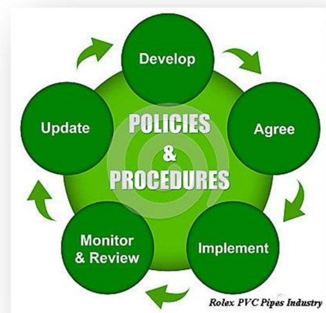
Introduction

Rolex PVC Pipes industry private limited was established in 2005 as manufacturer for unplasticised polyvinyl chloride (uPVC) Pressure and Non Pressure pipe Systems for cold potable water, electrical installations and other industrial and agricultural uses including household with the trade mark of Polyfine PVC Pipes. Since its production it has established a wide range of satisfied customers all over Pakistan.

Policy

The Management of Rolex PVC Pipes Industry is committed to total customer satisfaction by complying with the policies and procedures for quality assurance activities, providing finished products and services to the highest standards of quality , safety, reliability and durability and maintaining the company's competitive advantage and satisfaction of its customers through employees development, involvement, training, effective communication and improving the system on regular basis through checks and balance by the chief executive itself.



Mission

To increase the number of pleased and trusted customers, by involving them in our manufacturing and testing process of the product, and satisfying them from our quality for long term corporate relationship.

Vision

As known for its quality and durability of the product Rolex PVC wants to be the leader in domestic and international market.

Measurements

Rolex PVC Pipes industry has gained achievement in short Spain of time by gaining the certifications from the renounced intuitions nationally and worldwide for its Supreme performance and high quality. Currently Rolex PVC is certified by following institutions for its measurements in manufacturing of PVC Pipes.

ISO 9001-2008
Pakistan Engineering Council
Pakistan standard Institute (PSI)

Manufactures according to the international Standards

Certifications

GOVERNMENT OF PAKISTAN

THE TRADE MARKS REGISTRY, KARACHI

Trade Marks Ordinance 2001

POLYFINE PVC PIPE

Directorate of Labour Khyber Pakhtunkhwa

Registration Certificate

PARTNERSHIP ACT, 1932

OFFICE OF THE REGISTRAR OF FIRMS, NWFP, PESHAWAR

FORM "H"

ACS REGISTRARS

Rolex PVC Pipe Industry

ISO 9001:2008

"Manufacturer of PVC pipes"

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

CERTIFICATE OF INCORPORATION

Pakistan Standards

Pakistan Standards and Quality Control Authority

Licence for the use of the Pakistan Standard Mark

Rolex PVC Pipes

Rolex PVC Pipes uses the best quality resin and compound which results in the best physical properties and is maintained in every production run. A well trained and highly skilled staff is employed to check and maintain a strict quality control at each step of pipe manufacturing process such as material formulation, mixing and extrusion. A well-equipped laboratory is engaged round the clock to control the quality of the product at each stage of pipe production. Rolex PVC Pipes has wide range of products in PVC for different usage as below.

Rolex PVC Pipes are Applicable for

Water supply	*Pressure piping systems*	*Vent & Drain system*
Irrigation	*Potable water supply*	*Industrial piping for chemicals*
Electrical Conduits	*& Sewerage*	

Advantages of Rolex PVC pipes

Rolex PVC pipes has technical advantage over other systems

Strength

- *Rolex PVC pipes are highly resilient, tough and durable with high tensile and impact strength. Besides that they are five times lighter in weight as compared to other systems.*

Non Corrosive & Non toxic

- *Rolex PVC Pipes are designed for domestic water applications. The standard ensures the safety of products coming into contact with water.*
- *With many other slight corrosion may occur which result in the odor and taste of water but with the Rolex PVC Pipes there is no corrosive by products, therefore no contamination of the piped fluid.*

Low friction loss

- *Rolex PVC Pipes has smooth surfaces inside and outside which results in high flow rates of the fluids, since they are resistant to rusting, pitting, scaling and corrosion, the high flow rate can be maintained for the life time of the piping system.*

Fire resistant and low thermal conductivity

- *Rolex PVC Pipes does not support combustion and had very negligible thermal conductivity. Therefore fluids being piped maintain a more constant temperature and no insulation is required.*

Cost effective and maintenance free

- *Rolex PVC Pipes are extremely light weight, convenient to handle, relatively flexible, and easy to install. These features lead to lower installed cost than other piping system.*
- *Once PVC system is properly selected, designed and installed, it is virtually maintenance free. Therefore years of trouble free service can be expected when using Rolex PVC pipe system.*

Standards of Rolex PVC Pressure and Non-Pressure u-PVC Pipes

For Pressure Pipes:

(For Cold Potable pipes**)**

1. BSS 3505 B, C, D & E
2. PS 3051-91
3. Sch: 40, Sch: 80
4. DIN 8061 & 8062

For Sewerage and Vent Pipes:

1. ASTM D 2665 & ASTM D1785

For Electrical Conduit:

1. BSS 6099
2. ANSI/UL651

Range of Rolex PVC Pressure and Non-Pressure U-PVC Pipes

Nominal Diameter: From 2" to 10"

Rolex PVC Pressure and Non Pressure Pipes are available in any length Provided that the order is not less than 200 meters. The Pressure Pipes are supplied in Plain and socketed ends.

Table 1: Pipe Dimension for Class B, C, D & E

Rolex PVC Pressure Pipes for Cold potable Drinking water as per PSI Specification PS 3051/91 Equivalent to BSS 3505

Nominal Size	Outside Diameter		Wall Thickness											
			Class B (6 Bar)			Class C (9 Bar)			Class D (12 Bar)			Class E (15 Bar)		
Inch	Min. mm	Max. mm	Min. mm	Max. mm	kg/M	Min. mm	Max. mm	kg/M	Min. mm	Max. mm	kg/M	Min. mm	Max. mm	kg/M
1/2	21.2	21.5	-	-		-	-		-	-		1.7	2.1	0.15
3/4	26.6	26.9	-	-		-	-		-	-		1.9	2.5	0.22
1	33.3	33.8	-	-		-	-		-	-		2.2	2.7	0.32
1.1/4	42	42.5	-	-		-	-		2.2	2.7	0.41	2.7	3.2	0.50
1.1/2	48	48.5	-	-		-	-		2.5	3	0.54	3.1	3.7	0.65
2	60	60.7	-	-		2.5	3	0.68	3.1	3.7	0.82	3.9	4.9	1.03
3	88.4	89.4	2.9	3.4	1.17	3.5	4.1	1.41	4.6	5.3	1.82	5.7	6.6	2.22
4	113.7	114.9	3.4	4	1.78	4.5	5.2	2.32	6	6.9	3.03	7.3	8.4	3.65
5	139.4	141	3.8	4.4	2.44	5.5	6.4	3.49	7.3	8.4	4.55	9	10.4	5.65
6	167.4	169.1	4.5	5.2	3.46	6.5	7.6	5.01	8.8	10.2	6.57	10.8	12.5	7.95
8	218	220.2	5.3	6.1	5.30	7.5	9	7.72	10.3	11.9	10.04	12.6	14.5	12.17
10	271.6	274.4	6.6	7.6	8.26	9.7	11.2	11.97	12.8	14.8	15.59	15.7	18.1	19.89
12	322.2	325.5	7.8	9	11.6	11.5	13.3	16.85	15.2	17.5	21.91	18.7	21.6	26.68
14	353.7	357.3	8.5	9.8	13.9	12.6	14.5	20.27	16.7	19.2	26.49	-	-	32.16
16	404.3	408.5	9.7	11.2	17.90	14.5	16.7	26.43	-	-	34.15	-	-	46.61

Table 2: SCH 40 & SCH 80 as Per ASTM D 1785 & ASTM D 2665

Typical weight and dimensions of industrial PVC and u-PVC pipes schedule 40 and 80 are indicated in the table below

PVC Pipes - Schedule 40						
Nominal Pipe Size	Outside Diameter		Minimum Wall Thickness		Max. W.P	Weight
(inches)	*(inches)*	*(mm)*	*(inches)*	*(mm)*	*PSI*	*(lb/ft)*
1/2	0.84	21.336	0.109	2.769	600	0.16
3/4	1.05	26.67	0.113	2.87	480	0.21
1	1.315	33.401	0.133	3.378	450	0.32
1 1/4	1.66	42.164	0.14	3.556	370	0.43
1 1/2	1.9	48.26	0.145	3.683	330	0.51
2	2.375	60.325	0.154	3.912	280	0.68
2 1/2	2.875	73.025	0.203	5.156	300	1.07
3	3.5	88.9	0.216	5.486	260	1.41
4	4.5	114.3	0.237	6.02	220	2.01
5	5.563	141.3	0.258	6.553	190	2.73
6	6.625	168.275	0.28	7.112	180	3.53
8	8.625	219.075	0.322	8.179	160	5.39
10	10.75	273.05	0.365	9.271	140	7.55
12	12.75	323.85	0.406	10.312	130	10.01
14	14	355.6	0.438	11.125	130	11.8
16	16	406.4	0.5	12.7	130	15.43

PVC Pipes - Schedule 80						
Nominal Pipe Size	Outside Diameter		Minimum Wall Thickness		Max. W.P	Weight
(inches)	*(inches)*	*(mm)*	*(inches)*	*(mm)*	*PSI*	*(lb/ft)*
1/2	0.84	21.336	0.147	3.734	850	0.2
3/4	1.05	26.67	0.154	3.912	690	0.27
1	1.315	33.401	0.179	4.547	630	0.41
1 1/4	1.66	42.164	0.191	4.851	520	0.52
1 1/2	1.9	48.26	0.2	5.08	470	0.67
2	2.375	60.325	0.218	5.537	400	0.95
2 1/2	2.875	73.025	0.276	7.01	420	1.45
3	3.5	88.9	0.3	7.62	370	1.94

4	4.5	114.3	0.337	8.56	320	2.75
5	5.563	141.3	0.375	9.525	290	3.87
6	6.625	168.275	0.432	10.973	280	5.42
8	8.625	219.075	0.5	12.7	250	8.05
10	10.75	273.05	0.593	15.062	230	12
12	12.75	323.85	0.687	17.45	230	16.5
14	14	355.6	0.75	19.05	220	19.3
16	16	406.4	0.843	21.412	220	25.44

Table 2.1: Conversion Table

1 lb = 0.4536 kg
1 ft (foot) = 0.3048 m
1 in (inch) = 25.4 mm

Sewerage and Drainage Pipes

Rolex Sewerage and drainage pipes can be used for the following purposes

- Sewers and underground building drains for home and industry
- Storm sewers for home and industry
- Disposal fields for septic tank drains and leaching systems
- Subsoil drains for lowland and surface water drainage
- Sewer mains and sewer service

Table 3

PVC Sewer & Drain Pipe Dimensions - ASTM D2729						
Size	**Outside Diameter**		**Minimum Wall Thickness**		**Approx. Weight**	
(inches)	***(inches)***	***(mm)***	***(inches)***	***(mm)***	***Kg/mtr***	***(lbs/ft)***
3	3.25	82.55	0.069	1.7526	0.71134	0.478
4	4.215	107.061	0.073	1.8542	0.98219	0.66
6	6.275	159.385	0.093	2.3622	1.88402	1.266

Rolex Electrical Conduit Pipes

Rolex electrical conduit pipes are the state of the art PVC pipes for electrical installation inside ground and in open atmosphere. Rolex Schedule-40 and Schedule-80 is sunlight resistant. Meets or exceeds the requirements of NEMA TC-2 and UL-651.

Table 4: Rolex PVC Conduit Pipe Dimensions

Rolex Electrical Conduit Pipe Dimensions										
	SCH 40		SCH 40		SCH 80		SCH 40		SCH 80	
Nominal SIZE	**AVG OD (IN)**	**(mm)**	**Thickness(IN)**	**(mm)**	**Thickness(IN)**	**(mm)**	**WEIGHT PER FOOT (LBS)**	**Kg/m**	**WEIGHT PER FOOT (LBS)**	Kg/m
2	2.38	60.33	0.15	3.91	0.22	5.54	0.75	1.12	0.99	1.47
2.1/2	2.88	73.03	0.20	5.16	0.28	7.01	1.19	1.77	1.50	2.24
3	3.50	88.90	0.22	5.49	0.30	7.62	1.61	2.40	2.01	3.00
3.1/2	4.00	101.60	0.23	5.74	0.32	8.08	1.95	2.91	2.46	3.66
4	4.50	114.30	0.24	6.02	0.38	9.58	2.31	3.44	3.02	4.50
5	5.56	141.30	0.26	6.55	0.38	9.53	3.13	4.67	4.33	6.45
6	6.63	168.28	0.28	7.11	0.43	10.97	4.07	6.06	5.95	8.87

Table 5: Rolex PVC Conduit Pipes BSS 6099

Nominal size	BSS 6099 Electrical Conduit Pipes					
	Outer Dimater (mm)		Wall Thickness (mm)		Weight kg/m	
Inch	**min**	**max**	**Min**	**Max**	**min**	**max**
2	60.20	60.50	1.70	1.90	0.45	0.50
3	88.70	89.10	1.80	2.00	0.86	0.70
4	114.10	114.50	1.90	2.10	0.94	0.96

Table 6: *DIN 8061 & 8062 (e=wall thickness of pipe in mm)*

DIN 8061 & 8062										
Nominal Size	Class 1 (2.5 bar) PN 2		Class 2 (4 bar) PN 4		Class 3 (6 bar) PN 6		Class 4 (10 bar) PN 10		Class 5 (16 bar) PN 16	
	e	M/kg	e	M/kg	e	M/kg	e	M/kg	e	M/kg
20	-	-	-	-	-	-	-	-	1.5	0.137
25	-	-	-	-	-	-	1.5	0.174	1.9	0.212
32	-	-	-	-	-	-	1.6	0.264	2.4	0.342
40	-	-	-	-	1.8	0.334	1.9	0.35	3	0.525
50	-	-	-	-	1.8	0.422	2.4	0.552	3.7	0.809
63	-	-	-	-	1.9	0.562	3	0.854	4.7	1.29
75	-	-	1.8	0.642	2.2	0.782	3.6	1.22	5.6	1.82
90	-	-	1.8	0.724	2.7	1.13	4.3	1.75	6.7	2.61
110	1.8	0.95	1.9	1.16	3.2	1.64	5.3	2.61	8.2	3.9
125	1.8	1.08	2.5	1.48	3.7	2.13	6	3.34	9.3	5.01
140	1.8	1.21	2.8	1.84	4.1	2.65	6.7	4.18	10.4	6.27
160	1.8	1.39	3.2	2.41	4.7	3.44	7.7	5.47	11.9	8.17
200	1.8	1.74	4	3.7	5.9	5.37	9.6	8.51	14.9	12.8
225	1.8	1.96	4.5	4.7	6.6	6.76	10.8	10.8	16.7	16.1
250	2	2.4	4.9	5.65	7.3	8.31	11.9	13.2	18.6	19.9
280	2.3	3.11	5.5	7.11	8.2	10.4	13.4	16.6	20.8	24.9
315	2.5	3.78	6.2	9.02	9.2	13.2	15	20.9	23.4	31.5
400	3.2	6.1	7.9	14.5	11.7	21.1	19.1	33.7	29.7	50.8

Fluid Flow Properties

Fluid flow rate

Calculations of volume flow rate for PVC pressure and Non-Pressure Pipes
Q= aV where
a=cross sectional area of flow, ft^2.
V=Flow velocity, ft/sec
Q= Volume flow rate, ft^3/sec
For pipe with velocity given, the volumetric flow rate can be calculated as
Q=aV……… (1)
2" Schedule 40 Pipe with fluid velocity
V=2.9 ft/sec…. (i)
Di= inside diameter of pipe in inches
A= $\pi di^2/4=3.14(2.06712)^2/4=0.0233ft^2$…….. (ii) Putting (i) & (ii) in equation (1)
$Q=0.0233\times2.9=0.0676ft^3/sec$
$Q=0.0676ft^3/sec \times 7.48\ gal/ft^3 \times 60\ sec/min=30\ gals/min$

Pressure Flow in PVC Pipes

The Darcy-Weisbach equation is considered to be the most accurate model for estimating frictional head loss for a steady pipe flow. Since the Darcy-Weisbach equation requires iterative calculation an alternative empirical head loss calculation like the Hazen-Williams equation may be preferred:
$h = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / d_h^{4.8655}$ (2)
Where
h = friction head loss in feet of water per 100 feet of pipe (ft_{h20}/100 ft pipe)
c = Hazen-Williams roughness constant(C=150 for PVC Pipe)
q = volume flow (gal/min)
d_h = inside hydraulic diameter (inches)
If the flow is transient - *2300 < Re < 4000* - the flow varies between laminar and turbulent flow and the friction coefficient is not possible to determine. The friction factor can usually be interpolated between the laminar value at *Re = 2300* and the turbulent value at *Re = 4000.*
Re=Reynolds Number

EARTH LOAD

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

PE = Cd, V B------------------------- (3)
$CD = (1-e^{(-2k \tan \theta).}\ H /B) / 2k \tan \theta$
$K = 1-\sin \theta /1+\sin \theta$
Where,

PE = Static earth load, in Kg/cm^2
V = Specific weight of backfill, in Kg/cm^3 (Normal soil = 0.0018 Kg/cm^3)
H = Depth of cover, in cm
θ = Angle of repose of soil, 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:

Pt = 2w t (1+i)/(a+2H)(c+b+2H)--------------------(4)
Where:
Pt = Wheel load, in Kg/cm2
i = Impact coefficient (normally 0.3)
Wt = Load per wheel, in Kg
a = Length of wheel in contact with ground, in cm
b = Width of wheel in contact with ground, in cm
c = Distance between wheels of two parallel trucks, in cm
H = Depth of cover, in cm

COMBINED EXTERNAL LOAD

Combined external loads 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

Table 7: Relationship between burial depth and combined external loads

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	0.3478
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 PIPES

OPEN PIPING

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

dL = a L. dt--------------------------(5)
Where:
dL = Length of elongation or contraction, m
a = Coefficient of linear expansion per ˚C (PVC) Pipe = 7 x $10^{(-5)}$/ ˚C
L = Length of piping in m
dt = Temperature difference, in ˚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 be used.

BURIED PIPING

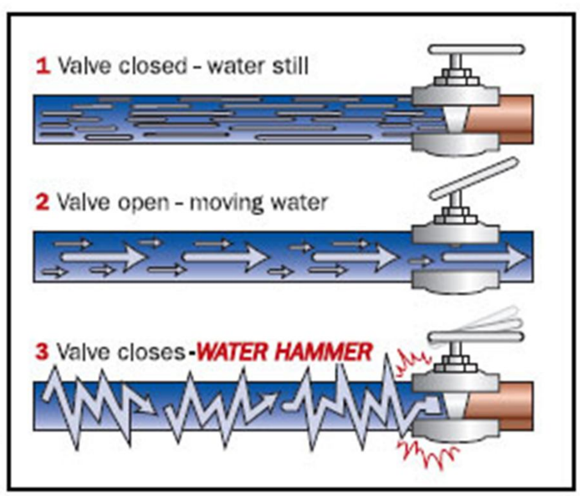
Each temperature varies throughout the day or the year due to atmospheric temperature and sunlight. The earth temperature at 0.6 to 1.2-m. depth is nearly equivalent to mean monthly temperature and that to around 10 m. depth to mean annual atmospheric temperature. Therefore, PVC pipes installed underground are subjected to extremely small temperature fluctuations. The elongation and contraction owing to temperature fluctuations 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.E. dt--------------------------(6)
Where:
h = thermal stress in Kg/cm^2
a = coefficient of linear expansion per degree ˚C.(PVC Pipe = 7x$10^{(-5)}$/ ˚C
e = Young's Modulus in Kg/cm^2
dt = temperature difference in ˚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 = (K.g/ r)/ (1+ K / E.dt) ………………….(7)
Where:
C = velocity of pressure propagation, in m/sec



K = bulk modulus of elasticity of liquid, in Kg/m^2 ($2.07 \times 10^{(8)}$ Kg/m^2)
E = Young's Modulus in Kg/m^2, (3.4 x 10(8) Kg/m^2 for PVC Pipe)
r = specific weight of liquid, in Kg/m^3
g = acceleration due to gravity (9.8 m/sec^2)
d = inside diameter of pipe, in m.
t = wall thickness of pipe, in m.

Pressure increase by water hammer is given by:

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

Laboratory Testing

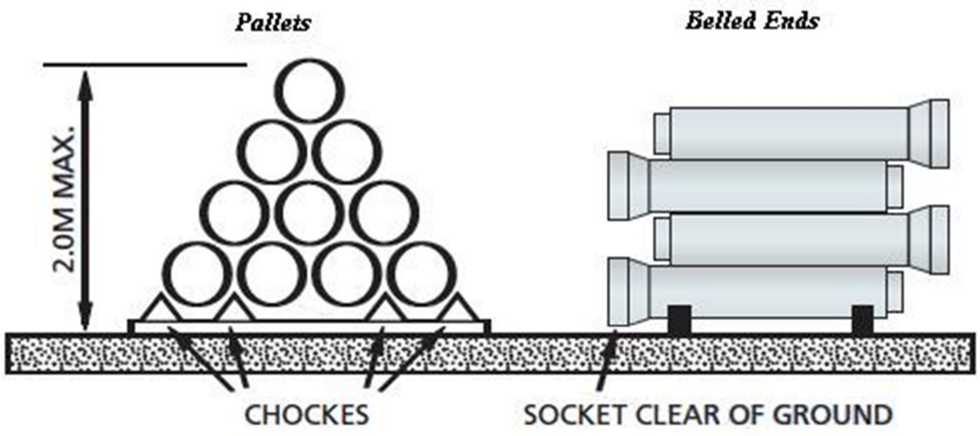
Rolex PVC Pipes industry has the state of the art PLC laboratory in which following tests are being carried out on regular basis by qualified and skilled personnel in order to ensure the quality of pipes round the clock.

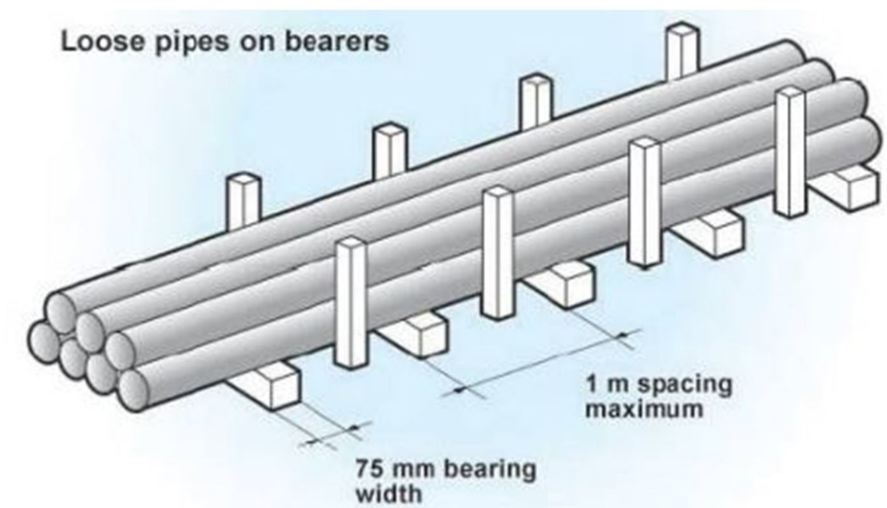
1. Methylene test
2. Heart Reversion test
3. Impact test
4. Fracture toughness test
5. Opacity test
6. Specific gravity test
7. Hydrostatic pressure test

Fig.1: Snap Shots of various Laboratory equipment's

Storage and Transportation

In storage of Rolex PVC Pipes it's taken care of, that each and every stack has its own support which provide adequate support to the every category of pipes i.e. Belled ends, pallets etc. Our storage is also protected from the harsh weathers of thunder lights, rain and sun.





Suggestions

Rolex PVC believes in constant improvement of their services through customer suggestions and replies. Your suggestions are highly appreciated in Rolex administration and proper feedback will be provided.

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