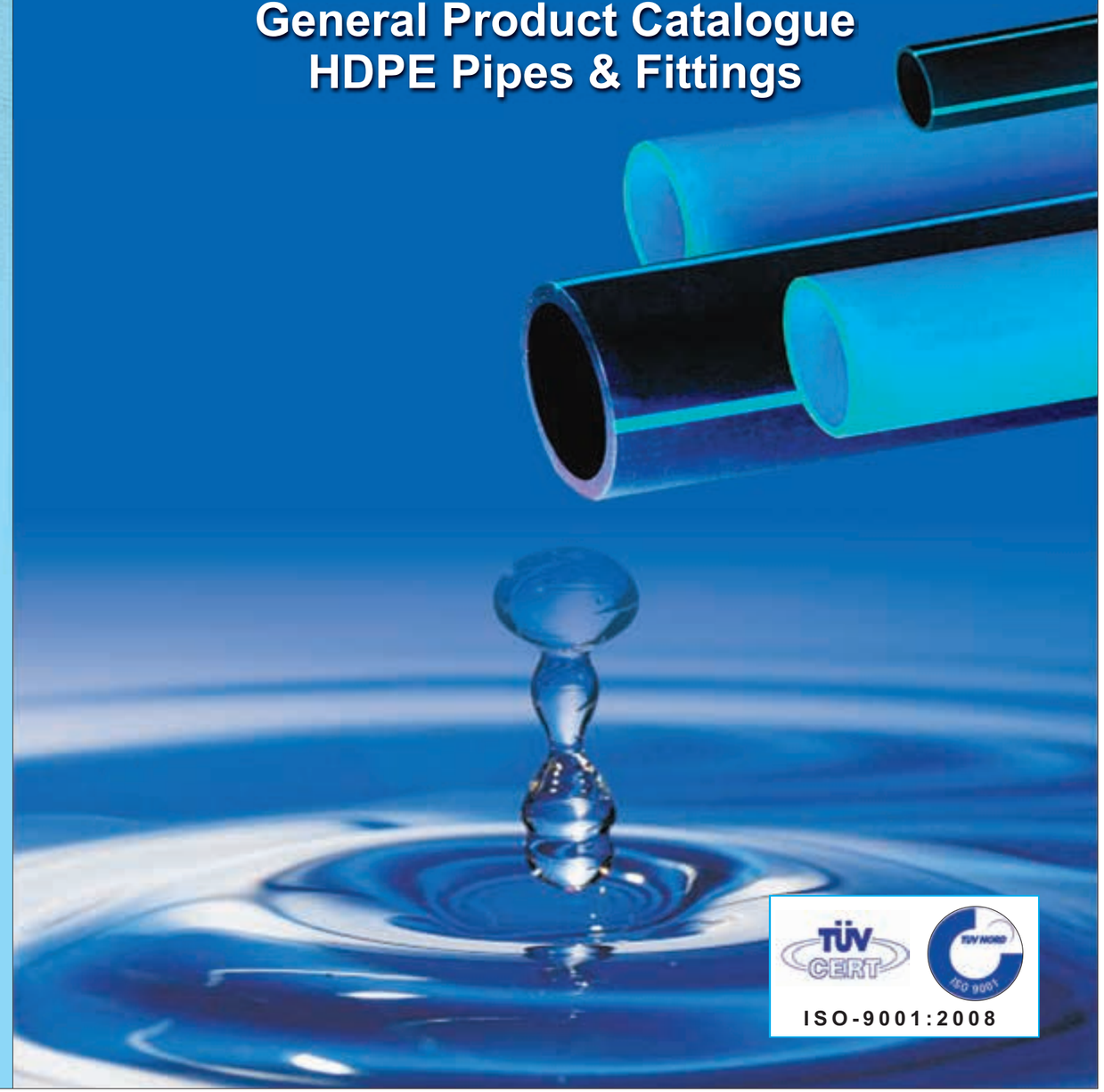
Haroon Market, 3rd Floor
Mobile: 0093 799 361046
Email: info@highstandardpipes.com
www.highstandardpipes.com

High Standard Pipe

High Standard Pipe®

General Product Catalogue
HDPE Pipes & Fittings



TÜV CERT

ISO-9001:2008

High Standard Pipe®

High Standard Pipe

PE 100	PN 3.2		PN 4		PN 5		PN 6.4		PN 7.8		PN 8	
PE 80	PN 2.5		PN 3.2		PN 4		PN 5		PN 6		PN 6.4	
PE 63	PN		PN 2.5		PN 3.2		PN 4		PN 4.8		PN 5	
d	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M
10											1.8	0.06
12											2	0.099
16											2.8	0.154
20											3.5	0.24
25											4.4	0.386
32											5.5	0.6
40							1.8	0.227	1.9	0.238	6.9	0.936
50					1.8	0.287	2	0.314	2.3	0.361	8.6	1.47
63			1.8	0.364	2	0.399	2.5	0.494	2.9	0.563	10.3	2.09
75	1.8	0.436	1.9	0.457	2.3	0.551	2.9	0.675	3.5	0.807	12.3	3
90	1.8	0.525	2.2	0.643	2.8	0.791	3.5	0.978	4.1	1.14	15.1	4.49
110	2.2	0.706	2.7	0.943	3.4	1.17	4.2	1.43	5	1.67	17.1	5.77
125	2.5	1	3.1	1.23	3.9	1.51	4.8	1.84	5.7	2.16	19.2	7.25
140	2.8	1.25	3.5	1.54	4.3	1.88	5.4	2.32	6.4	2.72	21.9	9.44
160	3.2	1.53	4	2	4.9	2.42	6.2	3.04	7.3	3.54	24.6	11.9
180	3.6	2.5	4.4	2.4	5.5	3.07	6.9	3.79	8.2	4.47	27.1	14.8
200	3.9	2.46	4.9	3.05	6.2	3.84	7.7	4.69	9.1	5.51	30.8	18.6
225	4.4	3.12	5.5	3.86	6.9	4.77	8.6	5.89	10.3	7	34.2	23
250	4.9	3.83	6.2	4.83	7.7	5.92	9.6	7.3	11.4	8.59	38.3	28.9
280	5.5	4.83	6.9	5.98	8.6	7.4	10.7	9.1	12.8	10.8	43.1	36.5
315	6.2	6.12	7.7	7.52	9.7	9.37	12.1	11.6	14.4	13.6	48.5	46.5
355	7	7.73	8.7	9.55	10.9	11.8	13.6	14.6	16.2	17.3	54.7	58.8
400	7.9	9.82	9.8	12.1	12.3	15.1	15.3	18.6	18.2	29.1		

PE 100	PN 8		PN 9.6		PN 10		PN 12.7		PN 16		PN 20		PN 25	
PE 80	PN 6.4		PN 7.7		PN 8		PN 10		PN 12.5		PN 16		PN 20	
PE 63	PN 5		PN 6		PN 6.3		PN 8		PN 10		PN 12.6		PN 16	
d	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M
10														
12														
16														
20														
25														
32														
40														
50							1.8	0.107	1.9	0.112	1.8	0.084	1.8	0.06
63					1.8	0.137	1.9	0.144	2.3	0.171	2.3	0.133	2.2	0.099
75	1.8	0.179	1.9	0.187	2.4	0.232	2.9	0.272	3.2	0.327	2.8	0.2	2.8	0.154
90	2	0.285	2.4	0.295	3	0.356	3.7	0.43	4.5	0.509	3.5	0.24	3.5	0.24
110	2.9	0.44	3	0.453	3.7	0.549	4.6	0.668	5.6	0.788	4.4	0.327	4.4	0.386
125	3.6	0.688	3.8	0.721	4.7	0.873	5.8	1.05	7.1	1.26	5.5	0.509	5.5	0.6
140	4.3	0.976	4.5	1.02	5.6	1.24	6.8	1.47	8.4	1.76	6.9	0.788	6.9	0.936
160	5.1	1.39	5.4	1.46	6.7	1.77	8.2	2.12	10.1	2.54	8.6	1.26	8.6	1.47
180	6.3	2.08	6.6	2.17	8.1	2.62	10	3.14	12.3	3.78	10.3	1.76	10.3	2.09
200	7.1	2.66	7.4	2.76	9.2	3.37	11.4	4.08	14	4.87	12.3	2.54	12.3	3
225	8	3.34	8.3	3.46	10.3	4.22	12.7	5.08	15.7	6.11	15.1	3.78	15.1	4.49
250	9.1	4.35	9.5	4.52	11.8	5.5	14.6	6.47	17.9	7.96	17.1	4.87	17.1	5.77
280	10.2	5.48	10.7	5.71	13.3	6.98	16.4	8.42	20.1	10.1	19.2	6.11	19.2	7.25
315	11.4	6.79	11.9	7.05	14.7	8.56	18.2	10.4	22.4	12.4	21.9	7.96	21.9	9.44
355	12.8	8.55	13.4	8.93	16.6	10.9	20.5	13.1	25.2	15.8	24.6	10.1	24.6	11.9
400	14.2	10.6	14.8	11	18.4	13.4	22.7	16.2	27.9	15.4	27.1	12.4	27.1	14.8
450	16	13.4	16.6	13.7	20.6	16.8	25.4	20.3	31.3	15.4	30.8	15.8	30.8	18.6
500	17.9	16.7	18.7	17.4	23.2	21.2	28.6	25.6	35.2	30.8	34.2	15.4	34.2	23
560	20.1	21.2	21.1	22.1	26.1	26.9	32.2	32.5	39.7	39.1	38.3	30.8	38.3	28.9
630	22.7	26.9	23.7	28	29.4	34.1	36.3	41.3	44.7	49.6	43.1	39.1	43.1	36.5
											48.5	49.6	48.5	46.5
											54.7	58.8		


CERTIFICATE

TÜV NORD

Certificate No.: CAC1405003

Report No.: CAC1404003

Holder: High Standard Pipe Co.
Pul-i-Charkhi Industrial Area – Hoodkhil -Kabul - Afghanistan

Product: Polyethylene Pipes for Plastics Piping Systems

Product Size & Specification: DN/OD : 20mm to 450mm
SDR 11 & SDR 17
PE 100

Reference Standards: BS EN 12201-2:2003 & CEN/TS 12201-7:2003

Hereby it is certified that manufacturing & quality control system of **High Standard Pipe Co.** for producing **Polyethylene Pipes for Plastics Piping Systems** Were assessed.

Report No. **CAC1404003** shows that the product specifications as well as manufacturing methods are complied with the requirements of the above mentioned standards.

This certificate has not been issued in order to obtain CE, GS, and/or other similar disciplines which are in use under certain accreditation schemes in other commercial & economic zones such as European Union.

Valid until: 2015-03-18

Dr. Kamran Rezaie

Managing Director & Member of Board
TÜV NORD Iran

Tehran, 2014-03-18


CERTIFICATE OF REGISTRATION

AMERICAN GLOBAL STANDARDS

ISO 9001

HIGH STANDARD PIPE COMPANY

Pulcharkhi Industry, Block-A, Street 5,
Kabul - Afghanistan

American Global Standards, LLC issues this certificate to the firm named above, having assessed and approved the firm's Quality Management System and finding the system conforms to the standards of:

ISO 9001:2015

The Quality Management System is applicable to the following:

Production of (HDPE) High-Density Polyethylene Pipes and Fittings, (PVC) Polyvinyl Chloride Pipes and Fittings, UPVC Pipes & Fittings, (PPR-C) Polypropylene Random Co-Polymer Pipes and Fittings

This approval is subject to the firm maintaining its system to the required standards, which will be monitored by AGS. In the assurance of this certificate, AGS assumes no liability to any party other than the firm named above, and then only in accordance with the agreed upon Quality Management System Assessment Agreement.

Certification Number: AGS-A-13003-Q
Original Approval: June 10, 2013
Date of Issue: June 10, 2018
Date of Expiration: June 09, 2021

For and on Behalf of American Global Standards, LLC

USA Office: 1187 Coast Village Road, Suite 480, Montecito, CA 93108 USA
Tel: 617-638-4648
www.americanglobal.org • info@americanglobal.org

AIAO-BAB
QMS
ACCREDITED


Certificate of Compliance

COMPANY NAME: HIGH STANDARD PIPE COMPANY
LOCATION : Pulcharkhi Industry, Block – A, Street 5, Kabul – Afghanistan
PRODUCTS: Polyvinyl Chloride (PVC – uPVC Pipes)

Reference Standards That are at HSP Company Capability range to Produce accordingly in their own parameters

ASTM, D 1784, D 1784, D 1785-94, D 2665, D 2441, D 2466, D2734, D3034 PSM
ASTM, F-439, F-437, F-532, F-679, F-1970
PrEN, 1452-1, 5
ANSI-UL 651-A, B 165
NEMA-Ts 2 & 8,
AWWA-C900-16, C905,
BSS, 5035, 3506, 5255, 3414, 4660, 6099, 5481, 6504, 4346,
DIN, 8061, 8062, 19531-4, 8078, 8080, 8063,
ISHRI, 9117, 9118 and 9119
ISO, 4422-2, ISO 161

Model No / Type: ø 20 mm – ø 455 mm (Normal Outside Diameter)

TESTS CONDUCTED:

- Colour, Material, Effect of Material on Water Quality ,Geometrical, Mechanical Properties Test
- Long / Short Term Hydrostatic Strength at 20 C°, Long Term Hydrostatic Pressure Resistance at 60 C° Test
- Longitudinal Reversion Test, Resistance to Dichloroethane Immersion Test
- Resistance to Acetone / Dichloromethane Immersion Test

TEST RESULTS: SATISFACTORY

The certificate is based on test results of randomly selected samples. This certificate can be used, by High Standard Pipe for their product compliance as well with required standard norms only for PVC - uPVC products.

Certification Number: AGS-AFG-15005 CoC
Date of Issue: October 29, 2018
Date of Expiration: October 28, 2017

For and on Behalf of American Global Standards, LLC

USA Office: 1187 Coast Village Road, Suite 480, Montecito, CA 93108 USA
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CERTIFICATE OF COMPLIANCE

Report No: **AGS-AFG-15005-CoC**

Holder: **High Standard Pipe Co.**
Pul-i-charkhi Industrial Area, Block- A, Street 5, Kabu l- Afghanistan

Product: **Polyethylene Pipes for Plastics Piping Systems.**

Product Size & Specification: **DN/OD: 20mm to 630mm**
SDR 11 & SDR 17, PE 100

Reference Standards: **BS EN 12201-2:2003 & CEN/TS 12201-7:2003**

Hereby it is certified that manufacturing & quality control system of **High Standard Pipe Co.**
For producing **Polyethylene Pipes for Plastics Piping Systems** Were assessed.

Report No: **AGS-AFG-15005-CoC** shows that the product specifications as well as manufacturing methods are complied with the requirements of the above mentioned standards.

This certificate has not been issued in order to obtain CE, GS and / or other similar disciplines which are in use under certain accreditation schemes in other commercial & economic zones such as European Union.

Certification No: AGS-AFG-15005-CoC
Date of Issue: August 17, 2018
Date of Expiration: August 16, 2019

For and on Behalf of American Global Standards, LLC

USA Office: 1187 Coast Village Road, Suite 480, Montecito, CA 93108 USA
Tel: 617-638-4648
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THE INTRODUCTION

Since the first days of formation and till today the basic purpose of “High Standard Pipe Co.” is producing according to requirements of the world standards with use of High Technologies, in accordance with wishes of consumers.

We hope that in near future, due to national technologies, products which are manufactured by our company will capture not only domestic, but also the international market.

Presenting to your attention new quality products, we hope, that you’ll pay attention to difference of their quality from similar products.

In this booklet you will find all information that may be interesting to you, related to release and exploitation of plastic pipes.

HSP HDPE Pottable Water Network Pipes and Fittings

Opportunities in Drinking Water for PE Pipes

Drinking water is one of the basic elements for life is fast becoming a rare and expensive resource - only 1% of the water on earth is suitable for drinking, and as living standards rise the demand for water rises at twice the rate of the world’s population. Currently over 20% of the world’s population do not have a suitable supply of drinking water.

in addition, in virtually all countries large quantities of water are wasted through leakage from old pipe systems. Steel systems fail due to corrosion, especially in cities due to salt and electrical currents. Ductile iron systems also corrode and build up internal deposits which degrade water and reduce flow.

In rural areas and in developing countries the need for low cost installation of new leak free systems is an investment for the future.

The Benefits of Polyethylene

Polyethylene has become the most popular material for pipe systems as it offers significant benefits compared to alternative materials, namely:

- Low Maintenance
- Low Cost of Installation
- Long Lifetime
- High Safety Record
- Easily Processed and Recycled

- **Low Maintenance** - PE pipes retain their strength and functionality with minimum maintenance- they are easily
- weldable into long sections,
- exhibit slow crack growth resistance along with resistance to rapid crack propagation and a long lifetime in both static and dynamic loads.
- **Lower Cost of Installation** - PE pipes are flexible, light weight and tough, enabling easier site handling and installation along with easier coiling into long lengths for easier handling and storage.
- **Long Lifetime**- PE pipes can be certified to last at least 50 years and to withstand harsh terrains and climates with no corrosion. They exhibit excellent
- chemical resistance, abrasion resistance and good resistance to weatherability and UV along with resistance to micro organism and rodent attack.
- **High Safety Record and No. Leakage**- Weldability brings leak free joints s no
- over long distances, and the ability to withstand high axial and bending loads without joint failure. Chemical inertness ensures no contamination of water through taste and adore.
- **Easily Processed and Recyclable** - Polyethylene as a thermoplastic is easily converted into various pipe and fitting dimensions and can be recycled into less critical applications at the end of its lifetime.

HSP HDPE Pottable Water Network Pipes and Fittings

Marking pipes

During manufacture, pipes are marked continuously with an interval in one meter.

Standard marking

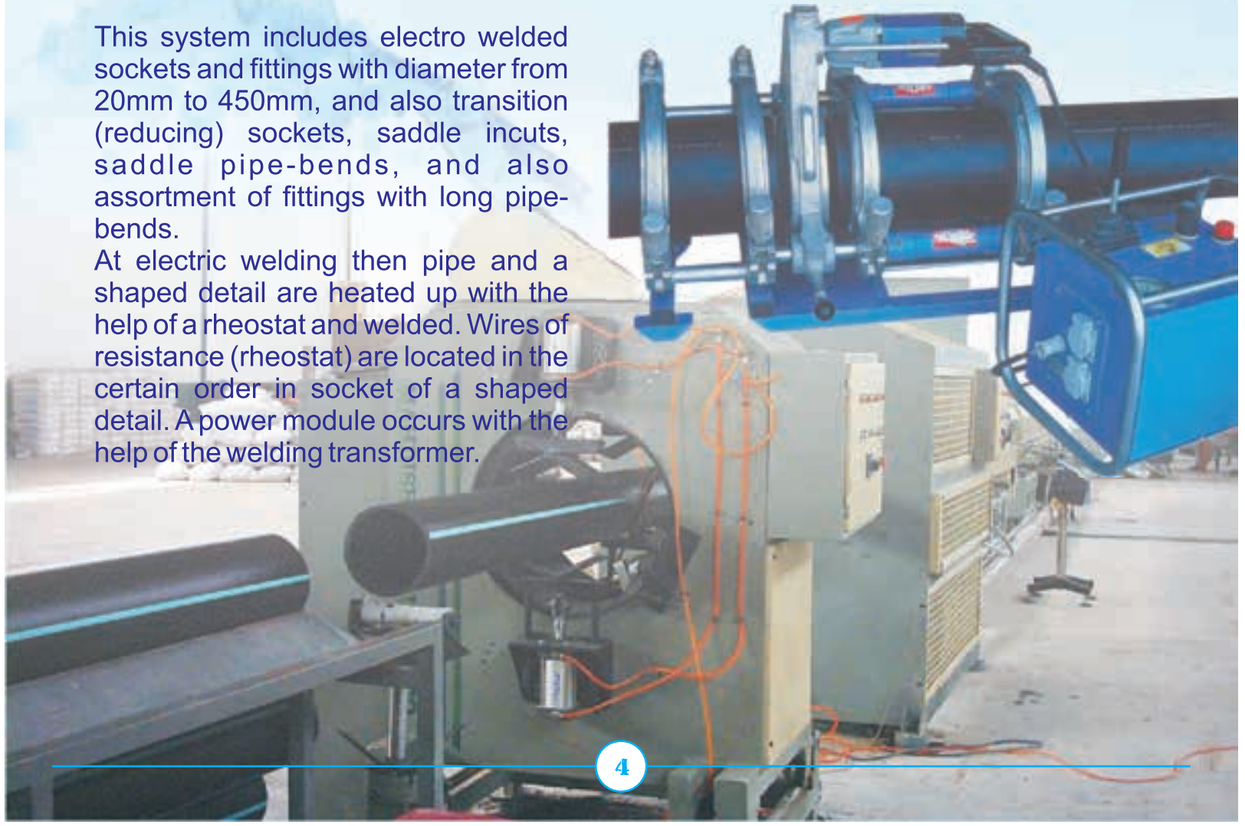
Marking is carried out differently depending on materials.
Standard marking covers the following data:

- Name of the manufacturer.
- A short designation of material (HDPE, PP-H, PP-R)
- The size (external x thickness of a wall)
- Nominal pressure (PN..)
- Date of Production
- A standard Designation

There is additional appropriate print to standardization (PE 100).

Electro- coupled welding

This system includes electro welded sockets and fittings with diameter from 20mm to 450mm, and also transition (reducing) sockets, saddle incuts, saddle pipe-bends, and also assortment of fittings with long pipe-bends.
At electric welding then pipe and a shaped detail are heated up with the help of a rheostat and welded. Wires of resistance (rheostat) are located in the certain order in socket of a shaped detail. A power module occurs with the help of the welding transformer.



PRODUCT IDENTITY CARD

PRODUCT NAME	HSP PE 80 NATURAL PIPES AND FITTINGS
RAW MATERIAL	MDPE 80 (=PE 80)
PRODUCT COLOR	BLACK
PRODUCTION STANDARDS	DIN 8074

PRODUCT SPECIFICATION

Production Range	∅25 – ∅500 mm
Pressure Rating	SDR 11 - PN 12,5 [for 4 bar lines in accordance with TSE]
Production Unit Lentgh	∅25 – ∅125 (in coils) ∅110 – ∅500 (11.8 meter bars)

TECHNICAL SPECIFICATIONS:

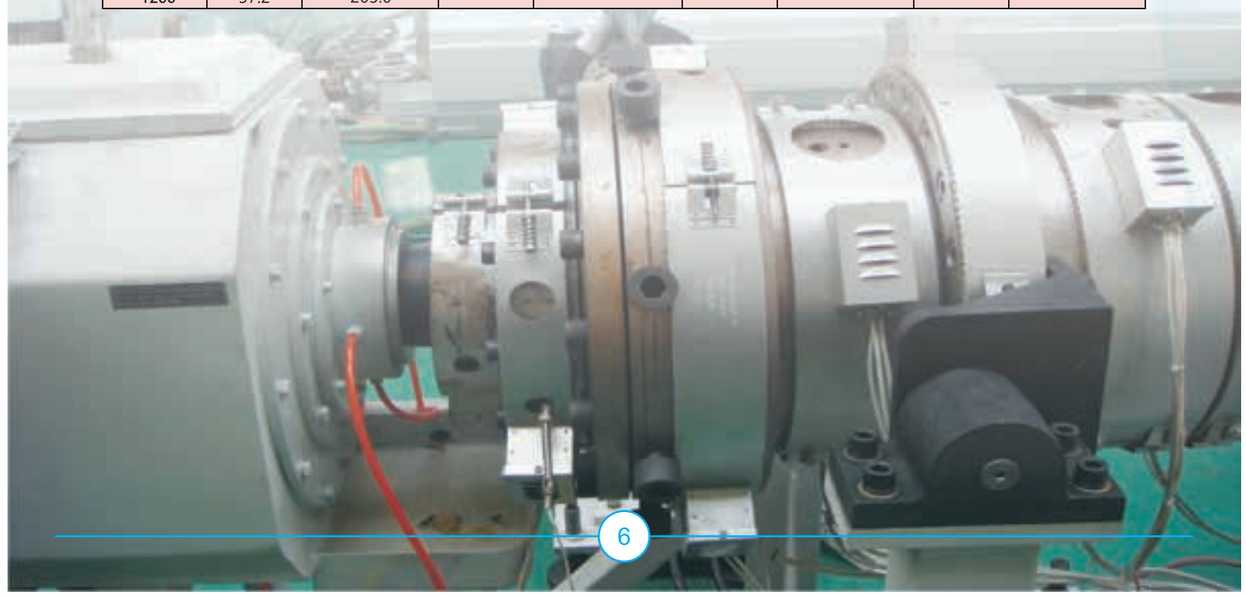
Polymer Data	PE 80	Unit	Test Method
Density at 23 °C	0,940	gr/cm^3	ISO 1183
Viscosity Number	280	cm3/gr	ISO 16283
MFR 190°/5 kg	0,85	gr/10 min	ISO 1133
MFR 190°/25 kg	18	gr/10 min	ISO 1133
Mechanical Properties			
Yield Strees	18	Mpa	ISO 527
Elongation at yield	10-12	%	ISO 527
Tensile Modulus	600	Mpa	ISO 527
Notched impact strength	-	Kj/m^2	ISO 179/1eA
+23 °C			
- 20 °C	-	Kj/m^2	ISO 179/1eA
Other Properties			
Oxidation - Induction time at 210 °C	≥ 20	min	ISO TR 10837
Carbon Black Content	2.3 ± 0.2	%	ISO 6964
Carbon Black Dispersion	≤ 3		ISO CD 11240
MRS minimum Required Strength	< 8	Mpa	ISO TR 9080
Resistance to S.C.P (Slow Crack Propagation) = 4.6 Mpa, 80 °C Notched)	<2000	h	EN 33479
Resistance to R.C.P. (Rapid Crack)	-	bar	ISO DIS 13477
Propagation S4-test 110/10 mm. 0°C			
Elongation at break	<600	%	EN 638
Linear Thermal Expansion	1.5 x 10	°C^{-1}	ASTM D 696
Specific Heat Capacity	1.9	J/g°C	(20-60°C) BPCL
Electrical Properties			
Electric Strength	>20	kV/mm	BS 2782:201 B
Volume resistivity	>10^{13}	Ωm	BS 2782:230 A
Surface resistivity	>10^{15}	Ω	BS 2782:231 A
Relative permitivity	2,6	-	BS 2067 1 TO 20 MHZ
Los tangent	3x10^{-4}	-	BS 2067

HSP HDPE Pottable Water Network Pipes and Fittings

High Standard Pipe Factory

PE 80 PIPE DIMENSION CONFORMING TO ISO 4427/DIN8074
DESIGN STRESS = 6.3 MPa

O.D.	S 10		S 6.3		S 5		S 4	
	SDR 21		SDR 13.6		SDR 11		SDR 9	
	PN 6.3		PN 10		PN 12.5		PN 16	
	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight
mm	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m
16							1.8	0.084
20			1.08	0.107	1.9	0.112	2.3	0.133
25			1.9	0.144	2.3	0.171	2.8	0.200
32			2.4	0.232	30	0.272	3.6	0.327
40	1.9	0.239	3	0.356	3.7	0.430	4.5	0.509
50	2.4	0.374	3.7	0.549	4.6	0.866	5.6	0.788
63	3	0.58	4.7	0.873	5.8	1.05	7.1	1.26
75	3.6	0.828	5.6	1.24	6.8	1.47	8.4	1.76
90	4.3	1.18	6.7	1.77	8.2	2.12	10.1	2.54
110	5.3	1.77	8.1	2.62	10.0	3.14	12.3	3.78
125	6.0	2.27	9.2	3.37	11.4	4.08	14.0	4.67
140	6.7	2.83	10.3	4.22	12.7	5.08	15.7	6.11
160	7.7	3.72	11.8	5.50	14.6	6.67	17.9	7.98
180	8.6	4.67	13.3	6.98	16.4	8.42	20.1	10.1
200	9.6	5.78	14.7	8.56	18.2	10.4	22.4	12.4
225	10.8	7.3	16.6	10.9	20.5	13.1	25.2	15.8
250	11.9	8.93	18.4	13.4	22.7	16.2	27.9	19.4
280	13.4	11.3	20.6	16.8	25.4	20.3	31.3	24.3
315	15.0	14.2	23.2	21.2	28.6	25.6	35.2	30.8
355	16.9	18.0	26.1	26.0	32.2	32.6	39.7	39.1
400	19.1	22.9	29.4	34.1	36.2	41.3	44.7	49.6
450	21.5	28.9	33.1	43.2	40.9	52.3	50.3	62.7
*500	23.9	35.7	36.8	53.3	45.4	64.5	55.8	77.3
*560	26.7	44.7	41.2	68.9	50.8	80.8	62.5	97.0
*630	30.0	56.4	46.3	84.6	57.2	102		
*710	33.9	71.8	52.2	107				
*800	38.1	91.1	58.8	136				
*900	42.9	115.0						
*1000	47.7	142.0						
*1200	57.2	205.0						



PRODUCT IDENTITY CARD

PRODUCT NAME	HSP HDPE 100 POTABLE WATER NETWORK PIPES
RAW MATERIAL	HDPE 100 (=PE 100)
PRODUCT COLOR	BLACK
PRODUCTION STANDARDS	DIN 8074

PRODUCT SPECIFICATION

Production Range	∅25 – ∅500 mm
Pressure Rating	PN 6.3 - PN 16
Production Unit Lentgh	∅25 – ∅125 (in coils) ∅110 – ∅500 (11.8 meter bars)

TECHNICAL SPECIFICATIONS:

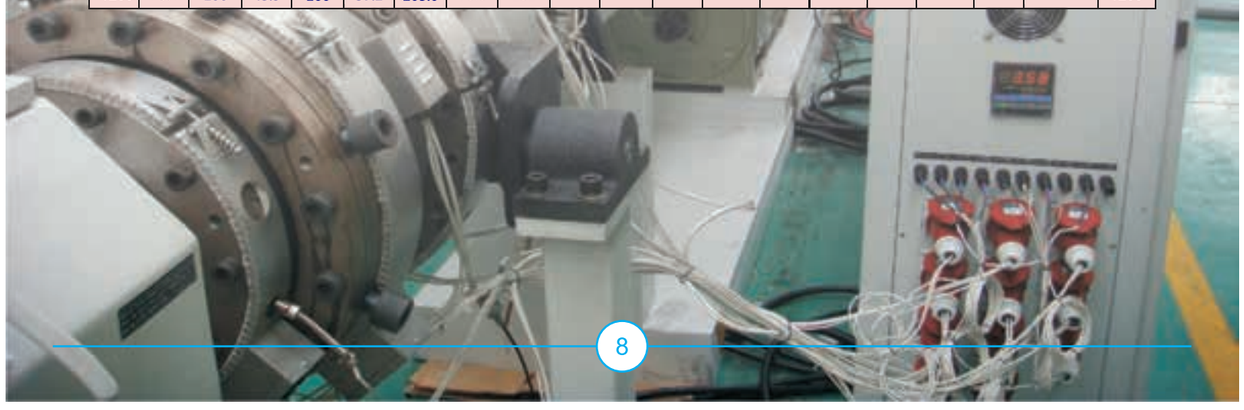
Polymer Data	PE 100	Unit	Test Method
Density at 23 °C	0.955	gr/cm^3	ISO 1183
Viscosity Number	360	cm3/gr	ISO 16283
MFR 190°/5 kg	0.22	gr/10 min	ISO 1133
MFR 190°/25 kg	6.6	gr/10 min	ISO 1133
Mechanical Properties			
Yield Strees	23	Mpa	ISO 527
Elongation at yield	9	%	ISO 527
Tensile Modulus	900	Mpa	ISO 527
Notched impact strength			
+23 °C	26	Kj/m^2	ISO 179/1eA
- 20 °C	13	Kj/m^2	ISO 179/1eA
Other Properties			
Oxidation - Induction time at 210 °C	≥ 20	min	ISO TR 10837
Carbon Black Content	2.3 ± 0.2	%	ISO 6964
Carbon Black Dispersion	≤ 3		ISO CD 11240
MRS minimum Required Strength	< 10	Mpa	ISO TR 9080
Resistance to S.C.P (Slow Crack Propagation) = 4.6 Mpa, 80 °C Notched)	<3000	h	EN 33479
Resistance to R.C.P. (Rapid Crack)	<25	bar	ISO DIS 13477
Propagation S4-test 110/10 mm. 0°C			
Elongation at break	<600	%	EN 638
Linear Thermal Expansion	1.8 x 10	°C^{-1}	ASTM D 696
Specific Heat Capacity	1.9	J/g°C	(20-60°C) BPCL
Electrical Properties			
Electric Strength	>20	kV/mm	BS 2782:201 B
Volume resistivity	>10^{13}	Ωm	BS 2782:230 A
Surface resistivity	>	Ω	BS 2782:231 A
Relative permitivity	2,6	-	BS 2067 1 TO 20 MHZ
Los tangent	3x10^{-4}	-	BS 2067

HSP HDPE Pottable Water Network Pipes and Fittings

High Standard Pipe Factory

PE 100 PIPE DIMENSION CONFORMING TO ISO 4427, DIN 8074 & PrEN 12201 SPECIFICATIONS.
DESIGN STRESS = 8 MPa

OD.	S 20		S 12.5		S 10		S 8		S 6.3		S 5		S 4		S 3.2		S 2.5		OD.
	SDR 41		SDR 26		SDR 21		SDR 17		SDR 13.6		SDR 11		SDR 9		SDR 7.4		SDR 6		
	PN 4		PN 6.3		PN 8		PN 10		PN 12.5		PN 16		PN 20		PN 25		PN 32		
	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	W.T.	Weight	
mm	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm	Kg/m	mm
20									1.08	0.107	1.9	0.112	2.3	0.133	2.8	0.154	3.4	0.180	20
25							1.8	0.137	1.9	0.144	2.3	0.171	2.8	0.200	3.5	0.240	4.2	0.279	25
32							1.9	0.187	2.4	0.232	30	0.272	3.6	0.327	4.4	0.386	5.4	0.454	32
40			1.8	0.227	1.9	0.239	2.4	0.295	3	0.356	3.7	0.430	4.5	0.509	5.5	0.600	6.7	0.701	40
50			2.0	0.314	2.4	0.374	3.0	0.453	3.7	0.549	4.6	0.668	5.6	0.788	6.9	0.936	8.3	1.09	50
63	1.8	0.364	2.5	0.494	3	0.58	3.8	0.721	4.7	0.873	5.8	1.05	7.1	1.26	8.6	1.47	10.5	1.79	63
75	1.9	0.457	2.9	0.675	3.6	0.828	4.5	1.02	5.6	1.24	6.8	1.47	8.4	1.76	10.3	2.08	12.5	2.44	75
90	2.2	0.643	3.5	0.978	4.3	1.18	5.4	1.46	6.7	1.77	8.2	2.12	10.1	2.54	12.3	3.00	15.0	3.51	90
110	2.7	0.943	4.2	1.43	5.3	1.77	6.6	2.17	8.1	2.62	10.0	3.14	12.3	3.78	15.1	4.49	18.3	5.24	110
125	3.1	1.23	4.8	1.04	6.0	2.27	7.4	2.76	9.2	3.37	11.4	4.08	14.0	4.67	17.1	5.77	20.8	6.75	125
140	3.5	1.54	5.4	2.32	6.7	2.83	8.3	3.46	10.3	4.22	12.7	5.08	15.7	6.11	19.2	7.25	23.3	8.47	140
160	4.0	2.00	6.2	3.04	7.7	3.72	9.5	4.52	11.8	5.50	14.6	6.67	17.9	7.98	21.9	9.44	25.3	11.0	160
180	4.4	2.49	6.9	3.79	8.6	4.67	10.7	5.71	13.3	6.98	16.4	8.42	20.1	10.1	24.6	11.9	26.6	14.9	180
200	4.9	3.05	7.7	4.69	9.6	5.78	11.9	7.05	14.7	8.56	18.2	10.4	22.4	12.4	27.4	14.6	29.9	17.2	200
225	5.5	3.86	8.6	5.89	10.8	7.3	13.4	8.93	16.6	10.9	20.5	13.1	25.2	15.8	30.8	18.6	33.2	21.8	225
250	6.2	4.83	9.6	7.30	11.9	8.93	14.8	11.0	18.4	13.4	22.7	16.2	27.9	19.4	34.2	23.0	37.4	27.0	250
280	6.9	5.98	10.7	9.10	13.4	11.3	16.6	13.7	20.6	16.8	25.4	20.3	31.3	24.3	38.3	28.9	41.6	33.8	280
315	7.7	7.52	12.1	11.6	15.0	14.2	18.7	17.4	23.2	21.2	28.6	25.6	35.2	30.8	43.1	36.5	48.5	42.7	315
355	8.7	9.55	13.6	14.6	16.9	18.0	21.1	22.1	26.1	26.0	32.2	32.6	39.7	39.1	48.5	46.3	52.3	54.0	355
400	9.8	12.1	15.3	18.6	19.1	22.9	23.7	28.0	29.4	34.1	36.2	41.3	44.7	49.6	54.7	58.8	60.5	68.9	400
450	11.0	15.3	17.2	23.6	21.5	28.9	26.7	35.4	33.1	43.2	40.9	52.3	50.3	62.7	61.5	74.4			450
*500	12.3	19.0	19.1	28.9	23.9	35.7	29.7	43.8	36.8	53.3	45.4	64.5	55.8	77.3	68.3	91.8			500
*560	13.7	22.6	21.4	36.2	26.7	44.7	32.2	54.8	41.2	68.9	50.8	80.8	62.5	97.0					560
*630	15.4	29.9	24.1	45.9	30.0	56.4	37.4	69.4	46.3	84.6	57.2	102							630
*710	17.4	38.0	27.2	58.4	33.9	71.8	42.1	88.1	52.2	107	64.5	131							710
*800	19.8	48.1	30.6	73.9	38.1	91.1	47.4	112	58.8	136	72.7	167							800
*900	22.0	60.9	34.4	93.4	42.9	115.0	53.3	143											900
*1000	24.5	75.2	38.2	115	47.7	142.0	59.3	176											1000
*1200	29.4	106	45.9	166	57.2	205.0	70.6	252											1200



Specifications of HSP PE100 pipes

- Advantage of perfect leak proof, no crack, no break and no deformation under pressure
- Availability of more than one connection method (butt welding, electrofusion welding, push fit sockets, etc.),
- Availability of connection at a place out of the trench,
- High resistance to chemicals, not affected from corrosion, decaying and abrasion,
- Advantage of less need of excavation and less need of bringing special filling sand from out of the site,
- Advantage of safe application in irregular surfaces like sea, river, lake passages and at places where there may be frequent earth movements,
- Advantage of being not affected from earth movements like landslide, earthquakes, etc,
- Advantage of having perfectly smooth internal surface. Because of this advantage of PE pies in comparison to the other pipe types, one size smaller PE pipe can make the same work of one size bigger pipe from other pipe types. This brings considerable savings in the overall cost of the pipe line and the service costs,
- PE pipes require less fittings for connection because they are elastic and in many places they do not require connection where the other type do. Because PE pipes are bendable with a radius of 20-35 times of its outer diameter. The other pipe types do not have this advantage,
- Advantage of higher durability and advantage of easy installation and transport without material loss,
- Advantage of mobilizability of the PE pipe production facilities. This enables very big savings in transport costs for projects where large diameter pipes are required,
- PE pipes have the advantage of very long service life under sever conditions. Minimum guaranteed service life of PE pipes is 50 years and decaying time 1000 years in nature,
- PE pipes do not require concrete blocks at places like bending and tee separations,
- PE pipes are light in weight which enables the installation with high speed at places where the construction season is short,
- Pe pipes have very good welding characteristics,
- PE pipes are elastic which is a big advantage during the earthquake or any other earth movements. This characteristics also gives big advantage in transport (coiling up to 125mm diameter) and in installation costs,
- High impact and breakage resistance,
- Very good adoption to earth movements,
- Very high resistance to direct sun light (UV resistance) for long time. This is supplied by Ultraviolet light resistance agent mixed to the PE raw material,
- Many different pressure resistance options. PE pipes can be produced resistant to 12 different pressure classes from 2.5 bars upto 32 bars,
- There is no need to take protection precautions at the time of installation like cathodic protection.

HSP HDPE Pottable Water Network Pipes and Fittings

Perfect Leak Proof at connection points

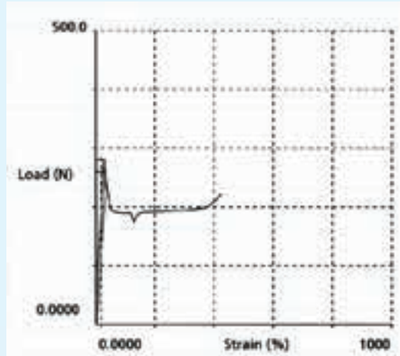


Figure 2.1.1a - Sample with butt welding (Result of tensile test)

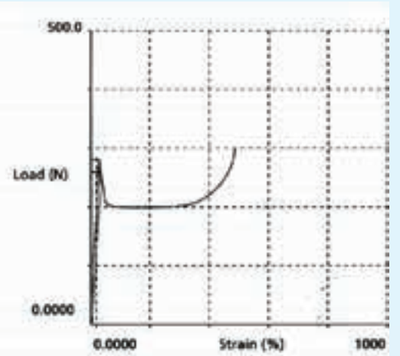


Figure 2.1.1b - Sample without welding (Result of tensile test)

As seen in the test samples, as the result of the tensile test, the energy required for breaking the welded and unwelded pipe area is the same. It means that the butt welded area is also as strong as the pipe itself. (Test sample is shown in picture 2.1.8)

Result of the test: Butt welding is the most reliable welding method for potable water PE pipes.

The advantages of Butt Welding;

- It does not require special fitting for connection.
- With butt welding, some fittings like bends and T pieces can be produced at the site.
- The butt welding machines are easy to supply in all corners of the world.
- The fittings produced for butt welding have low production costs.
- Butt welding can be applied for all diameters and for all pressure ratings (For best results the minimum wall thickness must be 3mm).
- The lips forming inside and outside the pipe increases the welding area's cross-section hence increasing the safety of the welded area.
- Butt welding operation is very easy to learn and very practical.

Availability of more than one connection method

PE pipes have the several options for connection. The connection method is selected according to the place and condition where the pipe will operate.

- **Butt welding method**

Picture 2.1.1-*Application of butt welding.*

This method of welding is the method most frequently used. For operating this welding, an electric power source and butt welding machine is enough.

- **Electrofusion welding**

Picture 2.1.2-*Application of electrofusion welding.*

This method is applied for ensuring the highest safety in the welding area. This welding method is used especially for gas transmission PE pipes where any gas leakage can cause mortal disaster. A socket specially designed and produced for this welding. The cost of this weld is higher than butt welding.

- **Push-Fit socket connection.**

Picture 2.1.3-*Application of push fit-socket connection.*

This system is not a welding but instead a system of pipe and muffle inserted into each other by pushing. This system is preferable for the ones who like connection with o-ring. The superiority of this system to the other o-ring systems is the usage of double o-ring which one of them ensuring the leak proof and the other prevents the movement of the pipe from its place in the socket.

Picture 2.1.4- *Cross-section of push-fit socket connection*

Availability of connection at a place out of the trench

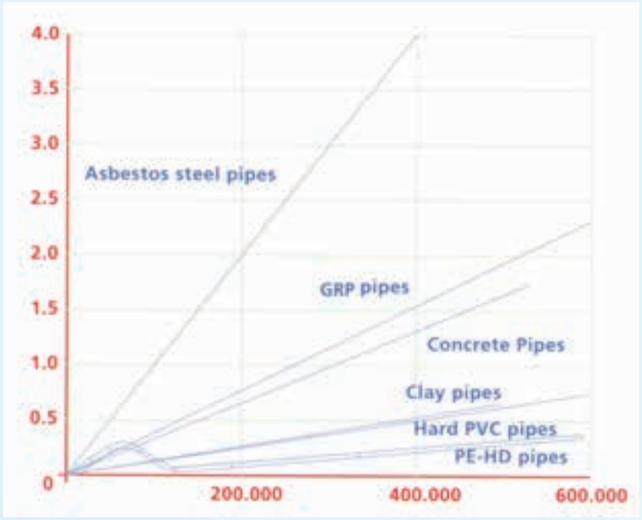
Because of their elastic nature, PE pipes can be connected at a place near the trench and then can be layed down into the trench. During the lay down, the pipe connection points do not move or break. This method of making connection out of the trench can be applied to all PE pipes of every diameter.

Advantages of PE pipes during installation

- It is enough to open the trench 5 cm wider than the pipe diameter. This means less excavation and less sand filling.
- To make connection in the trench is very difficult. To make welding works out of the trench gives good savings in installation time and costs.
- It is possible to prepare the pipe line near the pipe line area without even opening the trench. Because, if the trench is opened much earlier than the time of pipe line installation, then there may be some collapses in the walls of the trench and also it may necessary to clean the trench again which is a cost also.

Picture 2.1.5- *Making connection out of the trench and laying down the pipe.*

No Abrasion in PE 100 Pipes



Picture 2.1.7- *The curve of abrasion Test*

The curve above proves that HDPE PE100 pips have the best abrasion resistance value among the other pipes. For PE, throughout the service life, the abrasion is only 0.09mm

The curve above also proves that Asbestos steel pipes and GRP pipes have worse abrasion in comparison to the concrete pipes.

Besides their very good abrasion resistance, PE pipes have perfect resistance against the chemicals. These pipes give the best service in all acidic, alkaline and salty solutions.

The resistance of PE pipes to different chemical materials in listed in Table 2.1.6

The advantage of less need of bringing special filling sand out of the site, less excavation and less filling sand need.

For laying down the PE pipes, it is enough to leave a small place at each side of the pipe which is enough for the operation of the compaction machine. There is no need to bring sand for bedding. It is enough to prepare the trench bottom surface with an angle of 120 degree. The earth derived from the excavation can be used as filling sand after eliminating the big size stones and sharp objects that may damage the pipe. In rocky place, the sharp sides of the rocks are covered by sand in order not to allow it to damage the pipe.

Advantages

- Since there is no need to bring special filling sand from out of the excavated area, filling sand cost is minimum.
- Since less excavation is done, excavation and filling costs are minimum comparaed to the other pipe types.

Advantage of PE pipes being used in sea, lake and river passes

PE 100 pipes are elastic, not easily breakable, perfectly strong to external loads, perfectly strong to internal pressure and have 1000 years of decaying time in nature. These big advantages make them very suitable to be used in sea discharge, as well as sea, river and lake passes and also taking water to islands. PE 100 pipes are the easiest pipes to be sank under water either completely or as units of 300-500 meters.

Picture 2.1.7a- *A view from sea discharge application of 1600mm PN 4 PE pipes.*

Picture 2.1.7a- *Pipes another view from sea discharge application of 1600mm.*

Advantage of adoption to the earth movements, durability and high impact resistance

Below are the statistical values regarding the damage percentages of various pipe types at Kobe/Japan earthquake in 1995. This table tells everything about the superiority of PE pipes to the other pipes at tough conditions.

Table 2.1.1 *The damage percentages in the potable water lines at Kobe/Japan earthquake*

Pipe type	Percentage of damage Piece/km
Ductile cast iron pipe	0.488
Cast iron pipe	1.508
PVC pipe	1.430
Steel pipe	0.437
Asbestos Steel Pipe	1.782
PE pipe	0 (Zero)

Table 2.1.1 *The damage percentages in the gas pipe lines at Kobe/Japan earthquake*

	Steel pipe	Ductile cast, Iron Pipe	PE pipe
Total length	21,338	12,204	1,458
Number of damage	25,821	630	0 (zero)
Damage ratio (place/km)	1,210	0,052	0,000 (zero)

After the earthquake in Kobe/ the use of PE pipe in Japan increased as a boom. As a country in region of very active seismic zone, the use of PE 100 is increasing as a boom.

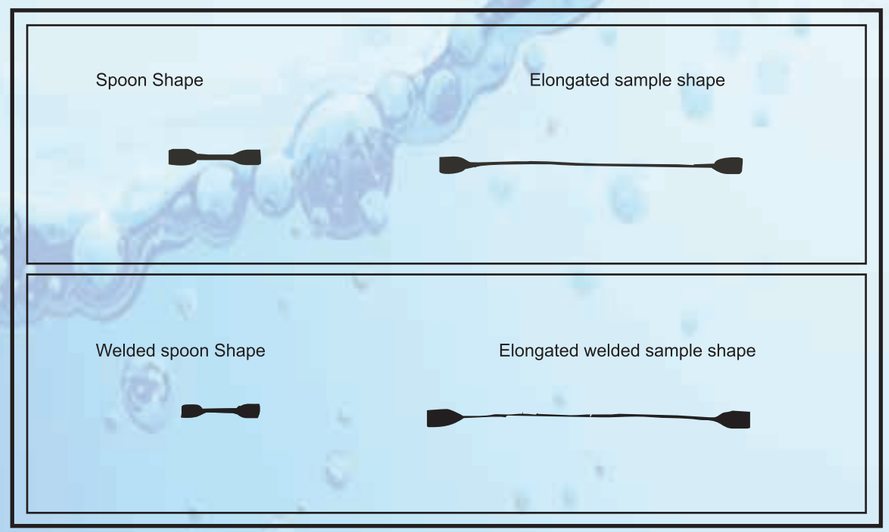


Table 2.5.2 - Butt-Welding capacity

Size (mm)	No. of Welding >SDR 26	No. of Welding >SDR 22
1600	2--3	-
1400	2--3	-
1200	3--4	3--4
1000	3--4	3--4
900	4--5	4--5
800	4--5	4--5
710	5--6	5--6
630	6--8	6--8
560	7--9	7--9
500	7--10	7--10
450	7--10	8--11
400	10--13	10--13
355	10--13	10--13
280	14--17	14--17
250	16--20	16--20
225	18--22	17--22
200	20--25	18--25
180	22--27	18--27
160	22--27	20--27
140	22--28	20--28
125	25--30	22--30
110	25--30	25--30
90	25--30	25--30
75	26--30	25--30

* Number of Weldings done in 8 work hours

Table 2.5.1 Butt welding Parameters for HSP PE 100 Pipes

Nomina Diameter	Wall Pressure	Height of lip formed thickness		Free heating Time for removing	Time for attaining the Cooling period Total welding period	heating plate necessary	welding temp under
mm	mm	bar	mm	Sec	Sec	Sec	Minute	hour
75	4.5	10	1,00	45	5	5	6	0.12
	6.8	6	1,00	68	6	6	10	0.18
90	3.3	6	0.5	33	5	5	6	0.11
	5.4	10	1,00	54	5	5	7	0.14
	8.2	16	1.5	82	6	6	11	0.21
110	4	6	0.5	40	5	5	6	0.11
	6.6	10	1	66	6	6	9	0.18
	10	16	1.5	100	6	6	13	0.25
125	4.5	6	1	45	5	5	6	0.12
	7.4	10	1.5	74	6	6	10	0.2
	11.4	16	1.5	114	6	6	14	0.28
140	5.1	6	1	51	5	5	7	0.13
	8.3	10	1.5	83	6	6	11	0.21
	12.7	16	2	127	8	8	17	0.32
160	5.8	6	1	58	6	6	8	0.15
	9.5	10	1.5	95	6	6	13	0.24
	14.6	16	2	146	8	8	19	0.36
180	6.5	6	1	65	6	6	9	0.17
	10.7	10	1.5	107	6	6	14	0.26
	6.54	16	2	164	8	8	20	0.39
200	7.2	6	1.5	72	6	6	10	0.19
	11.9	10	1.5	119	6	6	15	0.28
	18.2	16	2	182	8	8	22	0.43
225	8.2	6	1.5	82	6	6	11	0.21
	13.4	10	2	134	8	8	17	0.33
	20.5	16	2.5	205	10	11	26	0.49
250	9.1	6	1.5	91	6	6	12	0.23
	14.8	10	2	148	8	8	19	0.36
	22.7	16	2.5	227	10	11	28	0.53
280	10.1	6	1.5	101	6	6	13	0.25
	16.6	10	2	166	8	8	21	0.39
	25.4	16	2.5	254	10	11	30	0.58
315	11.4	6	1.5	114	6	6	14	0.28
	18.7	10	2	187	8	8	23	0.43
	28.6	16	3	286	12	14	35	0.66
355	12.9	6	2	129	8	8	17	0.32
	21.1	10	2.5	211	10	10	26	0.5
	32.2	16	3	322	12	12	38	0.73
400	14.5	6	2	145	8	8	19	0.35
	23.7	10	2.5	237	10	10	29	0.55
	36.3	16	3	363	12	12	42	0.18
450	16.3	6	2	163	8	8	20	0.39
	26.7	10	3	267	12	12	33	0.63
	40.9	16	3.5	409	16	16	45	0.87
500	18.1	6	2	181	8	8	22	0.42
	29.7	10	3	297	12	12	36	0.68
	45.4	16	3.5	454	16	16	46	0.89
560	20.3	6	2.5	203	10	10	25	0.48
	33.2	10	3	332	12	12	39	0.75
	50.8	16	4	508	20	20	61	1.17

Stubend DN	DN	PN Bar	d1	C	D	h	Delik sayisi	F	Screw
50	40	10	62	110	150	15	4	19	M 16
		16	62	110	150	15	4	19	M 16
		25	-	-	-	-	-	-	-
63	50	10	78	135	175	15	4	19	M 16
		16	78	135	175	15	4	19	M 16
		25	-	-	-	-	-	-	-
75	65	10	92	145	185	15	4	19	M 16
		16	92	145	185	15	4	19	M 16
		25	-	-	-	-	-	-	-
90	80	10	108	160	200	19	8	19	M 16
		16	108	160	200	19	8	19	M 16
		25	-	-	-	-	-	-	-
110	100	10	128	180	220	19	8	19	M 16
		16	128	180	220	19	8	19	M 16
		25	-	-	-	-	-	-	-
125	100	10	135	180	220	19	8	19	M 16
		16	135	180	220	19	8	19	M 16
		25	-	-	-	-	-	-	-
140	125	10	158	210	250	19	8	19	M 16
		16	158	210	250	19	8	19	M 16
		25	-	-	-	-	-	-	-
160	150	10	178	240	285	19	8	23	M 20
		16	178	240	285	19	8	23	M 20
		25	-	-	-	-	-	-	-
180	150	10	188	240	340	19	8	23	M 20
		16	188	240	340	19	8	23	M 20
		25	-	-	360	-	-	-	-
200	200	10	235	295	340	20	8	23	M 20
		16	235	295	340	20	12	23	M 20
		25	235	310	360	22	12	28	M 24
225	200	10	238	295	400	20	8	23	M 20
		16	238	295	400	20	12	23	M 24
		25	238	310	425	22	12	28	M 27
250	250	10	288	350	400	22	12	23	M 20
		16	288	355	400	22	12	28	M 24
		25	288	370	425	24.5	12	31	M 27
280	250	10	294	350	455	22	12	23	M 20
		16	294	355	455	22	12	28	M 24
		25	294	370	485	24.5	12	31	M 27
315	300	10	338	400	505	24.5	12	23	M 20
		16	338	410	520	24.5	12	28	M 24
		25	338	430	555	27.5	16	31	M 30
355	350	10	376	460	565	24.5	16	23	M 24
		16	376	470	580	26.5	16	28	M 27
		25	376	490	620	30	16	34	M 33
400	400	10	430	515	670	24.5	16	28	M 24
		16	430	525	-	28	16	31	-
		25	430	550	-	32	16	37	-
450	500	10	517	620	670	26.5	20	28	M 24
		16	-	-	-	-	-	-	-
		25	-	-	-	-	-	-	-
500	500	10	533	620	670	26.5	20	28	
		16	-	-	-	-	-	-	
		25	-	-	-	-	-	-	

Table 2.4.12- Flange dimensions according to DIN Standards

Stubend DN	DN	PN Bar	C	D	h	g	Delik sayisi	Screw
50	40	10	110	150	15	88	4	19
		16	110	150	15	88	4	19
		25	-	-	-	-	-	-
63	50	10	135	175	15	102	4	19
		16	135	175	15	102	4	19
		25	-	-	-	-	-	-
75	65	10	145	185	15	133	4	19
		16	145	185	15	133	4	19
		25	-	-	-	-	-	-
90	80	10	160	200	19	153	8	19
		16	160	200	19	153	8	19
		25	-	-	-	-	-	-
110	100	10	180	220	19	153	8	19
		16	180	220	19	153	8	19
		25	-	-	-	-	-	-
125	100	10	180	220	19	183	8	19
		16	180	220	19	183	8	19
		25	-	-	-	-	-	-
140	125	10	210	250	19	209	8	19
		16	210	250	19	209	8	19
		25	-	-	-	-	-	-
160	150	10	240	285	19	209	8	23
		16	240	285	19	209	8	23
		25	-	-	-	-	-	-
180	150	10	240	340	19	209	8	23
		16	240	340	19	209	8	23
		25	-	360	-	-	-	-
200	200	10	295	340	20	264	8	23
		16	295	340	20	264	12	23
		25	310	360	22	274	12	28
225	200	10	295	400	20	264	8	23
		16	295	400	20	264	12	23
		25	310	425	22	274	12	28
250	250	10	350	400	22	319	12	23
		16	355	400	22	319	12	28
		25	370	425	24.5	331	12	31
280	250	10	350	455	22	319	12	23
		16	355	455	22	319	12	28
		25	370	485	24.5	331	12	31
315	300	10	400	505	24.5	367	12	23
		16	410	520	24.5	367	12	28
		25	430	555	27.5	389	16	31
355	350	10	460	565	24.5	427	16	23
		16	470	580	26.5	432	16	28
		25	490	620	30	446	16	34
400	400	10	515	670	24.5	477	16	28
		16	525	-	28	484	16	31
		25	550	-	32	503	16	37
450	500	10	620	670	26.5	582	20	28
		16	-	-	-	-	-	-
		25	-	-	-	-	-	-
500	500	10	620	670	26.5	582	20	28
		16	-	-	-	-	-	-
		25	-	-	-	-	-	-

Table 2.4.13- Bilnd plate dimensions according to DIN Standards

Table 6.1.3- Comparison of HSP PE Sewage Pipes with the Other pipes Types

FEATURES PIPE TYP	DIZAYN PE	PVC	STEEL	DUCTILE FONT	CONCRETE	GRP	ASBESTOS	EXPLANATION
Production range (mm)	Ø20-Ø3600	Ø20-Ø360	Ø15-Ø400	Ø50-Ø2000	Ø200-Ø3200	Ø20-Ø1600	Ø;-Ø1600	
Guaranteed servicelife (year)	50	0-20	3--15	5--25	0--30	0--50	0-30	For the Pipes other then PE 100 pipes, the sevice life deppends on many parameters like quality of the raw material of the pipe bedding in the trench, etc
Feature of breaking	Very Durable	Weak	Durable	Durable	very weak	Partially Durable	very weak	
Max. Production length	500	6	12	6	4	6--12	4	
standard production length(m)	12	6	6	6	2	6	2	
Strength againist corrosion and abrasion	Very Durable	Partially Durable	very weak	very weak	Partially Durable	Durable	weak	The evaluation depende on the nature and type of the chemical like SO2, Nax, Clorine
The easines of Production fitting	Very easy	Very easy	Difficult	Very Difficult	Very Difficult	Very Difficult	Very Difficult	
The easines of installation(The	100	50	25	40	15	45	5	
Superiority from the side of hygiene	Perfect	Doubtful	Doubtful	Doubtful	Doubtful	Good	Trouble	
Surface roughness coefficient (c)	149	149	120	130	100	145	130	Depende on the quality of the production and raw matarial
Varierty of fitting and thire pirce	Perfect-Cheap	Perfect-Cheap	Limited-expensive	Limited-expensive	Limited-expensive	Limited-expensive	Limited-expensive	
Strength againist chemicals	Perfect	Doubtful	Trouble	Doubtful	Doubtful	Good	Doubtful	
Surface elasticity coefficient (c)	377	33	0.5	1	4.4	>33	-0.5	
Ability for passifying the ram impact	Perfect	Troubles	Trouble	Trouble	Trouble	Trouble	Trouble	
The easines of making pressure test at site	Perfect	Troubles	Trouble	Trouble	Trouble	Trouble	Trouble	Since the connection of the pipes other then steel and PE pipes is done using o-ring ,it is very difficult to have perfect leak proof,it is necessary to take additional precaution for absolute leak proof.
Need of bends at tum points	Very little	Very Much	Very Much	Very Much	Very Much	Very Much	Very Much	For PE 100 it is possible to make even full round shape with a diameters 25 time of the pipe outer diameters
Max. instant test pressure (for PN 10)	>28 bar	>16 bar	>40 bar	>40 bar	>13 bar	>18 bar	>13 bar	
The safety of1 connection points (Max:100-min;0)	100	0-50	0--80	0--80	0--30	0--70	0--40	the conncetion with o-ring always create problems for PE pipes, since the conncetion is done by welding, the molecular fusion makes
Ability for passifying the ram imp	Perfect	Doubtful	Trouble	Doubtful	Trouble	Doubtful	Trouble	
Needed trench width (as %Pipe diameter)	Approx.%5-10 wider than the Pipe dia	Approx.%100 wider than the Pipe dia	Approx.%200 wider than the Pipe dia	Approx.%110 wider than the Pipe dia	Approx.%200 wider than the Pipe dia	Approx %200 wider than the Pipe dia	Approx.%200 wider than the Pipe dia	these figure are for pipes with avarage 400 mm diameters
Need of bedding around the pipe (max;100 min;0)	10	100	70	60	100	100	100	For PE 100 pipes if there aren't sharp stones which may damage the pipe, there is no need make bedding around the pipes

Table 2.3.1 Pressure loss table for HSP PE 100 PN 10 Pipe. (calculated using colebrooke-White formula. K= 0.020mm)

D	63	mm		75	mm		90	mm		110	mm	
s	3.8	mm		4.5	mm		5.4	mm		6.6	mm	
DI	5.5.4	mm		66,0	mm		79.2	mm		96.8	mm	
Vort	Debye	Debye	J m/m	Debye	Debye	J m/m	Debye	Debye	J m/m	Debye l/s	Debye	J m/m
0.5	1.21	4.36	0.005554	1.72	6.2	0.00447	2.47	8.9	0.003569	3.68	13.25	0.002788
0.6	1.45	5.22	0.007712	2.06	7.42	0.006211	2.96	10.66	0.004961	4.42	15.92	0.003878
0.7	1.69	6.09	0.010192	2.4	8.64	0.008211	3.45	12.42	0.006562	5.16	18.58	0.005131
0.8	1.93	6.95	0.012987	2.74	9.87	0.010647	3.95	14.22	0.008367	5.89	21.21	0.006546
0.9	2.17	7.82	0.016094	3.08	11.09	0.012975	4.44	15.99	0.010375	6.63	23.87	0.008119
1	2.42	8.72	0.01951	3.43	12.35	0.015732	4.93	17.75	0.012584	7.36	26.5	0.00985
1.1	2.66	958	0.023232	3.77	13.58	0.018738	5.42	19.52	0.014991	8.1	29.16	0.011737
1.2	2.9	10.44	0.027258	4.11	14.8	0.021989	5.92	21.32	0.017595	8.84	31.83	0.013779
1.3	3.14	11.31	0.031585	4.45	16.02	0.025484	6.41	23.08	0.020395	9.57	34.46	0.015975
1.4	3.38	12.17	0.036214	4.79	17.25	0.029222	6.9	24.84	0.02339	10.31	37.12	0.018323
1.5	3.62	13.04	0.041141	5.14	18.51	0.033202	7.39	26.61	0.026579	11.04	39.75	0.020824
1.6	3.86	13.9	0.046366	5.48	19.73	0.037423	7.89	28.41	0.029962	11.78	42.41	0.023477
1.7	4.1	14.76	0.051887	5.82	20.96	0.041884	8.38	30.17	0.033537	12.52	45.08	0.026281
1.8	4.34	15.63	0.057705	6.16	22.18	0.046584	8.87	31.94	0.037303	13.25	47.7	0.029236
1.9	4.58	16.49	0.063817	6.51	23.44	0.051523	9.37	33.74	0.041262	13.99	50.37	0.032342
2	4.83	17.39	0.070224	6.85	24.66	0.0567	9.86	35.5	0.045411	14.72	53	0.035597
2.1	5.07	18.26	0.076925	7.19	25.89	0.062114	10.35	37.26	0.049751	15.46	55.66	0.039002
2.2	5.31	19.12	0.083918	7.53	27.11	0.067766	10.84	39.03	0.054281	16.2	58.32	0.042556
2.3	5.55	19.98	0.091205	7.87	28.34	0.073654	11.34	40.83	0.059001	16.93	60.95	0.046259
2.4	5.79	20.85	0.098783	8.22	29.6	0.079778	11.83	42.59	0.06391	17.67	63.62	0.050111
2.5	6.03	21.71	0.106653	8.56	30.82	0.086138	12.32	44.36	0.069009	18.4	66.24	0.054112
2.6	6.27	22.58	0.114814	8.9	32.04	0.092734	12.81	46.12	0.074296	19.14	68.91	0.058261
2.7	6.51	23.44	0.123266	9.24	33.27	0.099565	13.31	47.92	0.079773	19.88	71.57	0.062558
2.8	6.75	24.3	0.132009	9.58	34.49	0.106631	13.8	49.68	0.085438	20.61	74.2	0.067004
2.9	7	25.2	0.141042	9.93	35.75	0.113932	14.29	51.45	0.091291	21.35	76.86	0.071597
3	7.24	26.07	0.150365	10.27	36.98	0.121467	14.78	53.21	0.097332	22.08	79.49	0.076338
3.2	7.72	27.8	0.169881	10.95	39.42	0.13724	15.77	56.78	0.109979	23.55	84.78	0.086262
3.4	8.2	29.52	0.190554	11.64	41.91	0.15395	16.76	60.34	0.123376	25.03	90.11	0.096777
3.6	8.68	31.25	0.212382	12.32	44.36	0.171594	17.74	63.87	0.137523	26.5	95.4	0.10788
3.8	9.16	32.98	0.235366	13.01	46.84	0.190712	18.73	67.43	0.152419	27.97	100.7	0.11957
4	9.65	34.74	0.259502	13.69	49.29	0.209682	19.71	70.96	0.168063	29.44	105.99	0.131849
4.2	10.13	36.47	0.284791	14.37	51.74	0.230124	20.7	74.52	0.184454	30.91	11.28	0.144714
4.4	10.61	38.2	0.311232	15.06	54.22	0.251498	21.68	78.05	0.201592	32.39	116.61	0.158165
4.6	11.09	39.93	0.338823	15.74	56.67	0.273801	22.67	81.62	0.219477	33.86	121.9	0.172203
D	125	mm		140	mm		160	mm		180	mm	
s	7,4	mm		8.3	mm		9.5	mm		10.7	mm	
DI	110.2	mm		123.4	mm		141,0	mm		158.6	mm	
Vort	Debye	Debye	J m/m	Debye	Debye	J m/m	Debye	Debye	J m/m	Debye l/s	Debye	J m/m
0.5	4.77	17.18	0.002378	5.98	21.53	0.002071	2.47	8.9	0.003569	3.68	13.25	0.002788
0.6	5.73	20.63	0.003309	7.18	25.85	0.002882	2.96	10.66	0.004961	4.42	15.92	0.003878
0.7	6.68	24.05	0.00438	8.38	30.17	0.003816	3.45	12.42	0.006562	5.16	18.58	0.005131
0.8	7.64	27.51	0.005589	9.57	34.46	0.00487	3.95	14.22	0.008367	5.89	21.21	0.006546
0.9	8.59	30.93	0.006933	10.77	38.78	0.006043	4.44	15.99	0.010375	6.63	23.87	0.008119
1	9.54	34.35	0.008413	11.69	43.06	0.007333	4.93	17.75	0.012584	7.36	26.5	0.00985
1.1	10.5	37.8	0.010026	13.16	47.38	0.00874	5.42	19.52	0.014991	8.1	29.16	0.011737
1.2	11.45	41.22	0.011771	14.36	51.7	0.010263	5.92	21.32	0.017595	8.84	31.83	0.013779
1.3	12.4	44.64	0.013649	15.55	55.98	0.011901	6.41	23.08	0.020395	9.57	34.46	0.015975
1.4	13.36	48.1	0.015657	16.75	60.3	0.013653	6.9	24.84	0.02339	10.31	37.12	0.018323
1.5	14.31	51.52	0.017795	17.94	64.59	0.015519	7.39	26.61	0.026579	11.04	39.75	0.020824
1.6	15.27	54.98	0.020064	19.14	68.91	0.017499	7.89	28.41	0.029962	11.78	42.41	0.023477
1.7	16.22	58.4	0.022462	20.34	73.23	0.019591	8.38	30.17	0.033537	12.52	45.08	0.026281
1.8	17.17	61.82	0.024989	21.53	77.51	0.021797	8.87	31.94	0.037303	13.25	47.7	0.029236
1.9	18.13	65.27	0.027645	22.73	81.83	0.024114	9.37	33.74	0.041262	13.99	50.37	0.032342
2	19.08	68.69	0.030429	23.92	86.12	0.026544	9.86	35.5	0.045411	14.72	53	0.035597
2.1	20.03	72.11	0.033341	25.12	90.44	0.029085	10.35	37.26	0.049751	15.46	55.66	0.039002
2.2	20.99	75.57	0.36381	26.32	94.76	0.031739	10.84	39.03	0.054281	16.2	58.32	0.042556
2.3	21.94	78.99	0.039549	27.51	99..04	0.034503	11.34	40.83	0.059001	16.93	60.95	0.046259
2.4	22.9	82.44	0.042843	28.71	103.36	0.037379	11.83	42.59	0.06391	17.67	63.62	0.050111
2.5	23.85	85.86	0.046265	29.9	107.64	0.040366	12.32	44.36	0.069009	18.4	66.24	0.054112
2.6	23.8	89.28	0.049815	31.1	111.96	0.043463	12.81	46.12	0.074296	19.14	68.91	0.058261
2.7	25.76	92.74	0.05349	32.3	116.28	0.046672	13.31	47.92	0.0799773	19.88	71.57	0.062558
2.8	26.71	96.16	0.057293	33.49	120.57	0.049991	13.8	49.68	0.085438	20.61	74.2	0.067004
2.9	27.66	99.58	0.061222	34.69	124.89	0.05342	14.29	51.45	0.091291	21.35	76.86	0.071597
3	28.62	103.04	0.065278	35.88	129.17	0.05696	14.78	53.21	0.097332	22.08	79.49	0.076338
3.2	30.53	109.91	0.073768	38.28	137.81	0.064371	15.77	56.78	0.109979	23.55	84.78	0.086262
3.4	32.43	116.75	0.082762	40.67	146.42	0.072222	16.76	60.34	0.123376	25.03	90.11	0.096777
3.6	34.34	123.63	0.09226	43.06	155.02	0.080513	17.74	63.87	0.137523	26.5	95.4	0.010788
3.8	36.25	130.5	0.102262	45.45	163.62	0.089244	18.73	67.43	0.152419	27.97	100.28	0.11957
4	38.16	137.38	0.112766	47.84	172.23	0.098413	19.71	70.96	0.168063	29.44	105.99	0.131849
4.2	40.06	144.22	0.123772	50.24	180.87	0.108021	20.7	74.52	0.184454	30.91	11.28	0.144714
4.4	41.97	151.1	0.123528	52.63	189.47	0.118066	21.68	78.05	0.201592	32.39	116.61	0.158165
4.6	43.88	157.97	0.14729	55.02	198.08	0.12855	22.67	81.62	0.219477	33.86	121.9	0.172203

Table 2.3.1 Pressure loss table for HSP PE 100 PN 10 Pipe. (calculated using colebrooke-White formula. K= 0.020mm)

D	200	mm		225	mm		250	mm		280	mm	
s	11,9	mm		13,4	mm		14,8	mm		16,5	mm	
DI	176,2	mm		198,2	mm		220,4	mm		245,8	mm	
Vort m/s	Debye l/s	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m
0.5	12.2	43.92	0.001342	15.43	55.55	0.001163	19.08	6869	0.001023	23.92	86.12	0.000892
0.6	14.64	52.71	0.001869	18.52	66.68	0.001621	22.9	8244	0.001426	28.71	103.36	0.001244
0.7	17.07	61.46	0.002477	21. 60	77 .76	0.002148	26.71	9616	0.00189	33.49	120.57	0.0001649
0.8	19.51	70.24	0.003163	24.69	88.89	0.002744	30.53	10991	0.002415	38.28	137.81	0.002108
0.9	21. 95	79.02	0.003927	27.77	99.98	0.003407	3434	123.63	0.002999	43.06	155.02	0.002618
1	2439	87.81	0.004767	30.86	111. 10	0.004137	3816	137.38	0.003642	47.84	172 .23	0.003179
1.1	26.83	96.59	0.005684	33.94	122 .19	0.004934	41 97	151 .10	0.004343	52.63	189.47	0.003792
1.2	29.27	105.38	0.006676	37.03	133.31	0.005796	4579	164.85	0.005102	57.41	206.68	0.004456
1.3	31.7	114.12	0.007744	40.11	144.4	0.006723	4960	178.56	0.005919	62.2	223.92	0.005169
1.4	34.14	122.91	0.008887	43.2	155.52	0.007716	5342	192.32	0.006794	66.98	241 .13	0.005933
1.5	36.58	131 .69	0.010104	46.28	166.61	0.008773	5723	206.03	0.007725	71 .76	258.34	0.006747
1.6	39.02	140.48	0.011395	49.37	177 .74	0.009894	61 05	219.78	0.008713	76.55	275.58	0.007611
1.7	41 .46	149.26	0.01276	52.46	188.86	0.01108	6486	233.5	0.009758	81. 33	292.79	0.008524
1.8	43.9	158.04	0.014198	55.54	199.95	0.01233	6868	247.25	0.010859	86.11	310	0.009486
1.9	46.33	166.79	0.01571	58.63	211.07	0.013644	72 49	260.97	0.012017	90.9	327.24	0.010498
2	48.77	175.58	0.017295	61. 71	222.16	0.015022	7631	274.72	0.01323	95.68	344.45	0.011559
2.1	51 .21	184.36	0.018954	64.8	233.28	0.016463	8012	288.44	0.0145	100.47	361 .70	0.012669
2.2	53.65	193.14	0.020685	67.88	244.37	0.017967	8394	302.19	0.015826	105.25	378.9	0.013827
2.3	56.09	201.93	0.022489	70.97	255.5	0.019535	8775	315.9	0.017207	110.03	369.11	0.015035
2.4	58.53	210.71	0.024366	74.05	266.58	0.021156	91 57	329.66	0.018644	114.82	413.36	0.016291
2.5	60.96	219.46	0.026316	77 .14	277 .71	0.02286	9538	343.37	0.020137	119.6	430.56	0.017596
2.6	63.4	228.24	0.028337	80.22	288.8	0.024517	9920	357.12	0.021685	124.39	447.81	0.018949
2.7	65.84	237.03	0.030432	83.31	299.92	0.026437	10301	370.84	0.023289	129.17	465.02	0.020351
2.8	68.28	245.81	0.032598	86.39	311. 01	0.028319	10683	384.59	0.024948	133.95	482.22	0.021801
2.9	70.72	254,60	0.034837	89.48	322.13	0.030265	110,64	398.31	0.026663	138,74	499.47	0.0233
3	73,16	263,38	0.037148	92,56	333,22	0.032273	114,46	412,06	0.028432	143,52	516.68	0,024847
3.2	78,03	280,91	0.041986	98,73	355,43	0.036478	122,09	439,53	0,032138	153,09	551. 13	0,028086
3.4	82,91	298,48	0,047112	104,91	377,68	0,040933	129,72	467,00	0,036063	162,66	585,58	0,031518
3.6	87,79	316,05	0,052525	111,08	399,89	0,045537	137,35	494,46	0,040210	172,22	620,00	0,035142
3.8	92,66	333,58	0,058225	117,25	422,10	0,050591	144,98	521,93	0,044576	181,79	654,45	0,038959
4	97,54	351,15	0,064212	123,42	444,32	0,055795	152,61	549,40	0,049161	191,36	688,90	0,042968
4.2	102,42	368,72	0,070486	129,59	466,53	0,061247	160,24	576,87	0,053967	200,93	723,35	0,047169
4.4	107,29	386,25	0,077045	135,76	488,74	0,066949	167,87	604,34	0,058991	210,50	757,80	0,051561
4.6	112,17	403,82	0,083891	141. 93	510,95	0.072899	175,50	631 .80	0,064235	220,06	792,22	0,056146

D	315	mm		355	mm		400	mm		450	mm	
s	7,4	mm		8,3	mm		9,5	mm		10,7	mm	
DI	110,2	mm		123,4	mm		141,0	mm		158,6	mm	
Vort m/s	Debye lis	Debye m^3/h	J m/m	Debye lis	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m	Debye lis	Debye m^3/h	J m/m
0.5	30.27	108.98	0.000774	38.43	138.35	0.000671	48.83	175.79	0.000581	61.77	222.38	0.000504
0.6	36.32	130.76	0.00108	46.11	166	0.00936	58,59	210.93	0.0081	74.13	266.87	0.00704
0.7	42.37	152.54	0.001432	53.8	193.68	0.001241	68.36	246.1	0.001075	86.48	311 .33	0.00934
0.8	48.42	174.32	0.00183	61.48	221.33	0.001586	78.12	281 .24	0.001375	98.83	355.79	0.001195
0.9	54.48	196.13	0.002273	69.17	249.02	0.001971	87.89	316.41	0.001708	111. 19	400.29	0.0001485
1	60.53	217.91	0.002762	76.85	276.66	0.002394	97.65	351 .54	0.002075	123.54	444.75	0.001804
1.1	66.58	239.69	0.003294	84.54	304.35	0.002856	107.42	386.72	0.002476	135.9	489.24	0.002153
1.2	72. 63	261. 47	0.003871	92.22	332	0,03357	117.18	421. 85	0.00291	148.25	533.7	0.00253
1.3	78.69	283.29	0.004491	99.91	359.68	0.003895	126.94	456.99	0.003377	160,60	578.16	0.002937
1.4	84.74	305.07	0.005156	107.59	387.33	0.004472	136.71	492 .16	0.003877	172 96	622.66	0.003372
1.5	90.79	326.85	0.005863	115.27	414.98	0.005086	146.47	527.3	0.00441	185,31	667.12	0.003835
1.6	96.84	348.63	0.006614	122.96	442.66	0.005737	156.24	562.47	0.0004976	197.66	711 .58	0.004327
1.7	102.9	370.44	0.007408	130.64	470.31	0.006426	166	597.6	0.005573	210.02	756.08	0.004847
1.8	108.95	392. 22	0.008245	138,33	497.99	0. 007153	175.77	632.78	0.006204	222.37	800.54	0.005396
1.9	115	414	0.009125	14601	525.64	0.007916	185.53	667.91	0.006866	234,72	845	0.005972
2	121. 05	435.78	0.010047	153,70	553.32	0.08717	195.3	703.08	0.007561	24708	889.49	0.06577
2.1	127.11	457.6	0.011012	161 38	580.97	0.009554	205.06	738.22	0.08288	259,43	933.95	0.07209
2.2	133.16	479.38	0.001202	169,07	608.66	0.010429	214,83	773.39	0.09047	271 .79	978.45	0.0787
2.3	139.21	501 .16	0.001307	17675	636,30	0.01134	22459	808.53	0.09838	284,14	1022,91	0.08558
2.4	145.26	522. 94	0.014162	184,44	66399	0.012289	234,36	843.7	0.010661	29649	106737	0.09274
2.5	151. 32	544.76	0.015297	192 12	691 64	0.013274	24412	878.84	0.011515	308,85	1111,86	0.010018
2.6	157.37	566.54	0.016474	199,81	719,32	0,014295	253,88	913.97	0.012402	321 20	115632	0.01079
2.7	163,42	588.32	0.017693	20749	746,97	0.015354	26365	949,14	0,013321	333,55	1200,78	0.011589
2.8	169,47	610,1	0,018954	215,17	774,62	0,016449	273,41	98428	0,014271	345,91	1245,28	0.012416
2.9	175,53	631,91	0,020258	222,86	80230	0,017580	283,18	1019,45	0,015253	358,26	1289,74	0,013271
3	181,58	653,69	0,021603	230,54	829,95	0,018748	292,94	1054,59	0,016267	370,61	1334,20	0,014153
3.2	193,68	697,25	0,024420	245,91	885,28	0,021194	312,47	1124,90	0,018389	395,32	1423,16	0,016001
3.4	205,79	740,85	0,027405	261,28	940,61	0,023785	332,00	1195,20	0,020638	420,03	1512,11	0,017958
3.6	217,89	784,41	0,030558	276,65	995,94	p,0265,21	351,53	1265,51	0,023013	444,74	1601,07	0,020026
3.8	230,00	828,00	0,033877	292,02	1051,28	0,029403	371,06	1335,82	0,025515	469,44	1689,99	0,022203
4	242,10	871,56	0,037364	307,39	1106,61	0,032431	390,59	1406,13	0,028142	494,15	1778,94	0,024490
4.2	254,21	915,16	0,041018	322,76	1161,94	0,035603	410,12	1476,44	0,030896	518,86	1867,90	0,026886
4.4	266,31	958,72	0,044839	338,13	1217,27	0,038920	429,65	1546,74	0,033775	543,57	1956,86	0,029392
4.6	278,42	1002,32	0,048826	353,50	1272,60	0,042382	449,18	1617,05	0,036780	568,27	2045,78	0,032008

Table 2.3.1 Pressure loss table for HSP PE 100 PN 10 Pipe. (calculated using colebrooke-White formula. K= 0.020mm)

D	500	mm		560	mm		630	mm		710	mm	
s	29.7	mm		33.2	mm		33.2	mm		42.1	mm	
DI	440.6	mm		493.6	mm		493.6	mm		625.8	mm	
Vort	Debye l/s	Debye	J m/m	Debye l/s	Debye	J m/m	Debye l/s	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m
0.5	76.24	274.47	0.000445	95.68	334.45	0.000388	121.05	435.78	0.000338	153.8	553.68	0.000293
0.6	91.49	329.37	0.000621	114.82	413.82	0.000542	145.26	522.94	0.000471	184.55	664.38	0.000409
0.7	106.73	384.23	0.000824	133.95	482.22	0.00072	169.47	610.1	0.000626	215.31	775.12	0.000543
0.8	121.98	439.13	0.001054	153.09	551.13	0.000921	193.68	697.25	0.000801	246.07	885.56	0.000695
0.9	137.23	494.03	0.00131	172.22	620	0.001144	217.89	784.41	0.000995	276.83	996.59	0.00864
1	152.47	548.9	0.001592	191.36	688.9	0.001391	242.1	871.56	0.00121	307.59	1107.33	0.00105
1.1	167.72	603.8	0.0019	210.5	757.8	0.00166	266.31	958.72	0.001444	338.85	1218.06	0.001254
1.2	182.97	658.7	0.002233	229.63	826.67	0.001952	290.52	1045.88	0.001698	369.1	1328.76	0.001474
1.3	198.21	713.56	0.002592	248.77	895.58	0.002265	314.73	1133.03	0.001971	399.86	1439.5	0.001711
1.4	213.46	768.46	0.002976	267.9	964.44	0.002601	338.94	1220.19	0.002264	430.62	1550.24	0.001965
1.5	228.71	823.36	0.003385	287.04	1033.35	0.002959	363.15	1307.34	0.002575	461.38	1660.97	0.002236
1.6	243.95	878.22	0.00382	306.17	1102.22	0.003339	387.36	1394.5	0.002906	492.14	1771.17	0.002523
1.7	259.2	933.12	0.004279	253.31	1171.12	0.003741	411.57	1481.66	0.003256	522.89	1882.41	0.002827
1.8	274.45	988.02	0.004764	344.44	1239.99	0.004165	435.78	1568.81	0.003625	553.65	1993.14	0.003148
1.9	289.69	1042.89	0.005273	363.58	1308.89	0.00461	459.99	1655.97	0.004012	584.41	2103.88	0.003484
2	304.94	1097.79	0.008507	382.72	1377.8	0.005077	484.2	1743.12	0.004419	615.41	2214.62	0.003838
2.1	320.19	1152.69	0.006365	401.85	1446.66	0.00556	508.41	1830.28	0.004845	645.93	2325.35	0.004207
2.2	335.43	1207.55	0.006949	420.99	1515.57	0.006076	532.62	1917.44	0.005289	676.69	2436.09	0.004593
2.3	350.68	1262.45	0.007557	440.12	1584.44	0.006608	556.83	2004.59	0.005752	707.44	2546.79	0.001996
2.4	365.93	1317.35	0.008189	459.26	1653.34	0.007161	581.04	2091.75	0.006234	738.2	2657.52	0.005414
2.5	381.18	1372.25	0.008846	478.39	1722.21	0.00736	605.25	2178.9	0.006734	768.96	2768.52	0.005849
2.6	369.42	1427.12	0.009528	497.53	1791.11	0.008332	629.46	2266.06	0.007254	799.72	2768.26	0.0063
2.7	411.67	1482.02	0.012034	516.66	1859.98	0.00895	653.67	2353.22	0.007792	830.48	2879	0.006768
2.8	426.92	1536.92	0.010965	535.8	1928.88	0.009589	677.88	2440.37	0.008348	861.23	2989.73	0.007251
2.9	442.16	1591.78	0.01172	554.93	1997.75	0.010249	702.09	2527.53	0.008923	891.99	3100.43	0.007751
3	457.41	1646.68	0.012499	574.07	2066.66	0.010931	726.29	2614.65	0.009517	922.75	3211.17	0.008267
3.2	487.9	1756.44	0.014131	612.34	2204.43	0.012359	774.71	2788.96	0.01076	984.27	3321.9	0.009347
3.4	518.4	1866.24	0.01586	650.61	2342.2	0.013871	823.13	2963.27	0.012078	1045.78	3543.38	0.010492
3.6	548.89	1976.01	0.017686	688.88	2479.97	0.015469	871.55	3137.58	0.013469	1107.3	3764.81	0.011701
3.8	579.38	2085.77	0.019609	727.15	2617.74	0.017152	919.97	3311.9	0.014934	1168.82	3986.28	0.012975
4	609.88	2195.57	0.02163	765.43	2755.55	0.018919	968.39	3486.21	0.016474	1230.33	4207.76	0.014312
4.2	640.37	2305.34	0.023747	803.7	2893.32	0.020771	1016.81	3660.52	0.018087	1291.85	4429.19	0.015714
4.4	670.86	2415.1	0.025961	841.97	3031.1	0.022708	1065.23	3834.83	0.019774	1353.37	4650.66	0.01718
4.6	701.36	2524.9	0.028271	880.24	3168.87	0.02473	1113.65	4009.14	0.021534	1414.88	4872.14	0.01871

D	600	mm		900	mm		1000	mm		1200	mm	
s	47.4	mm		53.3	mm		59.3	mm		70.6	mm	
DI	705.2	mm		793.4	mm		881.4	mm		1058.8	mm	
Vort	Debye l/s	Debye	J m/m	Debye l/s	Debye	J m/m	Debye l/s	Debye m^3/h	J m/m	Debye l/s	Debye m^3/h	J m/m
0.5	195.3	703.08	0.000254	247.2	889.92	0.000221	305.08	1098.29	0.00195	440.24	1480.3	0.000157
0.6	234.36	843.7	0.000355	296.64	1067.91	0.000309	366.09	1317.93	0.000273	528.29	1584.87	0.00022
0.7	273.47	984.28	0.000471	346.08	1245.89	0.00041	427.11	1537.6	0.000362	616.34	1901.85	0.000292
0.8	312.53	1124.9	0.000603	395.52	1423.88	0.000525	488.12	1757.24	0.000464	704.39	2218.83	0.000374
0.9	351.53	1265.51	0.00075	444.96	1061.86	0.000653	549.14	1976.91	0.000577	792.43	2535.81	0.000465
1	390.59	1406.13	0.000912	494.4	1779.84	0.000794	610.15	2196.54	0.000701	880.48	2852.75	0.000565
1.1	429.65	1546.74	0.001089	543.84	1967.83	0.000947	671.17	2416.22	0.000837	968.53	3169.73	0.000675
1.2	468.71	1687.36	0.00128	593.28	2135.81	0.001114	732.18	2635.85	0.000985	1056.53	3803.71	0.000794
1.3	507.76	1827.94	0.001486	642.72	2313.8	0.001294	793.18	2855.52	0.001143	1144.62	4120.64	0.000922
1.4	546.82	1968.56	0.001707	692.16	2491.78	0.001486	854.21	3075.16	0.001313	1232.67	4437.62	0.001059
1.5	585.88	2109.17	0.001942	741.6	2669.76	0.001691	915.23	3294.83	0.001494	1320.72	4754.6	0.001205
1.6	624.94	2249.79	0.002192	791.04	2847.75	0.001908	976.24	3514.47	0.001687	1408.77	5071.58	0.00136
1.7	664	2390.4	0.002456	840.48	3025.73	0.002138	1037.25	3734.14	0.00189	1496.81	5388.52	0.001524
1.8	703.06	2531.02	0.002735	889.92	3203.72	0.002381	1098.25	3953.78	0.002104	1584.86	5705.5	0.001698
1.9	742.11	2671.6	0.003027	939.36	3381.7	0.002636	1159.29	4173.45	0.00233	1672.91	6022.48	0.00188
2	781.17	2812.22	0.003335	988.8	3559.68	0.002903	1220.3	4393.08	0.002566	1760.96	6339.46	0.00207
2.1	820.29	2952.83	0.003656	1038.23	3737.68	0.003183	1281.32	4612.76	0.002814	1849.01	6656.44	0.002479
2.2	859.29	3093.45	0.003991	1087.67	3915.62	0.003476	1342.32	4832.39	0.003072	1937.05	6973.38	0.002696
2.3	898.35	3234.06	0.004341	1137.11	4093.6	0.00378	1403.35	5052.06	0.003342	2025.1	7290.36	0.002923
2.4	937.41	3374.68	0.004705	1186.55	4271.58	0.004097	1464.36	5271.7	0.003622	2113.15	7607.34	0.003158
2.5	976.47	3515.3	0.005083	1235.99	4449.57	0.004427	1525.38	5491.37	0.003913	2201.2	7924.32	0.003402
2.6	1015.52	3655.88	0.005475	1285.43	4627.55	0.004768	1586.39	5711.01	0.004215	2289.24	8241.27	0.003654
2.7	1054.58	3796.49	0.005882	1334.87	4805.54	0.005122	1647.41	5930.68	0.004528	2377.29	8558.25	0.003916
2.8	1093.64	3937.11	0.00 6302	1384.31	4983.52	0.005488	1708.41	6150.32	0.004852	2465.34	8875.23	0.004186
2.9	1132.7	4077.72	0.006736	1433.75	516 1.5 0	0.005867	1769.44	6369.99	0.005187	2553.39	9192.21	0.004465
3	1171.76	4218.34	0.007185	1483.19	5339.49	0.006258	1830.45	6589.62	0.005532	2641.43	9509.15	0.005049
3.2	1294.87	4499.54	0.008124	1582.07	5695.46	0.007076	1952.48	7028.93	0.006256	2817.53	10143.11	0.005668
3.4	1327.99	4780.77	0.009119	1680. 95	6051.42	0.007943	2074.51	7458.24	0.007023	2993.62	10777.04	0.006322
3.6	1406.11	5062	0.01017	1 779.83	6407.39	0.008858	2196.54	7907.55	0.007832	3169.72	11411	0.007011
3.8	1484.22	5343.2	0.011287	1878.71	6763.36	0.009823	2318.57	8346.86	0.008685	3345.82	12044.96	0.007734
4	1562.34	5624.43	0.01244	1977.59	7119.33	0.010836	2440.6	8786.16	0.009581	3521.91	12678.88	0.008492
4.2	1640.46	5905.66	0.013659	2076.46	7475.26	0.011898	2562.63	9225.47	0.01052	3698.01	3312.84	0.009285
4.4	1718.57	6186.86	0.014934	2175.34	7831.23	0.13008	2684.66	9665.47	0.011502	3874.1	13946.76	0.010113
4.6	1796.69	6468.09	0.016264	2274.22	8187.2	0.014167	2806.69	10104.09	0.012527	4050.2	14580.72	0.172203

Auxiliary Equipments

HSP Butt-Welding Machine is provided as a set including the main machine with necessary equipments, set includes:

1- The main machine chassis
2- Hudraulic System
3- Heating System
4- Clamps Inserts for any diameter
5- Reduction and Flange Clamping Apparatus

Spare parts

Together with the machine set, a spare thermocouple is provided.

Guarantee conditions

HSP Butt - Weling Machine is guaranteed for 12 Months from the date of sale to the end use. The date of sale has to be proven through sales documents. Any faults that are, in our reasonable opinion proven defects in workmanship or material are in HSP Group's responsibility. Defects which are traceable to normal wear and tear, misuse, unsuitable working materials, use for purposes other than originally intended are excluded from the guarantee.

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS — PN 32

Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
16	3	0.5	30	5	5	6.0	6.7
20	3.4	0.5	34	5	5	6.0	6.7
25	4.2	0.5	42	5	5	6.0	6.9
32	5.4	1.0	54	5	5	7.4	8.5
40	6.7	1.0	67	6	6	9.5	10.8
50	8.3	1.5	83	7	7	11.6	13.2
63	10.5	1.5	105	7	7	14.2	16.2
75	12.5	2.0	125	8	8	16.6	18.9
90	15	2.0	150	9	9	19.4	22.2
110	18.3	2.0	183	10	11	23.2	26.6
125	20.8	2.5	208	11	12	25.1	29.9
140	23.3	2.5	233	11	13	28.9	33.2
160	26.6	3.0	266	12	14	32.7	37.6
180	29.9	3.0	299	13	15	36.6	42.1
200	33.2	3.0	332	15	17	40.5	46.6
225	37.4	3.5	374	18	22	52.1	59.0
250	41.5	3.5	415	19	23	54.7	62.3
280	46.5	3.5	465	19	24	57.8	66.3
315	52.3	4.0	523	22	26	62.3	71.8
355	59	4.0	590	27	30	69.0	79.8
400	56.7	4.0	667	33	33	76.7	88.9

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS — PN 6

Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
50	2.4	0.5	24	5	5	6.0	6.6
63	3	0.5	30	5	5	6.0	6.7
75	3.6	0.5	36	5	5	6.0	6.8
90	4.3	0.5	43	5	5	6.0	6.9
110	5.3	1.0	53	5	5	7.3	8.3
125	6	1.0	60	6	6	8.4	9.6
140	6.7	1.0	67	6	6	9.5	10.8
160	7.7	1.5	77	6	6	10.8	12.3
180	8.6	1.5	86	7	7	11.9	13.6
200	9.6	1.5	96	7	7	13.1	15.0
225	10.8	1.5	108	8	8	14.6	16.6
250	11.9	1.5	119	8	8	15.9	18.1
280	13.4	2.0	134	8	9	17.6	20.1
315	15	2.0	150	9	9	19.4	22.2
355	16.9	2.0	169	9	10	21.6	27.7
400	19.1	2.5	191	10	11	24.1	27.6
450	21.5	2.5	215	11	12	26.9	30.8
500	23.9	2.5	239	11	13	29.6	34.0
560	26.7	3.0	267	12	14	32.8	37.7
630	30	3.0	300	13	16	36.7	42.2
710	33.9	3.9	509	15	24	41.3	50.5
800	38.1	4.3	572	18	27	52.6	62.8
900	42.9	4.8	644	19	30	55.6	67.1
1000	47.7	5.3	716	20	33	58.6	71.4
1200	57.2	6.2	858	25	39	67.2	82.6
1400	66.7	7.2	1001	33	45	76.7	94.7
1600	76.2	8.1	1143	42	51	87.5	108.1

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS — PN 10

Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
40	2.4	0.5	24	5	5	6.0	6.6
50	3	0.5	30	5	5	6.0	6.7
63	3.8	0.5	38	5	5	6.0	6.8
75	4.5	1.0	45	5	5	6.0	6.9
90	5.4	1.0	54	5	5	7.4	8.5
110	6.6	1.0	66	6	6	9.4	10.7
125	7.4	1.5	74	6	6	10.5	11.9
140	8.3	1.5	83	7	7	11.6	13.2
160	9.5	1.5	95	7	7	13.0	14.8
180	10.7	1.5	107	7	7	14.4	16.5
200	11.9	1.5	119	8	8	15.9	18.1
225	13.4	2.0	134	8	9	17.6	20.1
250	14.8	2.0	148	9	9	19.2	22.0
280	16.6	2.0	166	9	10	21.3	24.3
315	18.7	2.0	187	10	11	23.7	27.1
355	21.1	2.5	211	11	12	26.4	30.3
400	23.7	2.5	237	11	13	29.4	33.7
450	26.7	3.0	267	12	14	32.8	37.7
500	29.7	3.0	297	13	16	36.4	41.8
560	33.2	3.0	332	15	17	40.5	46.6
630	37.4	3.5	374	18	22	52.1	59.0
710	42.1	4.7	632	19	24	55.1	66.3
800	47.4	5.2	711	20	27	58.4	71.0
900	53.3	5.8	800	22	30	63.3	77.5
1000	59.3	6.4	890	27	33	69.3	85.1
1200	70.6	7.6	1059	36	39	81.3	100.2
1400	82.4	8.7	1236	45	45	93.3	115.4
1600	94.1	9.9	1412	54	51	105.3	130.6

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS							PN 12.5
Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
40	3	0.5	30	5	5	6.0	6.7
50	3.7	0.5	37	5	5	6.0	6.8
63	4.7	1.0	47	5	5	6.3	7.3
75	5.6	1.0	56	5	5	7.8	8.9
90	6.7	1.0	67	6	6	9.5	10.8
110	8.1	1.5	81	6	6	11.3	12.9
125	9.2	1.5	92	7	7	12.6	14.4
140	10.3	1.5	103	7	7	14.0	15.9
160	11.8	1.5	118	8	8	15.8	18.0
180	13.3	2.0	133	8	9	17.5	20.0
200	14.7	2.0	147	9	9	19.1	21.8
225	16.6	2.0	166	9	10	21.3	24.3
250	18.4	2.0	184	10	11	23.3	26.7
280	20.6	2.5	206	10	12	25.8	29.6
315	23.2	2.5	232	11	13	28.8	33.1
355	26.1	3.0	261	12	14	32.1	36.9
400	29.4	3.0	294	13	16	36.0	41.4
450	33.1	3.0	331	15	17	40.4	46.4
500	36.8	3.0	368	16	19	44.8	51.5
560	41.2	3.5	412	19	23	54.5	62.1
630	46.3	3.5	463	19	24	57.7	66.1
710	52.2	5.7	783	22	24	62.2	76.0
800	58.8	6.4	882	27	27	68.8	84.4
900	76.2	7.1	993	32	30	76.2	93.8
1000	73.5	7.9	103	39	33	84.4	104.0

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS							PN 16
Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
32	3	0.5	30	5	5	6.0	6.7
40	3.7	0.5	37	5	5	6.0	6.8
50	4.6	1.0	46	5	5	6.2	7.1
63	5.8	1.0	58	6	6	8.1	9.2
75	6.8	1.0	68	6	6	9.7	11.0
90	8.2	1.5	82	6	6	11.4	13.0
110	10.0	1.5	100	7	7	13.6	15.5
125	11.4	1.5	114	8	8	15.3	17.4
140	12.7	2.0	127	8	8	16.8	19.2
160	14.6	2.0	146	9	9	19.0	21.7
180	16.4	2.0	164	9	10	21.0	24.1
200	18.2	2.0	182	10	11	23.1	26.5
225	20.5	2.5	205	10	12	25.7	29.5
250	22.7	2.5	227	11	13	28.2	32.4
280	25.4	2.5	254	12	14	31.3	36.0
315	28.6	3.0	286	13	15	35.1	40.3
355	32.2	3.0	322	14	17	39.3	45.2
400	36.3	3.0	363	16	19	44.2	50.8
450	40.9	3.5	409	18	23	54.3	61.8
500	45.4	3.5	454	19	24	57.1	65.4
560	50.8	4.0	508	21	25	60.8	70.0
630	57.2	4.0	572	25	29	67.2	77.6
710	64.5	7.0	968	31	32	74.5	91.7

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS							PN 20
Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
25	3	0.5	30	5	5	6.0	6.7
32	3.6	0.5	36	5	5	6.0	6.8
40	4.5	1.0	45	5	5	6.0	6.9
50	5.6	1.0	56	5	5	7.8	8.9
63	7.1	1.5	71	6	6	10.1	11.5
75	8.4	1.5	84	7	7	11.7	13.3
90	10.1	1.5	101	7	7	13.7	15.6
110	12.3	2.0	123	8	8	16.3	18.7
125	14	2.0	140	9	9	18.3	20.9
140	15.7	2.0	157	9	10	20.2	23.2
160	17.9	2.0	179	10	11	22.7	26.1
180	20.1	2.5	201	10	11	25.3	29.0
200	22.1	2.5	224	11	12	27.9	32.0
225	25.2	2.5	252	12	14	31.1	35.7
250	27.9	3.0	279	13	15	34.3	39.4
280	31.3	3.0	313	14	16	38.3	44.0
315	35.2	3.0	352	15	18	42.9	49.3
355	39.7	3.5	397	18	22	53.6	60.9
400	44.7	3.5	447	19	24	56.7	64.9
450	50.3	4.0	503	20	25	60.3	69.4
500	55.8	4.0	558	24	28	65.8	76.0
560	62.2	4.0	622	29	31	72.2	83.6

HSP HDPE 100 PIPES BUTT WELDING PARAMETERS							PN 25
Nominal Diameter (DN) mm	Wall Thickness (s) mm	Height of Bulge (11) mm	Non-Pressure Heating Time (t2) sec	Changeover Time (t3) sec	Pressure Built Up Time (t4) sec	Cooling Time (t5) min	Total Welding Time (t) min
20	3	0.5	30	5	5	6.0	6.7
25	3.5	0.5	35	5	5	6.0	6.8
32	4.4	0.5	44	5	5	6.0	6.9
40	5.5	1.0	55	5	5	7.8	8.7
50	6.9	1.0	69	6	6	9.8	11.2
63	8.6	1.5	86	7	7	11.9	13.6
75	10.3	1.5	103	7	7	14.0	15.911
90	12.3	2.0	123	8	8	16.3	8.7
110	15.1	2.0	151	9	9	19.5	22.4
125	17.1	2.0	171	9	10	21.8	25.0
140	19.2	2.5	192	10	11	24.2	27.8
160	21.9	2.5	219	11	12	27.3	31.3
180	24.6	2.5	246	12	13	30.4	34.9
200	27.4	3.0	274	13	15	33.7	38.7
225	30.8	3.0	308	14	16	37.7	43.3
250	34.2	3.0	342	15	18	41.7	47.9
280	38.3	3.5	383	18	22	52.7	59.7
315	43.1	3.5	431	19	23	55.7	63.6
355	48.5	3.5	485	20	25	59.1	67.9
400	54.7	4.0	547	24	27	64.7	74.7
450	61.5	4.0	615	29	31	71.5	82.7

Advantage of minimum 50 years service life of PE Pipes

The curve in the figure below shows the change in the physical properties of PE 100 pipes in time.

The production design of PE 100 pipes is done for a service life of 50 years. So, the minimum service life of PE 100 pipes is 50 years.

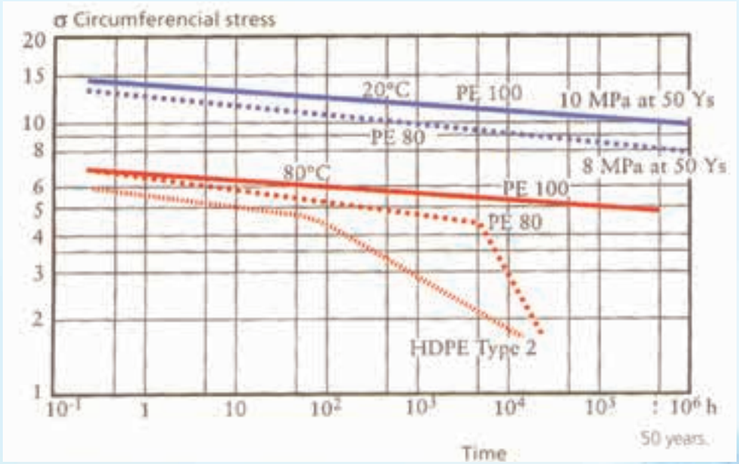


Figure 2.1.3 - the curve of hoop strees against time.

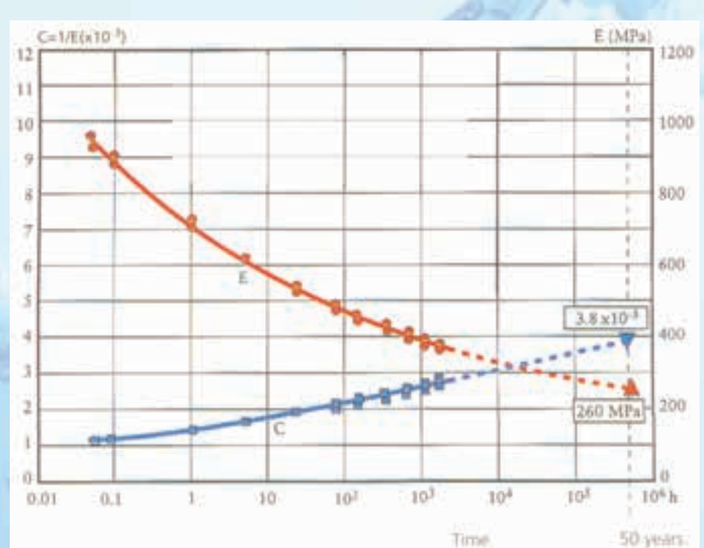


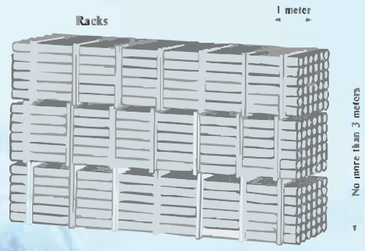
Figure 2.1.4- The change in the elasticity module of PE pipes in time.

Transportation

For transportation of pipes it is necessary to use cargo trailers with the flat platform, but not with spurs. At loading a package of pipes by the crane, it is necessary to use wide slings. Do not use chains, hooks and ropes. At loading and unloading, the small flexure or deflection is allowed. Standard 6 meter packages can be loaded by auto loader, but pipes of the greater length should be moved by lateral auto loader with a minimum 4 supporting plates, or the crane with beam (cross-beam). The reals of the small sizes fixed on pallets, are easily move by means of auto loader. Lifting of reels of big sizes (125mm, 160mm) is carried out by auto loader individually.

Storage

All materials should be carefully inspected at the time of delivery and any defective material set-aside before accepting the delivery into stores. The defective materials should be return to the suppliers immediately.
Pipes and fittings should be used in the order of delivery to ensure the correct rotation of stock.
All pipe stacks should be made on sufficiently firm, flat ground to support the weight of the pipes and any necessary lifting equipment. Stacking heights should generally be kept to a minimum and adequate space allocated for lifting machinery to manoeuvre without causing accidental damage.



For safety and convenience of handling the stacking height of bundles should not be more than 3m. To prevent possible deformation of the pipes, bundles must be stored timber to timber.
For similar reasons, pipe coils should be stored flat and the number of coils per stack should be limited to:

- **7 coils for 20mm pipe**
- **6 coils for 25mm pipe**
- **5 coils for 32mm pipe**
- **4 coils for 50mm pipe**
- **4 coils for 63mm pipe**
- **3 coils for 90mm pipe**
- **2 coils for 110, 125 and 180 pipes.**

Pipe coils also be stored as Vertical to suport each other.

Where individual pipe lengths are stacked in pyramidal fashion, deformation may occur in the lower layers. Such stacks should therefore be not greater than 2m high.

At all times pipes and fittings should be stored away from exhaust outlets and all other high temperature sources. Care should also be taken to avoid contact with lubricating or hydraulic oils, gasoline, solvents and other aggressive chemicals.

All special tool and equipment associated with the jointing of pipes and fittings should be stored separately and securely until they are required for use.