PRINCE plastic pipe systems

PRINCE
SIGN OF QUALITY

FORM II
[Section-8(xiii)]
STANDARDS DEVELOPMENT CENTRE (SDC)
PAKISTAN STANDARDS & QUALITY CONTROL AUTHORITY (PSQCA)
Licence for the use of Standard Mark

ORIGINAL

Licence No. CM/L-1044-A/1998(R)

1. By virtue of the power conferred on it under Section 8(xiii) the PSQCA Act-VI of 1996, the Authority hereby grants to **M/S. SARHAD PLASTIC, KARACHI,** (hereinafter called 'the licensee') this licence to use the Standard Mark set out in the first column of the First Schedule hereto open or in respect of the article(s)/process set out in the second column of the said Schedules which is/are manufactured in accordance with/conforms to the related Pakistan Standard(s) or a standard of any other country recognized by the Authority referred to in the third column of the said Schedule as from time to time amended or revised.

2. This licence carries the rights and obligations stipulated in the rules and regulations made under the above Act. In pursuance of his obligations, the licensee shall pay in due manner and time the scheduled "Marking Fee" set out in the second Schedule hereto and maintain to the satisfaction of the Authority the Scheme of Testing and Inspection a copy of which is attached hereto.

3. This licence shall be valid from **1ST APRIL, 2011 TO 31ST MARCH, 2013** and may be renewed as prescribed in the Rules and Regulations.
Signed, Sealed and Dated this **21ST NOVEMBER, 2011**

21/11/2011
Seal of the Authority
DIRECTOR (CONFORMITY ASSESSMENT)
Standards Development Centre
Pakistan Standards & Quality Control Authority
Government of Pakistan
Karachi

THE FIRST SCHEDULE

Standard Mark	Article / Process	Pakistan Standard(s)
1	2	3
Pakistan Standards	UN-PLASTICIZED POLYVINYL CHLORIDE (U-PVC) PRESSURE PIPES FOR COLD POTABLE WATER "PRINCE" BRAND (SIZES & CLASSES AS PER ANNEXURE-A)	PS: 3051/1998(R)

THE SECOND SCHEDULE
Schedule of Marking Fee for Licence No. CM/L-1044-A/1998(R)

Article / Process	Unit	Marking Fee Per Unit	Manner of Payment
1	2	3	4
UN-PLASTICIZED POLYVINYL CHLORIDE (U-PVC) PRESSURE PIPES FOR COLD POTABLE WATER "PRINCE" BRAND (SIZES & CLASSES AS PER ANNEXURE-A)	Quantum of Annual Production Value.	@ 0.1% OF EX-FACTORY PRICE	Through Bank Draft Quarterly

NOTE:
i. The Authority may, on one month's notice to a licencee, and during the period of the validity of the licence alter any terms and conditions subject to which the licence has been granted.
ii. Terms & Conditions to maintain C.M licence shall be applicable as attachment.
iii. In case of default the licencee shall be liable to pay the penalty of Rs.5000/- or @ of 10% of the out standing dues, whichever is higher.
iv. The PS Logo can be downloaded for detail of colour, size, width etc., from Website www.psqca.com.pk

INTRODUCTION

This is the technical handbook for engineers who design and install water pipelines in urban and farflung areas. It contains information, based on specialized experience of our company as well as that of our technical collaborators in meeting the specific demands of various areas with almost all types of geophysical terrains. Our Technical Services Department can take care of all the normal and abnormal behaviors. We have always been entirely devoted for producing uPVC extrusions and moldings.

QUALITY CONTROL

Sarhad Plastic Industries (Pvt) Ltd. maintains a continous and strict control over quality of the pipes through very stage of its process. The Plant is laid out to permit careful supervision of the blending process as well as close production control. Trained engineers and a well-equipped testing laboratory help in regular quality checks. In this way, a product of high purity and mechanical strength is ensured. The importance of this rigid control cannot be overemphasized, since the user is rarely in a position to carry out more than the most perfunctory tests or make simple visual comparisons.

PRINCE RIGID u.PVC PRESSURE PIPES

PRINCE unplasticized Poly Vinyl Chloride pipes are produced according to specifications under the technical know-how of British Standards, Pakistan Standards and other International Standards.

Four type of pressure pipes are produced at present, B-Class for working pressures upto 6 kg.cm^2, C-Class for working pressure upto 9 kg/cm^2, D-Class for working pressure upto 1kg/cm^2 and E-Class for working pressure upto 15 kg/cm^2. All ranges of PRINCE fittings and accessories for these pipes are also available. For any other special requirements we can also produce Special-Class Pipes.

Material Properties

TEST	UNIT	VALUE AT-20°C	REMARKS	DESIGN DATE
Specific Gravity	deg.	1.38-1.45	Model 1.43	1.43
Shock Rock Well		70-90 110-120	Equivalent to the hardness of aluminium	
Inflammability		Self-Extinguishing	Ignites when flame approaches but the fire extinguishes by it self when brought away from flame	
Weather Resistance		Color fading but no decrease in strength	Tensile strength increase slightly and elongation decreases.	
Primary Softening Point	°C	75-80	softening initiates at this point	
Welding temperature		180-185	Becomes slightly viscous	
Moulding temperature		190-200	Becomes paste like to collapse pipe shape	
Decomposing Point		205-210	Scorching by carbonization and dehydrochaloriation.	
Specific Volume Resistivity	Mem	3 - 5 x10	High Electrical Insulator No.	
Di-electric	kV/mm	23-28	Magnetizing	

Material: Chlorinated Polyvinyl Chloride (cPVC)

General Properties	
Specific Gravity	1.52 gm/cm^3
Flammability	Will not support combustion
Water Absorption	7 gm / cm^2
Mechanical Properties	
Ultimate Tensile Strength	575 kgf / cm^2
Compressive Strength	11 joules
Flexural Strength	1018 kgf / cm^2
Thermal Properties	
Softening Point VSP 5 kg	93 °C
Co-efficient of linear	8.3 x 10-5°C
Electric Properties	
Volume Resistivity	10^{14} ohm-cm
Surface Resistance	>10^{12} ohm
Power Factor (at 10 cycles)	3.0
cPVC is a non conductor of electriity and also non subject to galvanic or electrolytes attack. Electrical equipments should not be earthened to cPVC pipes.	
Colour:	Light Grey

Advantages of uPVC Pipes

PRINCE PVC PIPES provide the following distinct advantages:

Easy Installation

Requiring no special tools or skilled personnel. PVC pipes are easier to install than other piping systems.

Light Weight

PVC pipes are lighter in weight than traditional cast iron pipes. This gives saving in handling and installation costs.

Strength

PVC pipes are regarded as being flexible when properly installed in a trench using suitable bedding and backfill. PVC pipes, have better impact strength than its iron or clay counter part.

Non-Toxic

Do not change the taste or smell of water.

Corrosion Resistance

PVC pipes do not undergo physical deterioration due to corrosive sub soil.

Non - Flammable

PVC pipes do not support combustion.

Prince uPVC Pipes

Dimensions of class B,C,D & E according to BS - 3505 & PS - 3051

Nominal Outside Size Diameter			WALL THICKNESS							
			B-Class 6.0 bar (60m head of water)		**C-Class 9.0 bar** (90m head of water)		**D-Class 12.0 bar** (120m head of water)		**E-Class 15.0 bar** (150m head of water)	
Inch	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm	Min. mm
3/8”	17.0	17.3							1.5	1.9
1/2”	21.2	21.5							1.7	2.1
3/4”	26.6	26.9							1.9	2.5
1”	33.4	33.7							2.2	2.7
1 1/4”	42.1	42.4					2.2	2.4	2.7	3.2
1 1/2”	48.1	48.4					2.5	2.8	3.1	3.4
2”	60.2	60.5			2.5	2.8	3.1	3.4	3.9	4.3
2 1/2”	75.2	75.5			3.0	3.3	3.9	4.5	4.8	5.3
3”	88.7	89.1	2.9	3.3	3.5	4.1	4.6	5.3	5.7	6.6
4”	114.1	114.5	3.4	4.0	4.5	5.2	6.0	6.9	7.3	8.4
5”	140.0	140.4	3.8	4.4	5.5	6.4	7.3	8.4	9.0	10.4
6”	168.0	168.5	4.5	5.2	6.6	7.6	8.8	10.2	10.8	12.5
8”	218.8	219.4	5.3	6.1	7.8	9.0	10.3	11.9	12.6	14.3
10”	272.6	273.4	6.6	7.6	9.7	11.2	12.8	14.8	15.7	18.1
12”	323.4	324.3	7.8	9.0	11.5	13.3	15.2	17.5	18.7	21.6
14”	355.0	356.0	8.5	9.8	12.6	14.5	16.7	19.2	20.5	23.6
16”	405.9	406.9	9.7	11.2	14.5	16.7	19.0	21.9	23.4	27.0
18”	456.7	457.7	11.0	12.7	16.3	18.8	21.4	24.6	0.0	0.0
20”	507.5	508.5	12.2	14.1	18.1	20.9	0.0	0.0	0.0	0.0
22”	558.3	559.3	13.4	15.5	19.9	22.9	0.0	0.0	0.0	0.0
24”	609.1	610.1	14.6	16.8	21.7	25.0	--	--	--	--

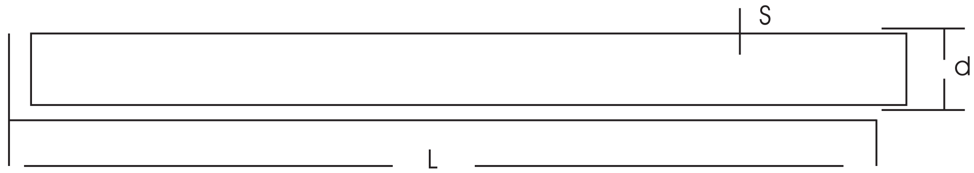
Weight of uPVC Pipe
per meter (minimum)

British Standard 3505 does not indicates weight of pipes, it depends on the formation, density and tolerance. Approximate weight for Prince uPVC pipes are given in the table below.

Nominal Size	CLASS-B Kgs/M	CLASS-C Kgs/M	CLASS-D Kgs/M	CLASS-E Kgs/M
3/8”	--	--	--	0.11
1/2”	--	--	--	0.15
3/4”	--	--	--	0.22
1”	--	--	--	0.32
1 1/4”	--	--	0.41	0.50
1 1/2”	--	--	0.54	0.65
2”	--	0.68	0.82	1.03
2 1/2”	--	1.01	1.20	1.58
3”	1.17	1.41	1.82	2.22
4”	1.78	2.32	3.03	3.65
5”	2.44	3.49	4.55	5.51
6”	3.46	5.01	6.57	7.95
8”	5.30	7.72	10.05	12.17
10”	8.26	11.95	15.59	18.89
12”	11.55	16.85	21.51	26.28
14”	13.87	20.27	26.49	36.16
16”	18.17	23.14	--	--
18”	23.14	33.83	--	--
20”	31.70	42.40	--	--
22”	38.35	50.94	--	--
24”	41.87	60.45	--	--

Dimensions According to

ASTM D-1785 SCHEDULE - 40



Nominal Size Inches	Outside Dia (d) mm	Wall Thickness (S) mm		Nominal Avg. Weight Kg/m	Pressure Rating Bar
		Min	Max		
½”	21.34	2.77	3.28	0.24	41.41
3/4”	26.67	2.87	3.38	0.33	33.10
1”	33.40	3.38	3.89	0.48	31.10
1 1/4”	42.16	3.50	4.06	0.65	25.50
1 1/2”	48.26	3.68	4.19	0.77	22.80
2”	60.32	3.91	4.42	1.04	19.30
21/2”	73.12	5.15	5.77	1.62	20.50
3”	88.90	5.49	6.15	2.14	17.90
4”	114.30	6.02	6.73	3.05	15.20
6”	168.28	7.11	7.98	5.37	12.40
8”	219.08	8.18	9.20	8.11	11.00

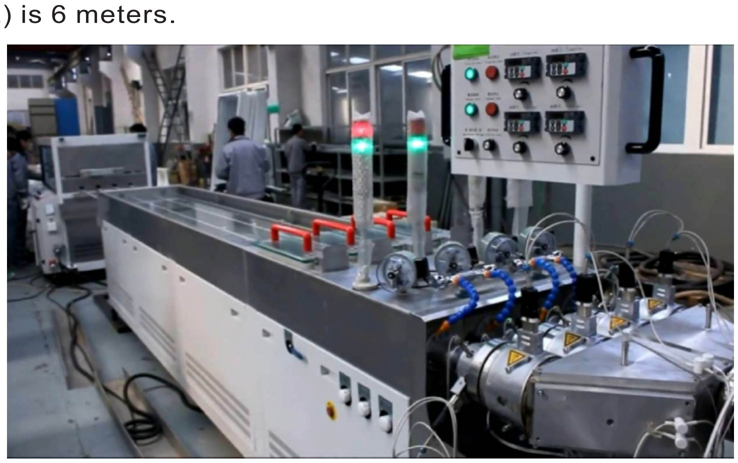
Pressure ratings apply only unthreaded pipes at 23° C. Threading of Sch-40 pipes is not recommended. The Standard (L) is 6 meters.

Dimensions According to

ASTM D-2241 SDR-SERIES

Nominal Size Inches	Outside Dia (d) mm	Wall Thickness (S) mm	Nominal Avg. Weight Kg/m	Pressure Rating Bar
2"SDR-26	60.32	2.8	0.768	11.00
3"SDR-32.5	88.90	2.7	1.093	8.62
3"SDR-26	88.90	3.5	1.417	11.00
4"SDR-41	114.30	3.2	1.667	6.89
4"SDR-32.5	114.30	4.0	2.082	8.62
4"SDR-26	114.30	4.5	2.333	11.00
6"SDR-64	168.28	3.2	2.450	4.34
6"SDR-41	168.28	4.5	3.445	6.89
6"SDR-32.5	168.28	5.2	3.987	8.62
8"SDR-41	219.08	6.0	5.988	6.89
8"SDR-32.5	219.08	7.0	6.987	8.62

The Standard Length (L) is 6 meters.



Dimensions According to DIN 8062

Nominal Size Inches	Wall Thickness			
	Series 2 4 bar mm	Series 3 6 bar mm	Series 4 10 bar mm	Series 5 16 bar mm
20	-	-	-	1.5
25	-	-	1.5	1.9
32	-	-	1.8	2.4
40	-	1.8	1.9	3.0
50	-	1.8	2.4	3.7
63	-	1.9	3.0	4.7
75	1.8	2.2	3.6	5.6
90	1.8	2.7	4.3	6.7
110	2.2	3.2	5.3	8.2
125	2.5	3.7	6.0	9.3
140	2.8	4.1	6.7	10.4
160	3.2	4.7	7.7	11.9
200	4.0	5.9	9.6	14.9
225	4.5	6.6	10.8	16.7
250	4.9	7.3	11.9	18.6
280	5.5	8.2	13.4	20.8
315	6.2	9.2	15.0	23.8
355	7.0	10.4	16.9	26.3
400	7.9	11.7	19.1	29.7
450	8.9	13.2	21.5	-
500	9.8	14.6	23.9	-
560	11.0	16.4	26.7	-
630	12.4	18.4	30.0	-

For irrigation, drainage and cable ducting working pressures are given at a temperature of 20°C

Maximum Sustained Working & Test Pressures

WORKING PRESSURE

Class	bar	kgf/cm^2	lbf/in^2
B	6	6.12	87
C	9	9.18	130
D	12	12.25	173
E	15	15.30	217

TEST PRESSURE

Class	bar	kgf/cm^2	lbf/in^2
B	9	9.18	130
C	14	13.77	195
D	18	18.38	259
E	23	22.95	325

The maximum admissible service pressures are calculated from known data on the basis of a life atleast 50 years of continuos operation and a safety factor greater than 2.

Short-Term Hydrostatic Pressure Resistance at 20°C

MAXIMUM 1 H FAILURE PRESSURE

Class of Pipe	Maximum 1 H failure pressure
6 bar class - B	21.6 bar
9 bar class - C	32.4 bar
12 bar class - D	43.2 bar
15 bar class - E	54.0 bar

PVC Pipes and Fittings

Prince u.PVC Fittings

SARHAD PLASTICS IS manufacturing a wide range of injection moulded & fabricated u.PVC Fittings in Pakistan under the brand name. **"PRINCE"** according to U.S. Standards ASTM D-2665 & 2466 ranging from 3" dia to 16" dia in white & light gray color.

DIMENSION & STANDARDS

All the dimension of solvent cement fittings such as bore. socket height and thickness are according to American and British Standards requirement.

WORKING PRESSURE

u.PVC Fittings 3" dia continues sustained working pressure 590 PSI
u.PVC Fittings 4" dia continues sustained working pressure 470 PSI

ADVANTAGES

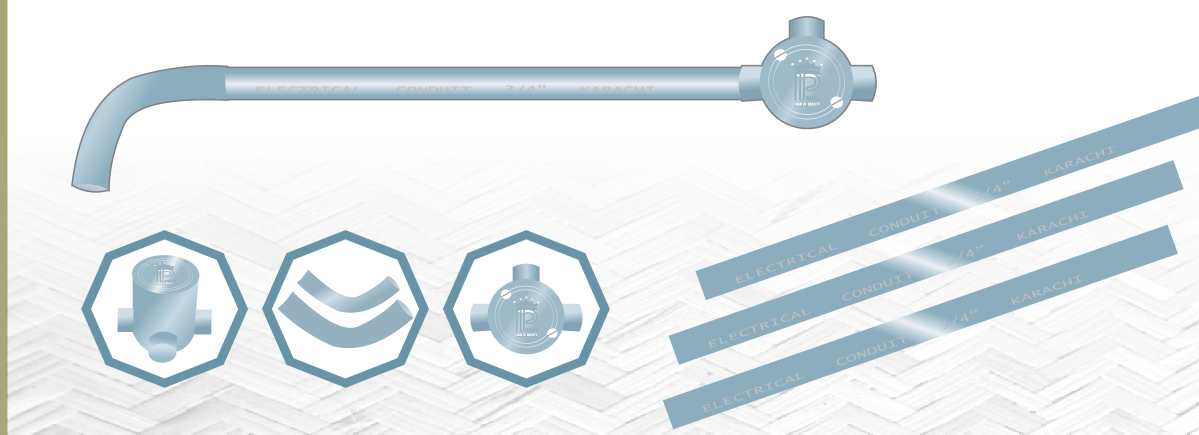
1. **NOT CORRODED** & completely unaffected by Acids, Alkalis And electrolytic corrosion from any source.
2. **EXCELLENT HYDRAULIC CHARACTERISTIC.** Is has extremely smooth bore as such frictional losses are at minimum and flow rates at the highest possible.
3. **NOT FLAMMABLE**
4. **BIOLOGICAL GROWN RESISTANT** due to smoothness of inner of u.PVC fittings prevents formaion of algaei, bacteria and fungus formation inside the fittings.
5. **LONG LIFE** more than 50 years is estimated for u.PVC Fittings.

PHYSICAL, THERMAL AND MECHANICAL PROPERTIES

1 Specific Gravity 1.43
2 Opacity < 0.05%
3 Water Absorption 2.4 mg/cm^2
4 Imflammability will not support conbustion
5 Vic at Softening Point 80 Deg. C
6 Tensile strength (N/mm^2) 525 kg/cm^2
7 Elongation at Break Point 60%
8 Impact Stength (izod, J/m 120 J/m)
9 K value 58
10 Shore Hardness 80
11 Hydraulic Test up to 500 PSI

PVC Pipes and Fittings

PVC ELECTRICAL CONDUIT Pipes and Fittings



PVC Electrical Conduit

pipes & fittings

BS 6099

Nominal Size Inches	Outside Diameter mm		Thickness mm	Weight kg/m
1/2”	17.00	17.30	1.04	0.086
3/4”	21.20	21.50	1.25	0.125
1”	26.60	26.90	1.33	0.173
1-1/4”	33.40	33.70	1.51	0.245
1-1/2”	42.10	42.20	1.86	0.398
2”	60.20	60.50	2.04	0.612
3”	89.70	89.10	1.80	0.798
4”	114.10	114.50	1.90	1.032

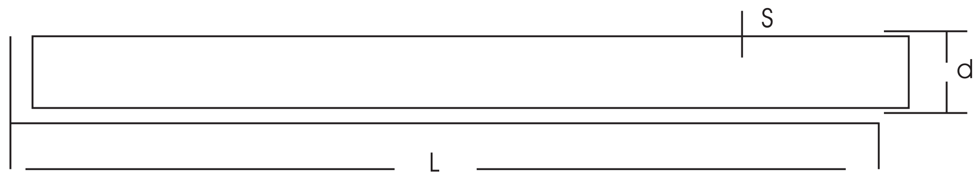
Dielectric Constant Test Cycle : 50 c/s	5.1 - 5.25
Dielectric Power Factor Test Cycle : 50 c/s	0.1 - 0.146
Shoering - Bridge Method	
Specific (Volume) Resistance	1.273 x 1013Ω - cm
Electronic Insulation Resistance A1 DC 1000 Volt Critical Supported Voltage	
AC 50 CS 11 KV One Minute	No Change

Advantages of C.PVC Pipes

1 Prove performance since 1960.
2 Consistently reliable joints
3 Small tool investment (cut and chamfering tool only)
4 Small tool investment (Substantial labor savings)
5 Elimination of torch use or welding machines
6 Reduces cost of insurance /lost man hours due to fewer job site injuries
7 Easier to work in tight places
8 Quiter than metal, insulates rather than resonates water flow noise
9 Greatly reduces condensation problems
10 Superior insulation reduces heat loss
11 Reduced water hammer
12 Full bore flow
13 Eliminates scale and corrosion problems
14 Reduces job site theft loss
45 Straight, professional appearance
46 No Contamination of water supply due to corrosion by products or additives
17 Third party (NSF) certification for potable water safety
18 Price stability
19 Eliminates Electrolysis
20 **SARHAD PLASTIC** are the poineers in making of **c.PVC pipes** upto 4" Diameter. No other company is manufacturing C.PVC upto this Diameter till now in this country.

Description of According to

ASTM F-441 SCHEDULE - 80



Nominal Size Inches	Wall Thickness mm	@ 73° F-23° C Pressure Ratings (PSI)	@ 2000° F/93° C Pressure Ratings (PSI)
1/2”	3.73	850	210
3/4”	3.91	390	170
1”	4.55	630	155
1 1/4”	4.85	520	130
1 1/2”	5.08	470	115
2”	5.54	400	100
2 1/2”	7.01	420	105
3”	7.62	370	90
4”	8.56	320	80
6”	10.97	280	70
8”	12.70	250	60
10”	15.06	230	55
12”	17.45	230	55

The Standard Length (L) is 6 meters.

CHLORINATED POLYVINYL CHLORIDE (cPVC)

This is thermoplastic piping material which can be used for higher temperature applications. It is a special Polymer with a higher class transition point, Which means advantages over regular uPVC Pipes & Fittings.

Design of Pipe Lines
Physical Factors

In designing of the pressure pipe lines, the tensile strength should be corrected by following formula (to be used fro 5°C to 30°C).

Ft	=	F-6.65 (t-20)
Ft	=	Tensile strength to be corrected in Kg/cm^2
F	=	Tensile strength at 20°C Kg/cm^2
T	=	Correction Temperature °C.

Relationship between Temperature and Tensile Strength is Shown Below:

TABLE

TEMPERATURE		TENSILE STRENGTH	
°C	(°F)	Kg/Cm^2	Lb/In^2
5	(41)	600	(5834)
10	(50)	567	(8064)
15	(59)	533	(7581)
20	(68)	500	(7112)
25	(77)	467	(6642)
30	(86)	434	(6173)

5.2 Relationship between Water Temperature and Short-term Bursting water pressure.

Short-term bursting Water pressure of PRINCE pipe is calculated fro the following formula:-

PB	=	2Ft. (D-t)
PB	=	Short-terms bursting pressure in Kg/cm^2
F	=	Tensile Strength of PRINCE pipe in Kg/cm^2
t	=	Wall Thickness of PRINCE pipe in cm^2
D	=	Outside diameter of PRINCE pipe in cm^2

Short terms bursting pressure of PRINCE pipe of the following diameter Class-D of BS 3505 at varying Water Temperature was calculated from Eq. The results are tabulated on the next page.

Design of Pipe Lines
Physical Factors

Relationship between Water Temperature and short terms Bursting Water Pressure in Kg/cm.

TABLE

Nominal Dia (in)	Temperature	5°C	10°C	15°C	20°C	25°C	30°C
2	D	68.3	64.5	60.7	59.9	53.2	49.4
3	D	69.2	65.4	61.5	57.7	53.9	50.1
4	D	70	66.2	62.2	58.3	54.5	50.6

STRENGTH BURIED PVC PIPE

Buried Pipelines Have Withstand the vertical due to the weight of the soil and the surcharge loads due to traffic.

BEARING CAPACITIES OF SOIL

The bearing capacities of soils depend on the soil texture and are generally.

TABLE

Soil Texture	Bearing Capacity Vertical		Bearing Capacity	
	Ton / m^2	(IB/In^2)	Ton / m^2	(IB/In^2)
Soft Silt & Slurry	1.4-4	(2-5-3)	0.4-1	(0.6-1.4)
Wet Silt	10.20	(14.2-28.4)	2.5	(3.6)
Soft Clay	10.15	(14.2-21.3)	2.6	(3.6)
Hard Clay	20.25	(28.4-35.6)	5-6	(7.1-8.5)
Wet Sand	20	(28.4)	5	(7.1)
Coarse Sand	30	(42.7)	6	(8.5)
Gravel contain Stone	40-50	(56.9-71.3)	7.5	(10.7)
Gravel contain Sand	50-60	(71.1-85.3)	10	(14.2)
Soft Rock	70-100	(99.6-142.2)	10-25	(14.2-35.6)
Hard Rock	200-400	(284.5-586.9)	50 & over	(71.1 & over)

Earthload

The load of backfill acting upon a buried pipe is calculated from the empirical formula of master and Anderson:-

$$PE = Cd, Vb$$

$$CD = \frac{1-e^{-2k\tan Ø \frac{H}{B}}}{2k\tan Ø}$$

$$K = \frac{1-\sin Ø}{1-\sin Ø}$$

where	PE	=	Static earth load, in kg/cm^2 specific weight of back fill, in kg/cm^3 (normal soil = 0.0018 kg/cm^3
	H	=	depth of cover, in cm
	Ø		angle of repose of sil, in deg (Normal soil = 40 deg.)
	B	=	width of trench, in cm

Wheel Load

Kogler formula is used to calculate the wheel load when loads such as those of trucks act upon a buried pipe:-

$$P\,t = \frac{2wt\ \ (1+1)}{(a+2H)\ (c+b+2H)}$$

where	P t	=	wheel load, in kg/cm2
	i		impact coefficient (normally 0.3)
	Wt		load per wheel, in kg
	q		length of wheel in contact with ground, in cm
	b		width of wheel in contact with ground, in cm
	c		distance between wheel of two paralle/ trucks, in cm
	H		depth of cover, in cm

Combined External Load

Combined external load acting upon a buried pipe are expressed by :-

	P	=	PE + Pt
where	P	=	Combined external load, kg.cm^2
	PE	=	Static earth load, kg/cm^2
	Pt	=	Wheel load, kg/cm^2

Relationship between burial depth and combined external loads is given below:-

DEPTH		EARTH LOAD	WHEEL LOAD	COMBINED LOAD
Cm	ft	Kg/cm^2	Kg/cm^2	Kg/cm^2
30	(1)	0.0493	1.226	1.2753
60	(2)	0.0905	0.546	0.6365
90	(3)	0.1248	0.313	0.4378
120	(4)	0.1533	0.204	0.3573
150	(5)	0.1771	0.144	0.3211
180	(6)	0.1969	0.107	0.3039
210	(7)	0.2135	0.083	0.2965
240	(8)	0.2272	0.066	0.2932

ELONGATION & CONTRACTION OF PVC PIPE OPEN PIPING

In case of open piping the elongation and contraction should be studied by the following relation:-

	dL	=	a L. dt
where	dL	=	Length of elongation or contraction, m
	a	=	Coefficient of linear expansion per
			c(PVC) pipe = 7 x 105 /^{o}C
	L	=	Length of Piping in m
	dt	=	Temperature difference in ^{o}C

Measure the maximum and minimum atmospheric temperature and the maximum and minimum water temperature. Then take the highest and the lowest temperatures of the four. The difference between these two should used.

Buried Piping

Each temperature varies throughout the day or the year due to atmospheric temperature and sunlight. The earth temperature at 0.6 to 1.2-m, depth is nearly equivalent to mean monthly temperature and that to around 10m, depth to means annual atmospheric temperature. Therefore, PVC pipes installed under ground are subjected to extremely small temperature fluctuations. The elongation and contraction owing to temperature fluctuation is inhibited by the friction force developed between the pipe and soil and is built up in the pipe as thermal stress. This obviates the need for providing a remedy for elongation and contraction.

The thermal stress is computed by:

$$h = a\,L.\,dt$$

where

h	=	thermal stress in kg / cm^2
a	=	coefficient of linear expansion per degree $^{\circ}$C (PVC Pipe = 7 x 10^5 / $^{\circ}$C)
s	=	Young's Modules in kg / cm^2
dt	=	temperature difference in $^{\circ}$C

WATER HAMMER

Water hammer occurs when a value installed in a pipeline filled with the following water is abruptly, opened or closed. The velocity of wave propagation at such time is given by:

$$C = \sqrt{\frac{K\frac{g}{r}}{1 + \frac{K}{E}\,\frac{d}{t}}}$$

where

C	=	velocity of pressure propagation, in m/sec
K	=	bulk modules of elasticity of liquid, in kg/m^2 (2-07 x 10^8 kg/m^2)
E	=	Young's Modules in kg/m^2 (3-4 x 10^8 kg/m^2 for PVC Pipe)
r	=	specific weight of liquid, in kg/m^2
g	=	acceleration due to gravity (9 m/sec^2)
d	=	inside diameter of pipe, in m
t	=	wall thickness of pipe in m

Water Hammer

Pressure increase by water hammer is given by:

	P	=	C.V / g
	P	=	head of increased pressure, in m
where	C	=	velocity of pressure propagation, in m / sec
	V	=	velocity of flow in pipe before value operation in m / sec
	G	=	acceleration due to gravity, (9.8 m Sec^2)

DESIGN DATA FOR MAINS

FLOW AND FRICTION LOSS IN PIPES

Quantity of flow can be calculated from the following formula if the velocity of flow in the pipe know:

	Q	=	AV
where	Q	=	flow rate in m^3 / sec
	A	=	cross-sectional area of pipe in m^2
	V	=	velocity of flow in pipe in m / sec

William - Hazen Formula, can calculated velocity of flow:

	V	=	$0.35464\ C.D^{0.63}\quad 1^{0.54}$
Which gives			
	Q	=	$0.27853\ CD^{0.63}\quad 1^{0.54}$
	I	=	$10.666\ C\text{-}^{1.85}\quad D4.87\quad Q^{1.85}$
	D	=	$1.6258\ C^{-0.38}\quad Q^{0.38}\quad Q^{0.205}$
	C	=	coefficient of velocity (140 is used for design)
	D	=	inside diameter of pipe in m
	I	=	hydraulic gradient $= \frac{h}{L}$
	L	=	length of piping in m.
	H	=	friction head loss in m.

Thus these equations can be used to calculate either loss of head or pipe diameter. For 2 inch and smaller pipes the following formula suffices:

	Q	=	$CD^{2.72}\ 1^{0.57}$
Which gives	Q	=	flow rate in cm3/sec
	C	=	coefficient of velocity (215 is used for design)
	D	=	inside diameter of pipe in cm
	I	=	hydraulic gradient H/L = h/L
	H	=	head in m
	L	=	length of piping in m
	H	=	friction head loss in m

Pipe Installation

Extremely reliable and satisfactory installations ca be achieved without difficulty using PRINCE u.PVC Pipes. Provided the special properties of this material are fully understood and taken into account. These are the most important factors to consider.

(a) Due allowance must be made for the co-efficient of thermal expansion

(b) Pipe work must be given adequate support, particularly in respect of heavy fitting

(c) In the design of special components, abrupt changes in cross section must be avoided, since the material in notch - sensitive.

PRINCE PIPES are generally laid with the crown about one meter below the surface. Allowance is to be made for the relatively high co-efficient expansion of PVC, particularly when laying on a hot day. Such pipes should be allowed to cool off in the trench before be incorporated at all high points. These values may be screwed into saddles, which can be used for ferrules for service connection. Valves and other heavy fittings should be properly anchored.

Excavation

The trench should not be opened too far in advance of pipe laying and should be backfilled as soon as possible. The width of the trench at the crown of the pipe should be as narrow as practicable, but to less than the outside diameter of the pipe plus 300 mm (12 in.) to allow proper compaction of the side fill. Above the crown of the pipe the trench may be of any convenient width.

The trench should be excavated to the depth below the invert of the pipe will allow necessary bedding. Before placing this bedding, the trench bottom should be prepared. All soft spots should be hardened in by gravel or broken stone. Rock projections should be removed. In fine grained soils such clays, silts or fine sand, disturbance and erosion of the bottom of the trench should be prevented by placing a layer of bedding material 75mm (3 in.) thick on the virgin surface on the bottom before permitting traffic.

Material for Bedding and Sidefill

Clay should never be used immediately around the pipe, for bedding, sidefill or backfill. It is not possible to compact it sufficiently, and it sis liable to swell, shrink and erode.

Some other soils, however, as excavated from the trench (such as free draining coarse sand, gravel, loam and soils of friable nature) may be suitable, but mus be capable of being compacted sufficiently to provide support for the pipe. Fills such as hard chalk, which break up when wet, should not be used.

Should the material excavated from trench be unsuitable, then granular material must be imported. The most suitable is gravel or broken stone from 10 mm to 5 mm (3/8 to 3/16) in size, since it requires little tamping, but coarse sand, or sand and gravel from 20 mm (3/4 in) down as it comes from the quarry, is acceptable. An excess of fine particles makes the mixtures more difficult compact when damp.

Bedding and Sidefilling

With flexible pipe it is of great importance that the sidefill should be very firmly compacted between the sides of the pipe and the soil sides of the trench sheeting should be partially withdrawn to allow this to be done. Before backfilling, any leveling pegs or temporary packing should be removed. The thickness of the bedding under the barrel of the pipe should not be less than one-third of the diameter and a minimum of 100mm. (4 in) thick. In very soft or wet conditions or where the bottom of the trench is very irregular, this thickness should be increased as necessary, to give a suitable bed.

The bedding should be throughly compacted in layers not more than 150 mm. (6 in) thick to give a uniform bed, true to gradient, on which the pipe may be laid. Pipes should be laid directly on this bedding. Bricks or other hard material must not be placed under the pipes for temporary support. After the pipes have been laid and tested. further bedding material should be placed around the pipe and thoroughly compacted in 75 mm. (3 in) layers by careful tamping up to the crown of the pipe, eliminating all cavaties under the two lower quadrants of the pipe.

The same material should then be placed over the crown of the pipe for not less than two-third of the diameter, with a minimum height of 100 mm. (4 in) and a maximum of 300 mm. (12 in) and be thoroughly compacted. The process of filling and tamping should proceed equally on either side of the pipe, so as to maintain an equal pressure on both sides.

Backfilling

Normal filling of the trench should then proceed in layers not exceeding 300 mm. (12 in) in thickness, each layer being well rammed. Heavy mechanical rammers should not be used until the fill has reached a depth of 300 mm. (12 in) above the top of the pipe.

Special consideration and selection of backfilling material will be necessary if the risk of surface subsidence is an important consideration: for example, tinder roads.

Use of concrete special cases

Generally, the use of concrete with PVC pipes is wasteful, since it converts a flexible pipeline into a beam of negligible flexural strength, which will fracture under minor ground movement. More than 2 Ft. of cover concrete is normally unnecessary.

Less than 450 mm. (18 in) of cover, elsewhere than under roads, narrow concrete slabs on a cushion of filling material above the pipe should be used as a protection against picks, etc. At shallow depths under roads, etc. special consideration should be given to all the engineering factors involved, such as the class of roads, its construction, and the proximity of other services.

At or above ground level concrete surround should be used to pretect the pipe.

Jointing and Coupling

Cutting

PRINCE PIPE can be cut by using, ordinary Hack Saw for smaller dia pipe and wide saw for larger diameter. Pipe must be cut at right angle either by hand or using Mitre Box against pipe axis.

Cleaning

Before applying jointing solution, care should be taken that pipe ends sockets of fitting should thoroughly be cleaned of sand, oil and dust.

Jointing Solution

Sharhad Plastic Industries (Pvt.) Ltd. also manufacture PRINCE JOINTING SOLUTION for most effective jointing of PRINCE pipe and fittings.

It is advisable to apply the jointing solution thinly and uniformly. Excessive solution will not offer desirable effectivencess. Cans containing jointing solution should be always closed when not in use and should be kept in dark cool places.

Caution

In jointing u.PVC pipe through jointing solution in cool climates (less than 5 °C it takes more time for jointing solution to dry during installation.

Therefore, when installing in cold climates, care should be taken to apply a very thin and uniform coat of jointing Solution.

Jointing and Coupling

PRINCE PIPE is joined by any of the following methods

Jointing Methods	Marks
1. TS. Methods	Pipes upto
2. One Step Sleeve Method	Pipes upto 8”
3. Two Step Zero Guage, Method	Medium and large dia pipe
4. Two Step plus Guage Method	Medium and large pipe
5. Metal fitting Method	All Pipes
6. Branching Process	All Pipes
7. Z.Joint System	From 2" to 18"

jointing of PRINCE pipes is relatively simple, but for a reliable joint it is important that the jointing procedure given below must be followed exactly. As with all pipe Jointing, cleanliness is of prime importance and pipe especially jointing ends should be supported clear of the ground to prevent dirt being smeared on to the surface. After applying jointing Solution, joints should be assembled as quickly as possible and certainly within 1-2 minutes depending on the temperature.

T.S (Taper Sleeved Method)

This method is to join pipe using TS. fitting performed in our factory. The inner sided of socket of all T.S. fitting have a slight taper. Pushing this socket over plain end of pipe after applying PRINCE solution can do jointing simply and correctly.

Procedure

1. Clean the inside of fitting socket and outside of pipe's plain end with acetone or petrol
2. Apply PRINCE solution thinly and uniform on the inside of the socket and outside of the pipe end to the marked length.
3. Push the pipe into the socket of the fitting strongly upto marked end.
4. After insertion wait for 20-30 second without disturbance. This will develop bond to prevent back out to pipe.
5. Wipe away excess solution.

NOTE: IN THIS T.S METHOD, PIPE SHOULD NOT BE GIVEN A HEAVY PULLOAD IN THE AXEL DIRECTION FOR 3 HOUR ATLEAST.

One Step Sleeve Method

Cases where PRINCE PIPE supplied without taper sleeve, joint can be made by sleeve jointing methods. As in this method, pipe is heated to soften with a blowlamp or heater; it is also called the heat application jointing method. Its procedure is as follows:

1. Bevel the outside of the male end and inside of the female end with file at 3 degree.
2. Clean the jointing part with a cloth.
3. Apply PRINCE jointing Solution thinly and uniformaly to the outside of the male end to the outside of the engaged (1.2 D)
4. Heat the outside of the female end uniformly with a blowlamp. (Heating length should be 1.5 D)
5. After the female end has been properly heated and it is softened apply the PRINCE jointing Solution to its side immediately push the male end into it. Care should be taken not to burn the pipe.
6. Correct the alignment and keep holding for few seconds without any disturbance.
7. Wipe away excess solution.
8. Cool it evenly by socked cloth or water spray.

Two step Zero Gauge Method

This is a method to join medium and large diameter pipes. Pipes for the jointing is prefabricated with a Zero gauge socket at one end. Each pair of pipes to be joined is put with tally marks and serial number because the outside of the male end of the pipe and inside of its socket end are of the same size. The following is the procedure for this method:

(a) Bevel the outside of the male end inside of the female end at 3 degrees.
(b) Coat male end with grease.
(c) Heat the female pipe to make it soft and rubber like. (The heating length should be 1.5 times outside diameter of the pipe)
(d) Insert male pipe into female end
(e) Keep two pipes straight and cool the sleeve portion with water.
(f) When cooled completely put a matching mark and number on both pipes (for re-joiting)
(g) Pull out male pipe, thus forming a Zero Socket.

NOTE: THESE ARE THE 1ST STEPS OF THE PROCESS INVOLVED IN THIS METHOD AND ARE USUALLY CARRIED OUT IN A WORKSHOP APART FROM THE SITE BUT IT IS ALSO PERMISSIBLE TO DO THIS JOB ON THE SITE.

One Step Sleeve Method

(h) Remove grease completely from the male and female end by petrol or acetone.

(i) Apply PRINCE jointing Solution thinly and uniformly on the inside of the socket and outside of the male pipe.

(j) Push male end into socket up to the marks and hold them straight for 10-20 seconds.

(k) Wipe away excess solution with dry cloth.

NOTE: TO INCREASE JOINT STRENGTH MORE QUICKLY UNIFORMLY HEAT THE JOINT WITH A BLOW LAMP TO THE DEGREE THAT IT LEAVES A TRACE OF NAIL TIP WHEN PUSHED BY A FINGER TIP AND IT IS REMOVED. AFTER HEATING COOL PIPE. DO NOT BRING THE BLOW LAMP TOO CLOSE TO PIPE, OTHERWISE IT MAY POSSIBLY CAUSE SOLUTION TO BURN AND PIPE TO BE SCRORCHED.

Two step Plus Gauge Method

In this method, the inside diameter of the socket is slightly larger than the outside diameter of the pipe and socket part pushed over the plain end, pipe is heated on the site for a closer fit.

Procedure

(a) Clean the inside of the socket and the outside of the plain end of pipe and apply PRINCE jointing solution thinly and uniformly on them.

(b) Push the pipe into the socket and hold.

(c) Heat with a blow lamp or gas burner. The socket tends to restore to its original diameter using this ability; the socket is adhered closely on the outside diameter of the pipe.

(d) Wipe away the excess solution

(e) Cool the joined portion with water.

Metal Fitting Method

Tapered Core

To join a PRINCE Pipe to a pipe of different taper joint is used. For this purpose a performed tapered core and tapered flange is used.

Procedure

(a) Furnish the PRINCE Pipe with a tapered flange.
(b) Heat the pipe end with a blow lamp.
(c) When the pipes softens apply PRINCE Solution to outside of the tapered core and inside the pipe.
(d) Insert the tapered core into the pipe and check the angle.
(e) Cool the jointed portion with water.
(f) Fasten the flanged together with bolts.

Branching Process

For the branching of a pipe, molded tees are commonly used, which are provided with molded socket, a pipe is insered into it. Joints of various types larger than 75 mm (dia) branching are made by welding.

In this process the PRINCE Pipe is heated by a jet of hot air from special welding torch onto the contact area of the surface being united. Thought this is a common method of welding thermoplastic materials, it requires considerable experience. The welding temperature is about 200^{o}C the filter rod should be of similar composition to the material welded.

Saddles

PRINCE Pipe do not have sufficient wall thickness for ferrules to be screwed directly into them. Metal Saddles made especially for these pipes are available for the purpose, and is easy to fit saddle for making service or branch connections from any point in on exisiting PRINCE Pipe more quickly and easily.

Metal Fitting Method

Procedure

(a) Isolate and depressurize section of main to be tapped.
(b) A hole is drilled in the existing main and rubber ring is placed around the hole.
(c) The two halves of the Saddle are then placed in position and fastened with the bolts.
(d) Tight the valve-socket using Teflon packing in the branch portion of the clamp saddle.
(e) Join pipe with valve-socket.

Repairing Damaged Price Pipe

Some time installed pipes may have the following defects:

(a) A portion of pipe is crushed or cracked
(b) Leakage at a Sleeve portion.
(c) Leakage at a Welded Section.

In case of B and C, pipe repair is easy, as these can be welded on the spot by welding machine

In case of (a) it is recommended to use a socket as explained below:

Repair Socket

One sleeve of socket is longer than the other by two or two and a half times.

(a) The appropriate length of damaged pipe is removed.
(b) Apply jointing Solution over the ends of pipes.
(c) The longer sleeve of the repair socket is pushed over one pipe until the tapered portion or neck prevents further sleeving.
(d) Then the shorter sleeve is pushed over the other pipe to the full length of the sleeve or till the longer sleeve is pulled back and removed half way.

This process is called the "PUSH AND PULL METHOD" After this, finish the joining process by finish-heating.

Coupling with 'Z' Type Rubber Rings (Z.Joint)

Prince Z - Joint

Z-joint is a patented invention of Wavin, Holland. Z-joint is available from 2" to 18" diameter. Z-joint is formed at the end of the pipe and therefore integral with it. It consists of a socket which is designed to give clearance fit on outside diameter of the corresponding pipe spigot end. In the socket is formed a rectangular groove into which is seated a rubber ring. The Z-joint ring is designed as a compression ring incorporating a hydraulic seal. The result of this is that within the limits of its pressure range, the socket, result in a thinning of the pipe wall in those regions and they would not therefore comply with the design requirements at the pipe. To compensate for this an external sleeve of the same material is shrunk onto the pipe before forming of the socket and the groove.

Jointing Method for Prince Z-Joints

Direction

1. Clean the inside of sockets particularly the groove of the socket and Z-joint ring. Insert the ring and check that it properly seated.
2. Lubricate evenly round the spigot (not the joint ring) with Z-joint lubricant.
3. Make sure that the pipes align correctly in both planes. Pus the spigot upto the depth of entry mark.

Cautions

If the pipe does not enter the socket without undue force being used, withdraw the pipe, remove the jointing, and recheck the Ring Seating and pipe Alignment.

Anchor changes of pipe line directions with trust block. Test first few joints and then after every 1000 meters. Before testing the line Must be back filled leaving the joints exposed. Z-joint pipe can be assembled in conditions of cold, wet or extreme heat.

Note

When Z-joint is used on buried services, changes in the length of the main are caused due to soil settlement and to expansion or contraction caused by temperature changes. The Z-jointis designed to permit an ample degree of axial movement to accommodate these changes.

Pressure Testing of pipe line

It is advisable to pressure test the pipe line at each stage of laying to ensure it has been laid and jointed correctly. Thus any fault is immediately evident and can be corrected before the line is commissioned.

a. Back-fill the line, leaving joints and fittings exposed.
b. Fill water, ensure that no air is left in the pipe. (See below)
c. Joints should be left for hours before being tested.
d. Ends should be blanked off using detachable couplings such as flange adapters and these should be supported to contain the thrust against the pressure.
e. To ensure against burst, all air should be purged from the pipe before testing. This can be achieved by filling the line with water from its lowest point and inserting bleeding valves at the highest points. As a secondary precautions, where water pressure is available, a foam pig should be forced through the line. The pig is a cylinder of polyurethane rubber foam 12"-18" long and should have a diameter about 25%, greater than the bore of the pipe.
f. For normal water work practice, test pressure need not exceed twice the safe working pressure of the pipe. The elasticity of PRINCE pipe itself will cause slight expansion under pressure.

A slight initial fall in the pressure reading will not necessarily indicate a fault. Likewise, thermal expansion caused by temperature change may affect the initial pressure reading slightly.

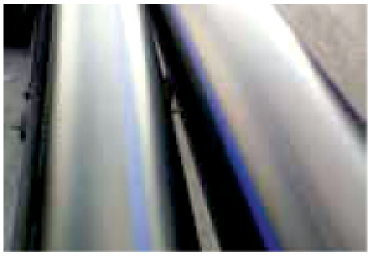
NOTE: Please contact our Technical Department for any assistance.

PRINCE HDPE 100

Plastic pipes

Prince HDPE 100 pipes are produced with a high qulaity and stand out. Our PE 100 pipe and fittings had reached the point 3 inch the petrochemical technology (HDPE Generation 3),HDPE had emerged in 1950, the Environmental Stress value (σ) for this product has given in the first time as 3,2 Mpa and have been developed through the time to reach 6,3-8,0 and 10 Mpa, the value today has become PE 100. The Raw materials of these days have the Environmental Stress value number 12,5 Mpa, but even if you find it the Petrochemical facilities had not started the production with this value yet. This is the meaning of raising the value, The highest the value of the environmental stress the more powerful raw material structure, and that means thinner wall thickness with more resistant pipe and providence of perfect water transmission.

As Prince company we follow the development of the quality laboratories from a very close view and always searching for any new. Our products diameters from 20 mm to 300 mm and produced with the highest quality. Thanks to the polyethylene features, is the pressurized clean water system which is one of the best alternatives, water pressure systems of underground and above ground, Sea Discharge projects, fish-producing farms as they use it to make a production cages. Usually the color of the polyethylene pipes that used above the ground is black. Prince prefer the PE 100 raw materials in production, this high quality raw material and the produced good it are being tested individually and shipped to the customer.



General properties of the polyethylene

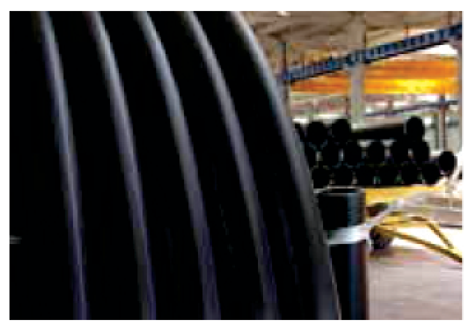
As the technology developed the raw materials of the plastic is developed also. in 1950 the 10w density polyethylene (PE 32-LDPE) is developed to be used in the drinking water systems for the first time, the PE 63 had developed to be used in the 10w pressures systems mostly 4 bar as gas pipes systems, after the PE 63 the PE 80 raw materials is started to be used. in the beging of 1990 PE100 raw materials is started to be used for drinking water systems and gas systems and it provide a high performance and economical solutions.

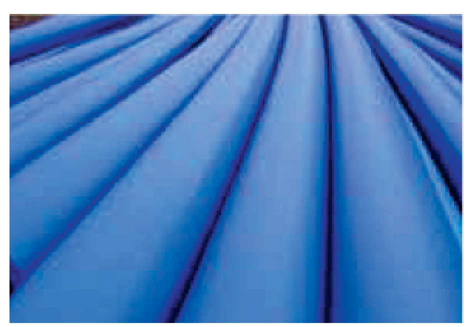
From 1960's HDPE pipes are started to be used in America and Canada for the drinking water systems. from that date it is been used in a serious projects and with no problems mentioned.

1. Generation; PE 32, PE 40 (LDPE), PE 63 (HDPE)

2. Generation; PE 80 (MDPE), PE 80 (HDPE)

3. Generation; PE 100 (HDPE)





Physical properties of HDPE (PE-100 Black)

Physical Properties	Typical Values	Unit	Test Methods
Density (Base resin)	949	Kg/m^3	ISO 1183/ISO 1872-2B
Density (Compound)	959	Kg/m^3	ISO 1183/ISO 1872-2B
Melt Flow Rate (190^{o}C/2.16kg)	<0.1	g/10 min	ISO 1133
Melt Flow Rate (190^{o}C/5.0kg)	0.25	g/10 min	ISO 1133
Tensile Strength at Yield (50 mm/min)	25	mpa	ISO 527-2
Elongation at Break	>600	%	ISO 527-2
Charpy Impact, notched (0 ^{o}C)	16	KJ/m^2	ISO 179/1eA
Hardness, Shore D	60	----	ISO 868
Carbon Black content	>2	%	ASTM D 1603
Brittleness Temperature	>-70	^{o}C	ASTM D 746
ESCR (10% legpal, F50)	>10000	h	ASTM D 1693-A
Thermal Stability (210^{o}C)	>15	Min	EN 728

TECHNICAL SPECIFICATIONS

S.No.	Dia (mm)	Diameter Tolerance (mm)			SDR 11 PN-16 Wall Thickness (mm)			SDR 13.6 PN-12.5 Wall Thickness (mm)			SDR 17 PN-10 Wall Thickness (mm)			SDR 21 PN-8.0 Wall Thickness (mm)			SDR 33 PN-6.0 Wall Thickness (mm)		
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
1	20	20.00	20.3	20.15	1.9	2.3	2.1	1.80	2.20	2.00	-	-	-	-	-	-	-	-	-
2	25	25.00	25.3	25.15	2.3	2.8	2.55	2.00	2.30	2.15	1.80	2.20	2	-	-	-	-	-	-
3	32	32.00	32.3	32.15	2.9	3.4	3.15	2.40	2.80	2.60	2.00	2.30	2.15	-	-	-	-	-	-
4	40	40.00	40.4	40.2	3.7	4.3	4	3.00	3.50	3.25	2.40	2.80	2.6	2.00	2.30	2.15	-	-	-
5	50	50.00	50.50	50.25	4.60	5.40	5.00	3.70	4.20	3.95	3.00	3.40	3.20	2.40	2.80	2.60	2.00	2.30	2.15
6	63	63.00	63.60	63.30	5.80	6.60	6.20	4.70	5.30	5.00	3.80	4.30	4.50	3.00	3.40	3.20	2.50	2.90	2.70
7	75	75.00	75.70	75.35	6.80	7.80	7.30	5.60	6.30	5.95	4.50	5.10	4.80	3.60	4.10	3.85	2.90	3.30	3.10
8	90	90.00	90.90	90.45	8.20	9.30	8.75	6.70	7.50	7.10	5.40	6.10	5.75	4.30	4.90	4.60	3.50	4.00	3.75
9	110	110.00	111.00	110.50	10.00	11.20	10.60	8.10	9.10	8.60	6.60	7.40	7.00	5.30	6.00	5.65	4.20	4.80	4.50
10	125	125.00	126.20	125.60	11.40	12.80	12.10	9.20	10.30	9.75	7.40	8.40	7.90	6.00	6.70	6.35	4.80	5.40	5.10
11	140	140.00	141.30	140.65	12.70	14.20	13.45	10.30	11.50	10.90	8.30	9.30	8.80	6.70	7.50	7.10	5.40	6.10	5.75
12	160	160.00	161.50	160.75	14.60	16.30	15.45	11.80	13.10	12.45	9.50	10.60	10.05	7.70	8.60	8.15	6.20	7.00	6.60
13	180	180.00	181.70	180.85	16.40	18.30	17.35	13.30	14.80	14.05	10.70	11.90	11.30	8.60	9.60	9.10	6.90	7.70	7.30
14	200	200.00	201.80	200.90	18.20	20.30	19.25	14.70	16.30	15.50	11.90	13.20	12.55	9.60	10.70	10.15	7.70	8.60	8.15
15	225	225.00	227.10	226.05	20.50	22.80	21.65	16.60	18.40	17.50	13.40	14.90	14.15	10.80	12.00	11.40	8.60	9.60	9.10
16	250	250.00	252.30	251.15	22.70	25.20	23.95	18.40	20.40	19.40	14.80	16.40	15.60	11.90	13.20	12.55	9.60	10.70	10.15
17	280	280.00	282.60	281.30	25.40	28.20	26.80	20.60	22.80	21.70	16.60	18.40	17.50	13.40	14.90	14.15	10.70	11.90	11.30
18	315	315.00	317.90	316.45	28.60	31.70	30.15	23.20	25.70	24.45	18.70	20.70	19.70	15.00	16.60	15.80	12.10	13.50	12.80
19	355	355.00	358.20	356.60	32.20	35.70	33.95	26.10	28.90	27.50	21.10	23.50	22.30	16.90	18.70	17.80	13.60	15.10	14.35
20	400	400.00	403.60	401.80	36.30	40.20	38.25	29.40	32.50	30.95	23.70	26.20	24.95	19.10	21.20	20.15	15.30	17.00	16.15
21	450	450.00	453.80	451.90	40.90	45.20	43.05	33.10	36.60	34.85	26.70.	29.50	28.10	21.50	23.80	22.65	17.20	19.10	18.15
22	500	500.00	504.00	502.00	45.40	50.20	47.80	36.80	40.60	38.70	29.70	32.80	31.25	23.90	26.40	25.15	19.10	21.20	20.15
23	560	560.00	564.30	562.15	50.80	56.10	53.45	41.20	45.50	43.35	33.20	36.70	34.95	26.70	29.50	28.10	21.40	23.70	22.55
24	630	630.00	634.60	632.30	57.20	63.20	60.20	46.30	51.10	48.70	37.40	41.30	39.35	30.00	33.10	31.55	24.10	26.70	25.40
25	710	710.00	714.90	712.45	79.30	87.40	60.20	52.20	57.60	54.90	42.10	46.50	44.30	33.90	37.40	35.65	27.20	30.10	28.65
26	800	800.00	805.00	802.50	89.30	98.40	60.20	58.80	64.80	61.80	47.40	52.30	49.85	38.10	42.10	40.10	30.60	33.80	32.20
27	900	900.00	908.10	904.05	-	-	-	66.20	73.00	69.60	53.30	58.80	56.05	42.90	47.30	45.10	34.40	38.30	36.35
28	1000	1000.00	1009.00	1004.50	-	-	-	72.50	79.90	76.20	59.30	65.50	62.35	47.70	52.60	50.15	38.20	42.20	40.20
29	1200	1200.00	1210.80	1205.40	-	-	-	88.20	97.20	92.70	67.90	74.80	71.35	57.20	63.10	60.15	45.90	50.60	28.25
30	1400	1400.00	1412.60	1406.30	-	-	-	102.90	113.30	108.10	82.40	90.80	86.60	66.70	73.50	70.10	53.50	59.00	56.25
31	1600	1600.00	1614.40	1607.20	-	-	-	117.60	129.50	123.55	94.10	103.70	98.90	76.20	84.00	80.10	61.20	67.50	64.35

General properties of corrugated pipes

Prince corrugated pipe is produced as self-muffed and slef-sleeved from Ø100 to 500 diameter size in SN4 and SN8 classes according to TS EN 13476-1 and DIN 16961-16566 standards. As it is produced self-muffed in all diameter sizes, it is made of polyethylene, resistant to corrosion, and durable against abrasion and it has excellent resistance against chemicals, so it is an ideal product for long life sewer systems. Corrugated pipes are joint using muffed gaskets or sleeved gaskets. It can be assembled in all kinds of building sites.

It provides impermeability until 0,5 bars of pressure, which means the sewage does not affect the underground water. Easiness in storage and transport is ensured by telescopic stowing. Corrugated pipes are very light and they are resistant against shocks. They do not cause any wastage during transport and storage. No heavy equipment is needed during laying pipes, as they are quite light. Their project speed is more than other pipes thanks to easy-joining methods. As the inner surface of corrugated pipes is produced in light color, it gives the opportunity to control the pipe with a camera when necessary. As corrugated pipes have less hydraulic roughness when compared to other pipes, they can be optimized by choosing a smaller diameter, allowing a lower project cost. Their inner surface is smooth, so the particulate in the system cannot stick to the pipe surface and any possible constrictions are prevented. Corrugated pipes are neither affected by ground motions, nor deformed, as they are flexible. The life of corrugated pipes is minimum 50 years.

advantages of *Corrugated pipes*

They have high resistance against corrosion as they are polyethylene and polypropylene.

Their external influence guaranteed life is minimum 50 years, and they can be used for up to 100 years.

As plastics have hydraulic smoothness, they have less resistance to fluids and the fluid flows with higher fill factor, which means choosing a smaller diameter group, allowing lower project costs.

Casualties during practice are out of questions.

As their density is much lower than cement and cast, the need for heavy construction equipment is minimum.

They do not pollute the ground water or the soil as they have high abrasion resistance and do not get punctured.

Even if the ground is pebbled, it stretches under heavy load and prevents breaking.

It does not let trees to block the channels.

It allows the production of all kinds of fittings and special products for the project.

It does not leak or get dislocated when welled with electrofusion even under 4 bars of pressure.

They do not break because of earthquakes.

They can be used in river, lake and sea transitions.

They can be used for the venting of preliminary treated water taken from treatment facilities to the sea currents.

PRINCE

plastic pipe systems

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MANUFACTURER

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