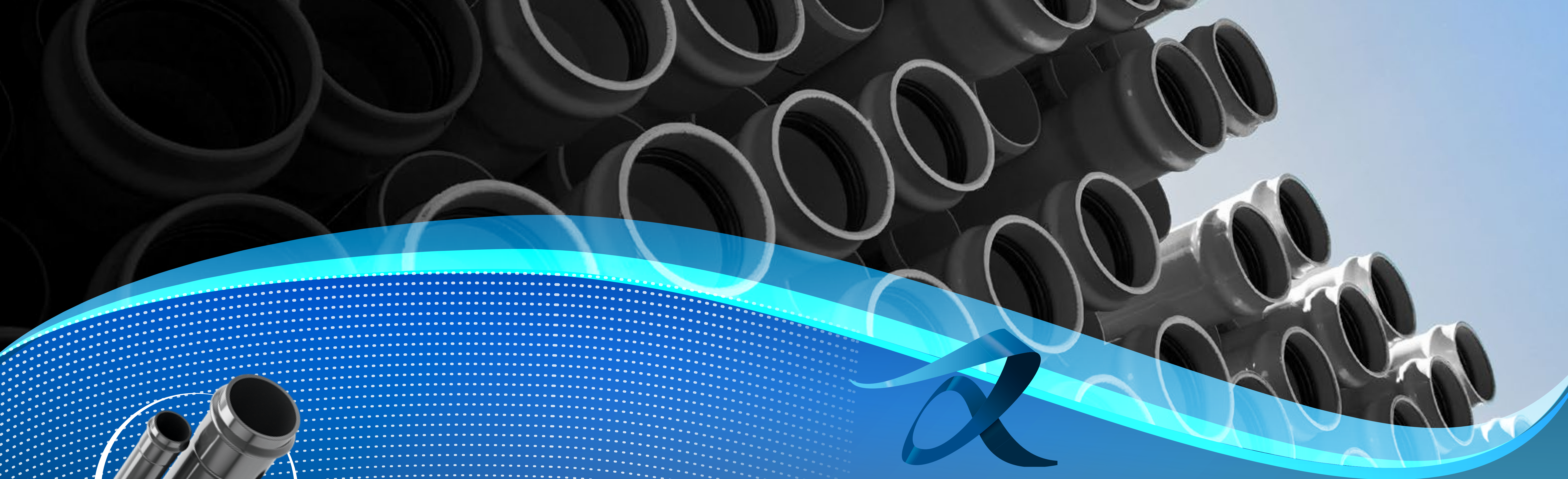

PVC/UPVC
NETWORKS SOLUTIONS

ALROWAD
INDUSTRIAL COMPLEX

Head Quarter

Industrial Zone B1 Plot No. Xa, Xb 10th Of Ramadan City, Egypt.

+2 055 449 9298/4 - +2 055 449 9290
+2 055 449 9290
Info@alrowadpipe.com

Local Sales

010 13333084/5

International Sales

Neighboring No.9 - Model No.17 - flat No. 1 - Building No. 4
10th of Ramdan city - Egypt
+2 055 43 54 137 - +20 101 21 83 97 20
+2 055 43 54 137
export@alrowadpipes.com

www.Alrowadpipes.com

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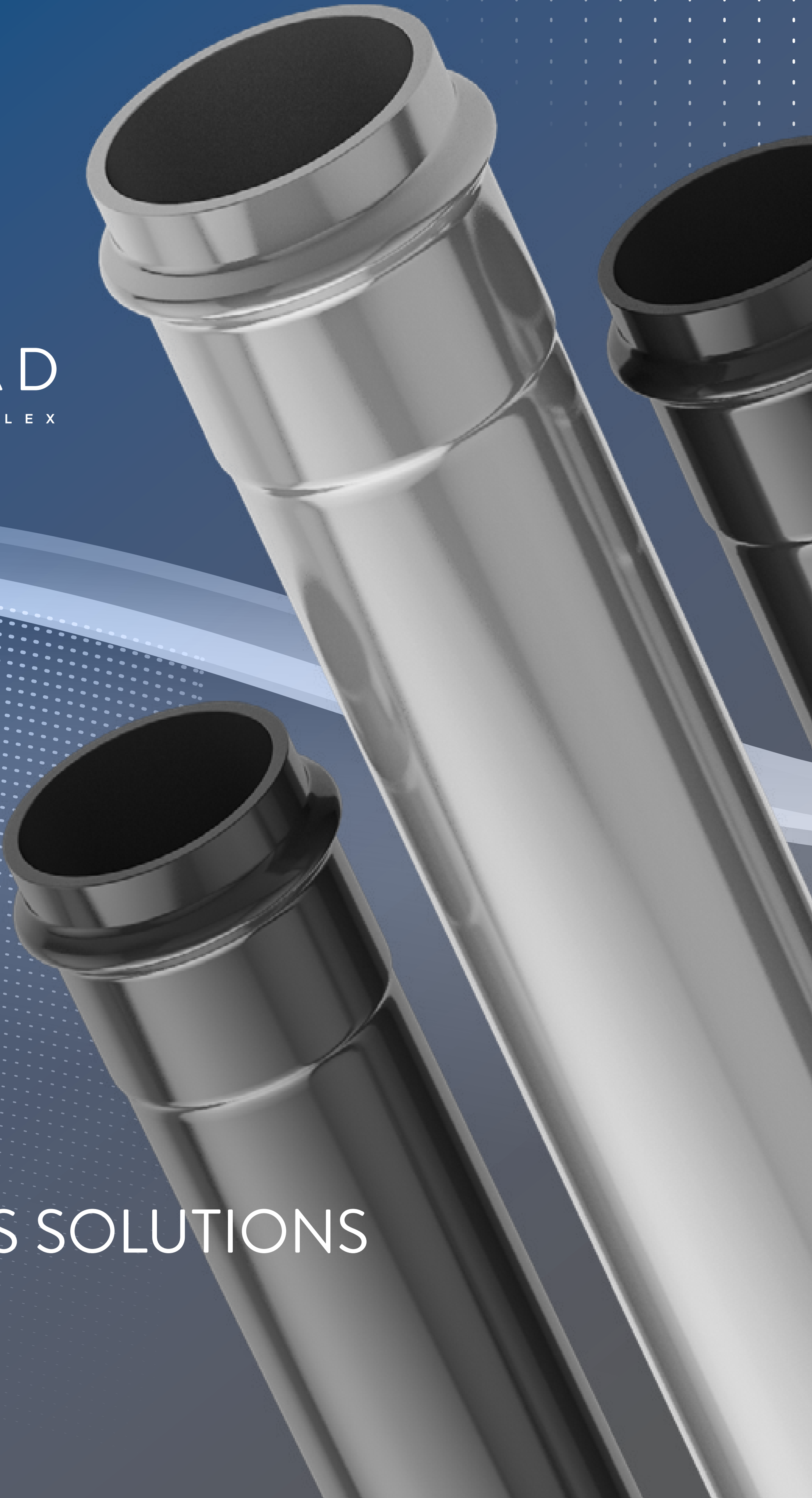

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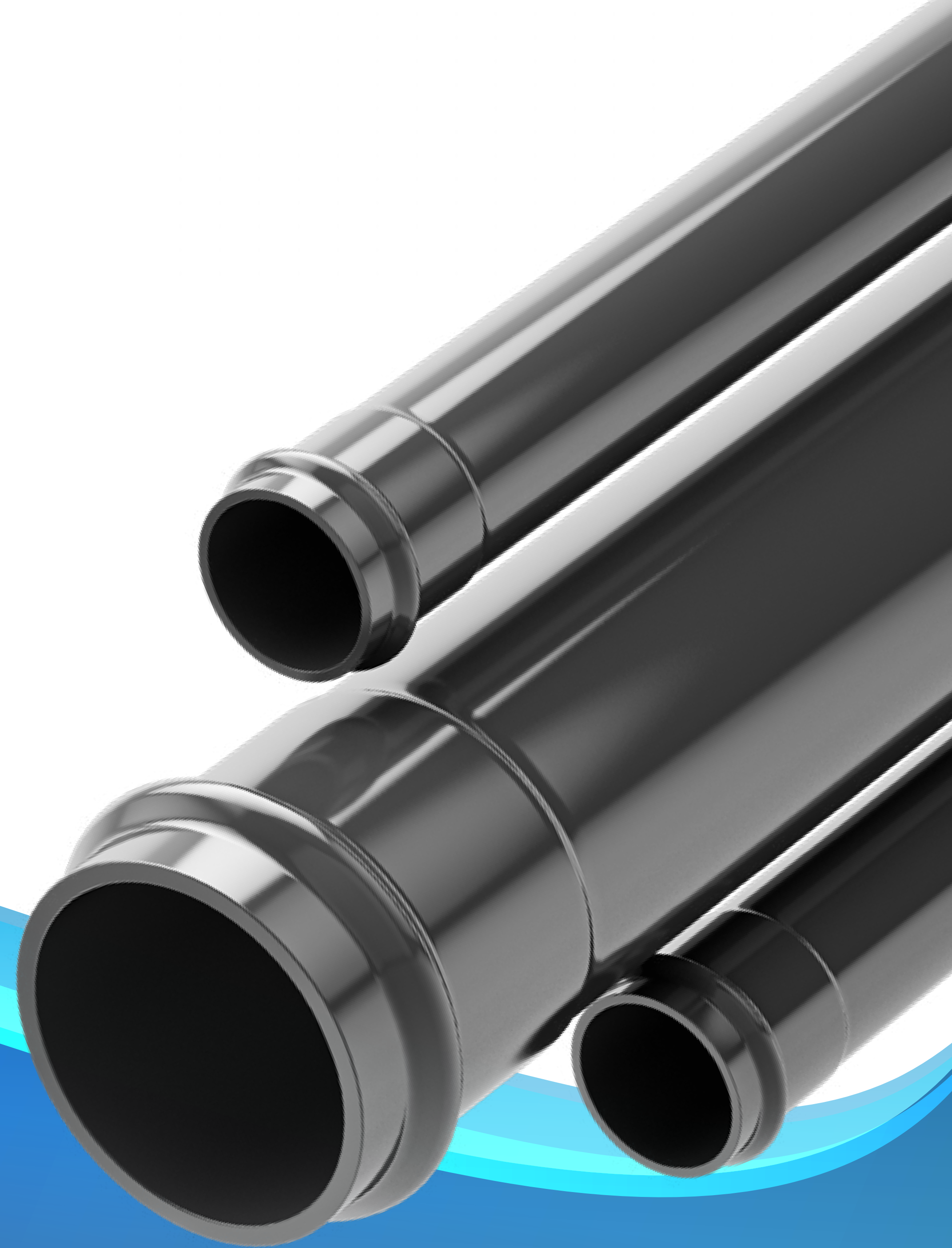
ALROWAD PVC
P I P I N G S Y S T E M S



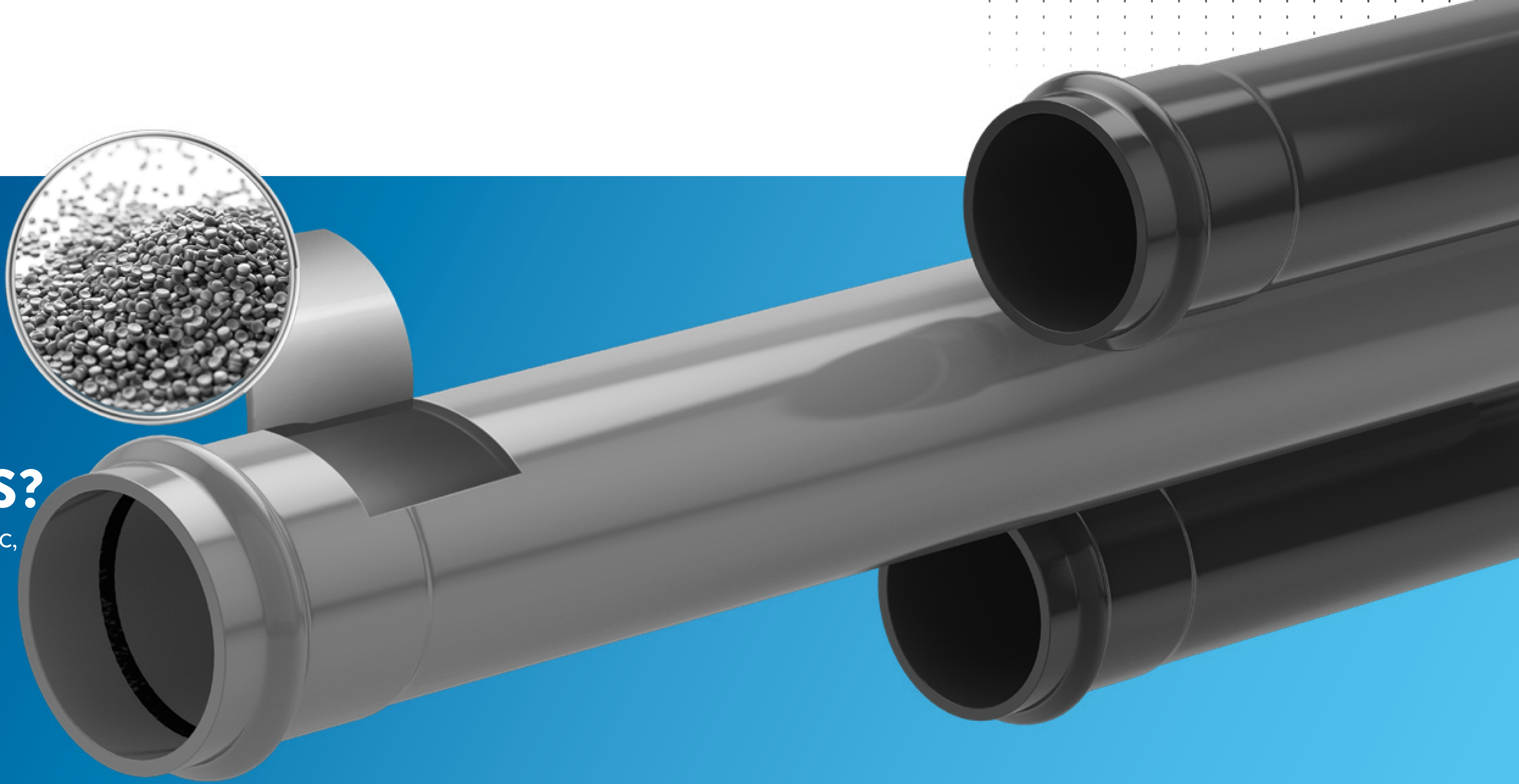
IS A LEADING MANUFACTURER OF PVC, UPVC

with their state of the art manufacturing facility based in the Industrial area of Bani -Suif 150 KM south of Cairo Egypt..

IN ADDITION TO ..

Manufacturing PVC pipe systems, Alrowad PVC Piping Systems also imports and supplies various ranges of fittings, valves, and components for water networks – from the source to The tap.

alrowadpipes.com



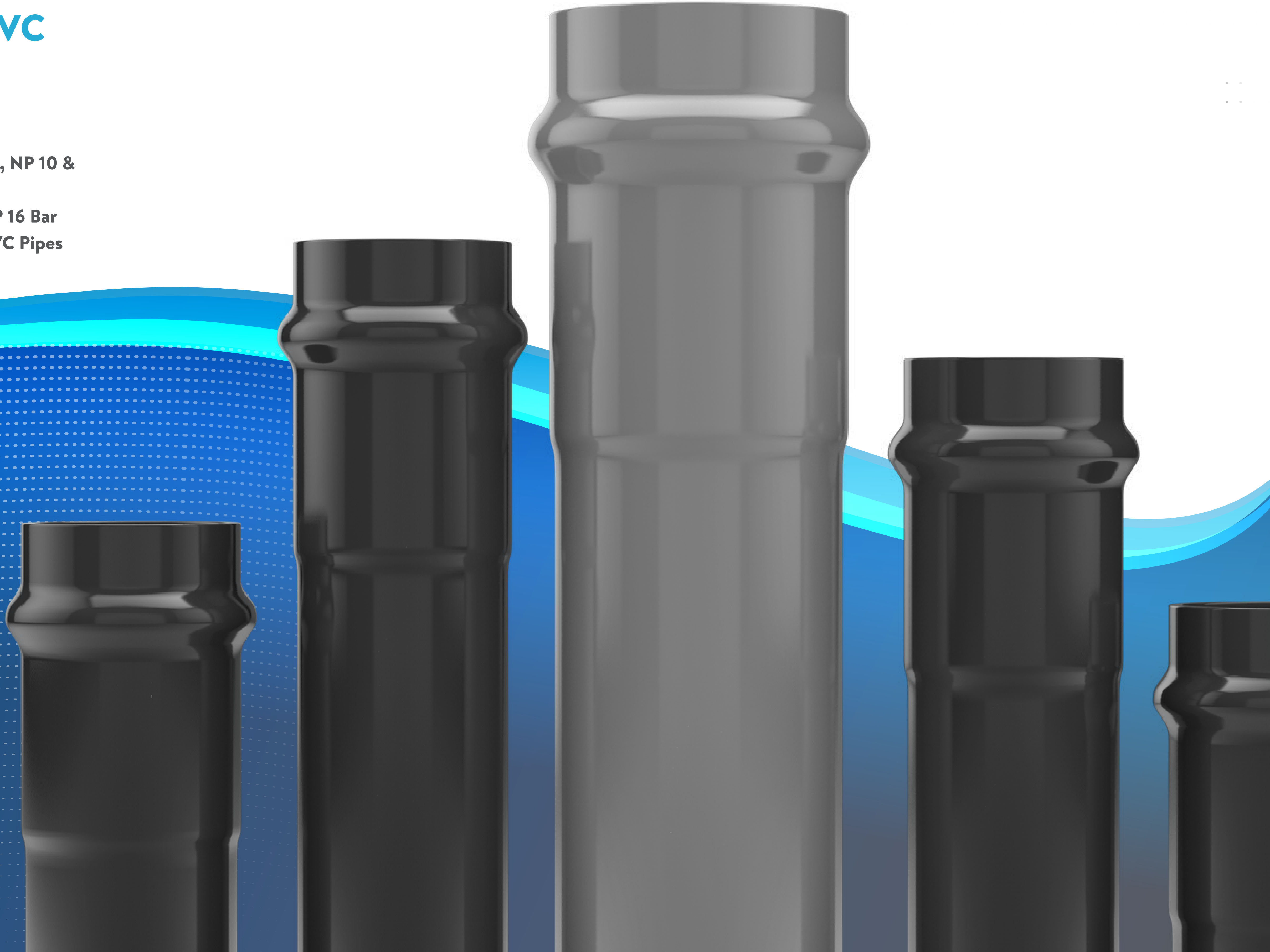
WHY PVC FOR **PRESSURE** APPLICATIONS?

PVC pressure pipe systems, including UPVC, PVC offer advantages when compared to traditional products, namely:

- ENHANCED HYDRAULIC PERFORMANCE.
- DURABILITY AND TOUGHNESS RESISTANCE TO HANDLING AND INSTALLATION DAMAGE.
- CORROSION RESISTANCE GREATER SERVICE LIFE.
- LOWER MASS EASE OF HANDLING AND INSTALLATION.
- PARTICULARLY SUITED TO LABOR INTENSIVE PROJECTS.
- LOCKEDIN SEALING RING SYSTEM NO SPECIALIST INSTALLATION SKILLS REQUIRED.
- LOW INSTALLATION TIME.
- MANUFACTURED WITHIN NATIONALLY/INTERNATIONALLY ACCEPTED STANDARDS.
- SAVINGS ON TRANSPORT COSTS.
- EXCESS OF 50 YEARS OF SERVICE LIFE ON PVC AND UPVC.
- UNIQUE COMBINATION OF PROPERTIES
  - TOUGHNESS
  - STIFFNESS
  - HIGH TENSILE AND HOOP STRENGTH
  - EXCELLENT RESISTANCE TO CREEP
- PREDICTABLE LONGTERM BEHAVIOR
- ENERGY EFFICIENT PVC PIPE PRODUCTION CONSUMES LESS ENERGY DURING MANUFACTURING THAN STEEL, CLAY OR DUCTILE IRON

ALROWAD PVC / UPVC STANDARDS

1. MANUFACTURING STANDARDS
2. STANDARD TABLES
3. Fabricated uPVC Long Radius Bends NP, NP 10 & NP 16 Bars
4. Fabricated Couplers NP6, NP10 and NP 16 Bar
5. Chemical Resistance of ALROWAD uPVC Pipes



ALROWAD UPVC PIPES ARE MANUFACTURED IN ACCORDANCE WITH

- ISO 800/48
- ISO 4422
- ISO 4435
- T.C. 161
- DIN 8061, 8062 ,19532,19534 and 4925
- BS 3505, 4660, 5481.
- ASTM D-1785, for (Sch. 40, 80)
- ASTM D-2241 (SDR)
- ASTM D-2665
- EN Standard PR EN 1401, PR EN 1452-2.
- EG 1717

RANGE OF PRODUCTION

- Pipes from ALROWAD are manufactured according to size range of 16mm up to 800 mm
- Pipes manufactured in accordance with BS & ASTM Standards range from 1/2 inch up to 8 inches in various pressure ratings.
- BS & ASTM PVC pipes are available with plain head and tail or socket joints.
- ALROWAD pipes are produced in 6 meters standard length (other lengths are available on request), standard colors are grey, white and black (other colors are available on request).

MANUFACTURING STANDARDS

SDR 41 S20 PN6 — ISO - 1452 - 2

Outside Diameter			SDR 41 S20 PN6[1]					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
110	110.4	2.2	2.7	3.2	8.529	8.558	8.572	6000
125	125.4	2.5	3.1	3.7	11.164	11.201	11.220	6000
140	140.5	2.8	3.5	4.1	13.978	14.025	14.048	6000
160	160.5	3.2	4.0	4.6	18.078	18.138	18.168	6000
180	180.6	3.6	4.4	5.1	22.480	22.554	22.592	6000
200	200.6	4.0	4.9	5.6	27.606	27.698	27.744	6000
225	225.7	4.5	5.5	6.3	34.904	35.021	35.079	6000
250	250.8	5.0	6.2	7.1	43.698	43.843	43.916	6000
280	280.9	6.8	6.9	7.8	54.113	54.293	54.384	6000
315	316.0	7.6	7.7	8.7	67.931	68.158	68.271	6000
355	356.1	8.6	8.7	9.8	86.355	86.643	86.787	6000
400	401.2	9.6	9.8	11.0	109.399	109.764	109.946	6000
450	451.4	10.8	11.0	12.3	137.890	-	138.580	6000
500	501.5	12.0	12.3	13.8	171.576	-	172.434	6000
630	631.9	15.2	15.4	17.2	270.090	-	271.441	6000
710	712.0	17.1	17.4	19.4	343.553	-	345.271	6000

- Nominal pressure PN6 is based on service (design) coefficient C=2.0

SDR 33 S16 PN6 & PN8 — ISO - 1452 - 2

Outside Diameter			SDR 33 S16					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 6[1]					
40	40.2	1.4	1.5	1.9	1.760	1.766	-	6000
50	50.2	1.4	1.6	2.0	2.344	2.352	-	6000
63	63.3	1.5	2.0	2.4	3.615	3.627	3.633	6000
75	75.3	1.6	2.3	2.8	4.991	5.007	5.016	6000
90	90.3	1.8	2.8	3.3	7.162	7.185	7.197	6000
			PN 8[2]					
110	110.4	2.2	3.4	4.0	10.623	10.658	10.676	6000
125	125.4	2.5	3.9	4.5	13.700	13.746	13.769	6000
140	140.5	2.8	4.3	5.0	16.998	17.055	17.083	6000
160	160.5	3.2	4.9	5.6	21.937	22.010	22.047	6000
180	180.6	3.6	5.5	6.3	27.739	27.832	27.878	6000
200	200.6	4.0	6.2	7.1	34.716	34.832	34.890	6000
225	225.7	4.5	6.9	7.8	43.195	43.339	43.411	6000

Outside Diameter			SDR 33 S16					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
250	250.8	5.0	7.7	8.7	53.540	53.719	53.808	6000
280	280.9	6.8	8.6	9.7	66.921	67.144	67.256	6000
315	316.0	7.6	9.7	10.9	84.745	85.028	85.169	6000
355	356.1	8.6	10.9	12.2	107.111	107.468	107.647	6000
400	401.2	9.6	12.3	13.8	136.343	136.797	137.024	6000
450	451.4	10.8	13.8	15.4	171.645	-	172.504	6000
500	501.5	12.0	15.3	17.1	211.615	-	212.673	6000
630	631.9	15.2	19.3	21.5	335.772	-	337.451	6000
710	712.0	17.1	21.8	24.2	426.589	-	428.722	6000

- For nominal sizes up to 90mm, nominal pressure PN8 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN10 is based on service (design) coefficient C=2.0

SDR 26 S12.5 PN8 & PN10 — ISO - 1452 - 2

Outside Diameter			SDR 26 S 12.5					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 8 [1]					
32	32.2	0.5	1.5	1.9	1.393	1.398	-	6000
40	40.2	0.5	1.6	2.0	1.859	1.865	-	6000
50	50.2	0.6	2.0	2.4	2.841	2.850	-	6000
63	63.3	0.8	2.5	3.0	4.478	4.493	4.500	6000
75	75.3	0.9	2.9	3.4	6.114	6.135	6.145	6000
90	90.3	1.1	3.5	4.1	8.846	8.875	8.890	6000
			PN 10 [2]					
110	110.4	1.4	4.2	4.9	12.959	13.002	13.024	6000
125	125.4	1.5	4.8	5.5	16.667	16.723	16.751	6000
140	140.5	1.7	5.4	6.2	21.022	21.092	21.128	6000
160	160.5	2.0	6.2	7.1	27.536	27.628	27.674	6000
180	180.6	2.2	6.9	7.8	34.269	34.383	34.440	6000
200	200.6	2.4	7.7	8.7	42.465	42.607	42.678	6000
225	225.7	2.7	8.6	9.7	53.330	53.508	53.596	6000
250	250.8	3.0	9.6	10.8	66.049	66.269	66.379	6000
280	280.9	3.4	10.7	12.0	82.339	82.613	82.750	6000
315	316.0	3.8	12.1	13.6	104.842	105.192	105.367	6000
355	356.1	4.3	13.6	15.2	132.435	132.876	133.097	6000
400	401.2	4.8	15.3	17.1	167.877	168.437	168.717	6000
450	451.4	5.4	17.2	19.2	212.203	-	213.264	6000
500	501.5	6.0	19.1	21.3	261.688	-	262.996	6000
630	631.9	7.6	24.1	26.8	415.428	-	417.505	6000
710	712.0	8.6	27.2	30.2	527.899	-	530.538	6000

- For nominal sizes up to 90mm, nominal pressure PN8 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN10 is based on service (design) coefficient C=2.0

SDR 21 S10 PN10 & PN12.5 — ISO - 1452 - 2

Outside Diameter			SDR 21 S 10					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 10 [1]					
32	32.3	0.5	1.6	2.0	1.470	1.475	-	6000
40	40.2	0.5	1.9	2.3	2.151	2.158	-	6000
50	50.2	0.6	2.4	2.9	3.390	3.401	-	6000
63	63.3	0.8	3.0	3.5	5.248	5.266	5.574	6000
75	75.3	0.9	3.6	4.2	7.491	7.516	7.529	6000
90	90.3	1.1	4.3	5.0	10.718	10.754	10.772	6000
			PN 12.5 [2]					
110	110.4	1.4	5.3	6.1	16.058	16.111	16.138	6000
125	125.4	1.5	6.0	6.8	20.497	20.565	20.599	6000
140	140.5	1.7	6.7	7.6	25.655	25.741	25.784	6000
160	160.5	2.0	7.7	8.7	33.612	33.724	33.780	6000
180	180.6	2.2	8.6	9.7	42.217	42.358	42.428	6000
200	200.6	2.4	9.6	10.8	52.273	52.447	52.534	6000
225	225.7	2.7	10.8	12.1	66.025	66.245	66.355	6000
250	250.8	3.0	11.9	13.3	80.775	81.044	81.179	6000
280	280.9	3.4	13.4	15.0	101.923	102.263	102.432	6000
315	316.0	3.8	15.0	16.7	128.037	128.464	128.678	6000
355	356.1	4.3	16.9	18.8	162.504	163.045	163.316	6000
400	401.2	4.8	19.1	21.3	207.150	207.841	208.186	6000
450	451.4	5.4	21.5	23.9	261.917	-	263.226	6000
500	501.5	6.0	23.9	26.5	323.065	-	324.681	6000
630	631.9	7.6	30.0	33.2	510.577	-	513.130	6000

- For nominal sizes up to 90mm, nominal pressure PN10 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN12.5 is based on service (design) coefficient C=2.0

SDR 17 S8 PN12.5 & PN16 — ISO - 1452 - 2

Outside Diameter			SDR 17 S8					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 12.5 [1]					
25	25.2	0.5	1.5	1.9	1.072	1.076	-	6000
32	32.2	0.5	1.9	2.3	1.698	1.704	-	6000
40	40.2	0.5	2.4	2.9	2.675	2.684	-	6000
50	50.2	0.6	3.0	3.5	4.105	4.118	-	6000
63	63.3	0.8	3.8	4.4	6.527	6.549	6.559	6000
75	75.3	0.9	4.5	5.2	9.192	9.222	9.238	6000
90	90.3	1.1	5.4	6.2	13.189	13.233	13.255	6000

Outside Diameter			SDR 17 S8					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 16 [2]					
110	110.4	1.4	6.6	7.5	19.604	19.670	19.702	6000
125	125.4	1.5	7.4	8.4	24.982	25.065	25.106	6000
140	140.5	1.7	8.3	9.4	31.350	31.454	31.506	6000
160	160.5	2.0	9.5	10.7	40.883	41.019	41.087	6000
180	180.6	2.2	10.7	12.0	51.695	51.867	51.953	6000
200	200.6	2.4	11.9	13.3	63.757	63.970	64.076	6000
225	225.7	2.7	13.4	15.0	80.830	81.099	81.234	6000
250	250.8	3.0	14.8	16.5	99.041	99.371	99.536	6000
280	280.9	3.4	16.6	18.5	124.383	124.798	125.005	6000
315	316.0	3.8	18.7	20.8	157.465	157.990	158.253	6000
355	356.1	4.3	21.1	23.5	200.340	201.008	201.342	6000
400	401.2	4.8	23.7	26.3	253.139	253.983	254.405	6000
450	451.4	5.4	26.7	29.6	320.664	-	322.267	6000
500	501.5	6.0	29.7	32.9	396.120	-	398.101	6000

- For nominal sizes up to 90mm, nominal pressure PN12.5 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN12.5 is based on service (design) coefficient C=2.0

SDR 13.6 S6.3 PN16 & PN20 ISO - 1452 - 2

Outside Diameter			SDR 17 S8					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 16 [1]					
20	20.2	0.5	1.5	1.9	0.843	0.846	-	6000
25	25.2	0.5	1.9	2.3	1.302	1.306	-	6000
32	32.2	0.5	2.4	2.9	2.104	2.111	-	6000
40	40.2	0.5	3.0	3.5	3.229	3.239	-	6000
50	50.2	0.6	3.7	4.3	4.971	4.988	-	6000
63	63.3	0.8	4.7	5.4	7.910	7.936	7.949	6000
75	75.3	0.9	5.6	6.4	11.185	11.222	11.241	6000
90	90.3	1.1	6.7	7.6	15.998	16.052	16.078	6000
			PN 20 [2]					
110	110.4	1.4	8.1	9.2	23.680	23.759	23.799	6000
125	125.4	1.5	9.2	10.4	30.488	30.589	30.640	6000
140	140.5	1.7	10.3	11.6	38.169	38.296	38.359	6000
160	160.5	2.0	11.8	13.2	49.789	49.955	50.038	6000
180	180.6	2.2	13.3	14.9	63.175	63.385	63.491	6000
200	200.6	2.4	14.7	16.4	77.448	77.706	77.835	6000
225	225.7	2.7	16.6	18.5	98.314	98.642	98.806	6000

Outside Diameter			SDR 17 S8					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
225	225.7	2.7	16.6	18.5	98.314	98.642	98.806	6000
250	250.8	3.0	18.4	20.5	121.096	121.500	121.702	6000
280	280.9	3.4	20.6	22.9	151.687	152.193	152.446	6000
315	316.0	3.8	23.2	25.8	192.200	192.840	193.161	6000
355	356.1	4.3	26.1	29.0	243.607	244.419	244.825	6000
400	401.2	4.8	29.4	32.6	308.878	309.908	310.422	6000
450	451.4	5.4	33.1	36.7	391.204	-	393.160	6000
500	501.5	6.0	36.8	40.7	482.622	-	485.035	6000

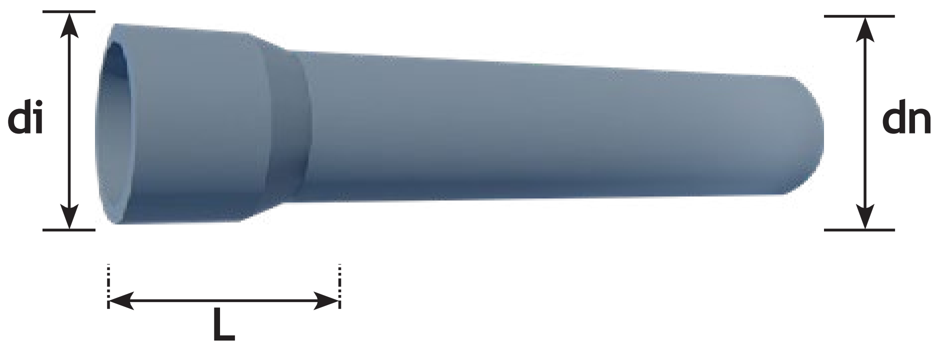
- For nominal sizes up to 90 mm, nominal pressure PN16 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN20 is based on service (design) coefficient C=2.0

SDR 11 S5 PN20 & PN25 ISO - 1452 - 2

Outside Diameter			SDR 11 S5					
Outside Diameter		Ovality	Wall Thickness		Weight Per Pipe			Std. Length
Min.	Max.	Max.	Min.	Max.	PE	SJ	RJ	
mm	mm	mm	mm	mm	kg	kg	kg	mm
			PN 20 [1]					
20	20.2	0.5	1.9	2.3	1.019	1.022	-	6000
25	25.2	0.5	2.3	2.8	1.550	1.555	-	6000
32	32.2	0.5	2.9	3.4	2.458	2.467	-	6000
40	40.2	0.5	3.7	4.3	3.893	3.906	-	6000
50	50.2	0.6	4.6	5.3	6.025	6.045	-	6000
63	63.3	0.8	5.8	6.6	9.519	9.550	9.566	6000
75	75.3	0.9	6.8	7.7	13.271	13.315	13.337	6000
90	90.3	1.1	8.2	9.3	19.201	19.265	19.297	6000
			PN 25 [2]					
110	110.4	1.4	10.0	11.2	28.462	28.556	28.604	6000
125	125.4	1.5	11.4	12.8	36.893	37.016	37.077	6000
140	140.5	1.7	12.7	14.2	45.976	46.130	46.206	6000
160	160.5	2	14.6	16.3	60.310	60.511	60.612	6000
180	180.6	2.2	16.4	18.3	76.216	76.470	76.597	6000
200	200.6	2.4	18.2	20.3	93.956	94.269	94.425	6000

- For nominal sizes up to 90 mm, nominal pressure PN20 is based on service (design) coefficient C=2.5
- For nominal sizes 110 mm and above, nominal pressure PN25 is based on service (design) coefficient C=2.0

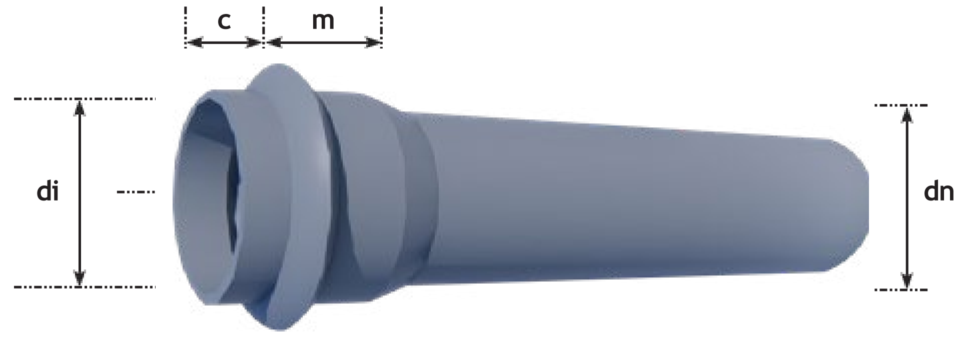
DIMENSIONAL SPECIFICATION FOR SJ SOCKETS



Nominal Inside Diameter of Socket (dn)	Mean Inside Diameter of Socket, di		Socket Ovality	Socket Length, L
dn	Minimum	Maximum	Maximum	Minimum
20	20.1	20.3	0.25	16.0
25	25.1	25.3	0.25	18.5
32	32.1	32.3	0.25	22.0
40	40.1	40.3	0.25	26.0
50	50.1	50.3	0.3	31.0
63	63.1	63.3	0.4	37.5
75	75.1	75.3	0.5	43.5
90	90.1	90.3	0.6	51.0
110	110.1	110.4	0.7	61.0
125	125.1	125.4	0.8	68.5
140	140.2	140.5	0.9	76.0
160	160.2	160.5	1.0	86.0
180	180.2	180.6	1.1	96.0
200	200.2	200.6	1.2	106.0
225	225.3	225.7	1.4	118.5
250	250.3	250.8	1.5	131.0
280	280.3	280.9	1.7	146.0
315	315.4	316	1.9	163.5
355	355.4	356.1	2.0	183.5
400	400.4	401.2	2.0	206.0

- For nominal inside diameter, dn, of a socket shall be equal to the nominal outside diameter of the pipe.
- The mean inside diameter, di, shall be measured at the midpoint of the socket length.

DIMENSIONAL SPECIFICATION FOR RJ SOCKETS

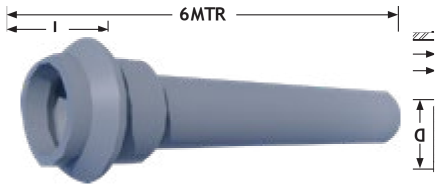


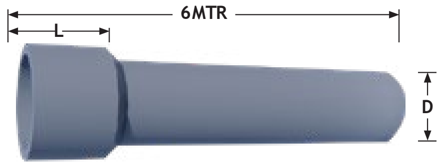
Nominal Inside Diameter of Socket (dn)	Minimum Mean Inside Diameter of Socket	Maximum Ovality		Minimum Depth of Engagement	Length of Socket Entrance & Sealing Area
dn	di	S 20 To S 16	S 12.5 To S 5	m	c
63	63.4	1.2	0.6	58	32
75	75.4	1.2	0.7	60	34
90	90.4	1.4	0.9	61	36
110	110.5	1.7	1.1	64	40
125	125.5	1.9	1.2	66	42
140	140.6	2.1	1.3	68	44
160	160.6	2.4	1.5	71	48
180	180.7	2.7	1.7	73	51
200	200.7	3.0	1.8	75	54
225	225.8	3.4	2.1	78	58
250	250.9	3.8	2.3	81	62
280	281.0	5.1	2.6	85	67
315	316.1	5.7	2.9	88	72
355	356.2	6.5	3.3	90	79
400	401.3	7.2	3.6	92	86
450	451.5	8.1	4.1	95	94
500	501.6	9.0	4.5	97	102
630	632.0	11.4	5.7	105	123
710	712.3	12.9	6.5	109	136

- The wall thickness of the sockets at any point, except the sealing ring groove, shall not be less than the minimum wall thickness of the pipe.
- The wall thickness of the sealing ring groove shall not be less than 0.8 times the minimum wall thickness of the pipe.

STANDARD TABLES

ALROWAD UPVC PIPES ACCORDING TO SSA 14 & 15/1998, ISO 161/1 AND DIN 8061/62 STANDARD, NOMINAL OUTSIDE DIAMETERS & NOMINAL WALL THICKNESS





Nominal Outside Diameter (mm)	Socket Depth for R/J mm (t)	Socket Depth for S/J mm(t)	CLASS I 2 Bar		CLASS II 4 Bar		CLASS III 6 Bar		CLASS IV 10 Bar		CLASS V 16 Bar	
			Nom. wt kg/m	Nom. thick. of the wall mm	Nom. wt kg/m	Nom. thick. of the wall mm	Nom. wt kg/m	Nom. thick. of the wall mm	Nom. wt kg/m	Nom. thick. of the wall mm	Nom. wt kg/m	Nom. thick. of the wall mm
16											0.090	1.2
20		20									0.137	1.5
25		25							0.174	1.5	0.212	1.9
32		32							0.264	1.8	0.342	2.4
40		40					0.334	1.8	0.350	1.9	0.525	3.0
50		50					0.422	1.8	0.552	2.4	0.809	3.7
63	117	63					0.562	1.9	0.854	3.0	1.289	4.7
75	119	70			0.642	1.8	0.782	2.2	1.220	3.6	1.820	5.6
90	124	79			0.774	1.8	1.130	2.7	1.750	4.3	2.610	6.7
110	129	91	0.950	1.8	1.160	2.2	1.640	3.2	2.610	5.3	3.900	8.2
125	132	100	1.080	1.8	1.480	2.5	2.130	3.7	3.340	6.0	5.010	9.3
140	135	109	1.210	1.8	1.840	2.8	2.650	4.1	4.100	6.7	6.270	10.4
160	142	121	1.390	1.8	2.410	3.2	3.440	4.7	5.470	7.7	8.170	11.9
200	150	145	1.740	1.8	3.700	4.0	5.370	5.9	8.510	9.6	12.800	14.9
225	162	160	1.960	1.8	4.700	4.5	6.760	6.6	10.800	10.8	16.100	16.7
250	162	175	2.400	2.0	5.650	4.9	8.310	7.3	13.200	11.9	19.900	18.6
280	170	193	3.110	2.3	7.110	5.5	10.400	8.2	16.600	13.4	24.900	20.8
315	180	214	3.780	2.5	9.020	6.2	13.100	9.2	20.900	15.0	31.500	23.4
355	189		4.870	2.9	11.400	7.0	16.700	10.4	26.500	16.9	39.900	26.3
400	200		6.100	3.2	14.500	7.9	21.100	11.7	33.700	19.1	50.800	29.7
450	213		7.650	3.6	18.300	8.9	26.800	13.2	42.700	21.5	-	-
500	253		9.370	4.0	22.400	9.8	32.900	14.6	52.600	23.9	-	-
630	315		14.700	5.0	35.700	12.4	52.200	18.4	83.200	30.0	-	-
710	450		18.900	5.7	45.300	14.0	66.100	20.7	-	-	-	-
800	-	-	23.9	6.4	57.2	15.7	83.9	23.3	-	-	-	-

- Note: SSA 14 is a withdrawn standard replaced by SASO-ISO 1452 -2 and produced on request only for an indefinite period of time.

ALROWAD UPVC PIPES ACCORDING TO DIN 19534

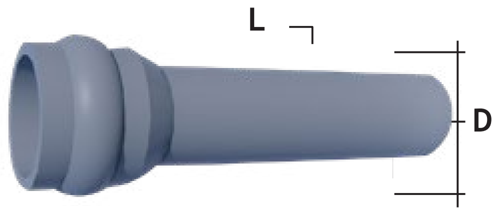
Nominal Diameter (mm)	Outside Diameter (mm)	Wall Thickness (mm) (S)
100	110	3.00
125	125	3.00
150	160	3.60
200	200	4.50
250	250	6.10
300	315	7.70
400	400	9.80
500	500	*12.20
600	630	15.40

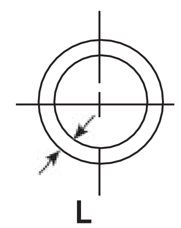
- For a Transitory period for this existing wall thickness S1=13.4 mm may still be used. Special reference must be made to this when ordering.

ALROWAD UPVC PIPES ACCORDING TO BRITISH STANDARD BS 3505 / 3506

Nominal Size (mm)	Outer Dia. (mm)	CLASS C 9 Bar		CLASS D 12 Bar		CLASS E 15 Bar	
		Thickness mm	Nominal Weight kg/m	Thickness mm	Nominal Weight kg/m	Thickness mm	Nominal Weight kg/m
1/2”	21.2 - 21.5					1.7	0.158
3/4”	26.6 - 26.9					1.9	0.225
1”	33.4 - 33.7					2.2	0.350
1/4”	42.1 - 42.4			2.2	0.434	2.7	0.508
1/2”	48.1 - 48.4			2.5	0.534	3.1	0.667
2”	60.2 - 60.5	2.5	0.683	3.1	0.850	3.9	1.042
3”	88.7 - 89.1	3.5	1.417	4.6	1.834	5.7	2.250
4”	114.1 - 114.5	4.5	2.350	6.0	3.050	7.3	3.700
6”	168.0 - 168.5	6.6	5.084	8.8	6.720	10.8	8.134
8”	218.8 - 219.4	7.8	7.086	10.3	10.170	12.6	12.280

ALROWAD UPVC PIPES FOR NON PRESSURE, SOIL WASTE & VENT APPLICATIONS:





ALROWAD PIPES FOR TELEPHONE DUCT ACCORDING TO ARENTO SPECIFICATION T.C 161 A

Nominal size mm	Outside diameter		Wall thickness		socket depth MM
	(S)	Tolerance	(S)	Tolerance	
50	50	0.2	1.8	0.4	80
110	110	0.3	3.2	0.6	170

- length of pipe 6 meter not incl . The socket
- Eash pipe has one rubber ring to connection

ALROWAD PIPES FOR WATER SUPPLY AND IRRIGATION ACCORDING TO EGYPTIAN STANDARD ES : 2008/1-484 - ISO 1996/-4422

Nominal outside diameter DN	6 bar S 16.7 SDR 34.4 PN 6		8 bar S 12.5 SDR 26 PN 8		10 bar S 10 SDR 21 PN 10		12.5 bar S 8 SDR 17 PN 12.5		16 bar S 6.3 SDR 13.6 PN 16		25 bar S 4 SDR 9 PN 25	
	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M
20	–	–	–	–	–	–	–	–	1.5	0.137	2.3	0.196
25	–	–	–	–	–	–	1.5	0.17	1.9	0.212	2.8	0.294
32	–	–	–	–	1.6	0.264	1.9	0.277	2.4	0.342	3.6	0.482
40	–	–	1.6	0.291	1.9	0.350	2.4	0.437	3.0	0.525	4.5	0.750
50	–	–	2.0	0.422	2.4	0.552	3.0	0.683	3.7	0.809	5.6	1.16
63	1.9	0.562	2.5	0.717	3.0	0.854	3.8	1.09	4.7	1.29	7.1	2.04
75	2.2	0.782	2.9	0.99	3.6	0.122	4.5	1.54	5.6	1.82	8.4	2.60
90	2.7	1.13	3.5	1.43	4.3	1.75	5.4	2.21	6.7	2.61	10.1	4.14

Nominal outside diameter DN	bar 8 S 16 SDR 33 PN 8		bar 12.5 S 10 SDR 21 PN 12.5		bar 20 S 6.3 SDR 13.6 PN 20		bar 25 S 5 SDR 11 PN 25	
	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M
110	3.4	1.7	5.3	2.61	8.1	3.90	10.0	5.00
125	3.9	2.21	6	3.34	9.2	5.01	11.4	6.48
140	4.3	2.74	6.7	4.18	10.3	6.27	12.7	8.09
160	4.9	3.57	7.7	5.47	11.8	8.17	14.6	10.63
180	5.5	4.51	8.6	6.88	13.3	10.4	16.4	13.40
200	6.2	5.64	9.6	8.51	14.7	12.8	18.2	16.57
225	6.9	7.06	10.8	10.8	16.6	16.1	–	–
250	7.7	8.76	11.9	13.2	18.4	19.9	–	–
280	8.6	10.96	13.4	16.6	20.6	24.9	–	–
315	9.7	13.91	15.0	20.9	23.2	31.5	–	–
355	10.9	17.62	16.9	26.5	26.1	39.9	–	–
400	12.3	22.40	19.1	33.7	29.4	50.8	–	–
450	13.8	28.27	21.5	42.7	33.1	67.82	–	–
500	15.3	34.83	23.9	52.6	36.8	83.77	–	–
560	17.2	43.85	26.7	65.8	–	–	–	–
630	19.3	55.36	30.0	83.2	–	–	–	–
710	21.8	70.47	–	–	–	–	–	–
800	24.5	89.24	–	–	–	–	–	–

- The Length Of Pipe 6 Meter Incl.socket Or As Requested
  Each Pipe Has One Rubber Ring To Connection And The Color D. Grey Or As Requested.
- S Is The Pipe Series And Equals $\frac{DN-EN}{2\,EN}$
- SDR Is The Standard Dimention Ratio And Equal $\frac{DN}{EN}$
- S and SDR Are Related By The Equation [SDR]= 2 (S) + 1

Dn= Nominal Uotside Diameter
En= Nominal Wall Thickness

ALROWAD PIPES FOR SEWERAGE ACCORDING TO EGYPTIAN STANDARDS ES 1717 /2008 - ISO 4435/2003

Nominal outside diameter DN	"SN 2 SDR 51"		" SN 4 SDR 41"		" SN 8 SDR 34"	
	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M	No.thick of Wall MM	No.Wt KG/M
110	_	_	3.2	1.64	3.2	1.64
125	_	_	3.2	1.82	3.7	2.13
160	3.2	2.41	4	2.91	4.7	3.44
200	3.9	3.7	4.9	4.46	5.9	5.37
250	4.9	5.65	6.2	7.06	7.3	8.31
315	6.2	9.02	7.7	11.11	9.2	13.2
355	7	11.4	8.7	14.06	10.4	16.7
400	7.9	14.5	9.8	17.8	11.7	21.1
450	8.8	18.3	11	22.53	13.2	26.8
500	9.8	22.4	12.3	28	14.6	32.9
630	12.3	35.7	15.4	43.944	18.4	52.2
710	13.9	45.3	17.4	56.15	_	_
800	15.7	57.2	19.6	71.39	_	_

ALROWAD PIPES FOR SEWERAGE ACCORDING TO ASTMD 1785 SCHEDULE 40.80

Normal size inch	outside diameter mm		schedule (40)				schedule (80)			
			Thickness mm		weight kg/m	Pressure rating bar	Thickness mm		weight kg/m	Pressure rating bar
	Min	Max	Min	Max			Min	Max		
2/1	21.2	21.2	2.8	3.3	0.24	41.4	3.7	4.2	0.31	58.6
4/3	26.6	26.9	2.9	3.4	0.33	33.1	3.9	4.4	0.41	47.6
1	33.4	33.7	3.4	3.9	0.48	31.0	4.6	5.1	0.60	43.4
4/1 1	42.1	42.4	3.6	4.1	0.65	25.5	4.9	5.4	0.84	35.9
2/1 1	48.1	48.4	3.7	4.2	0.77	22.8	5.1	5.7	1.03	32.4
2	60.2	60.5	3.9	4.4	1.04	19.3	5.5	6.2	1.41	27.6
3	88.7	89.1	5.5	6.2	2.14	17.9	7.6	8.5	2.88	25.5
4	114.1	114.5	6.0	6.7	3.05	15.2	8.6	9.6	4.22	22.1
6	168.0	168.5	7.1	8.0	5.37	12.4	11.0	12.3	8.05	19.3
8	218.8	219.4	8.2	9.2	8.11	11.0	12.7	14.2	12.23	17.2

- the length of pipe 6 meter or as requested
- the pipes are without socket and the color is white

CHEMICAL RESISTANCE OF ALROWAD UPVC PIPES

ALROWAD uPVC & cPVC pipes and fittings have excellent chemical resistance to most mineral acids, bases, salts and aliphatic hydrocarbons. When they used within their allowable pressure and temperature ranges they will provide a good alternative to metallic piping which corrodes when exposed to the same aggressive chemical solutions. The informatin contained in the following chemical resistance tables are based on data supplied to us by our raw material manufacturers and some actual field experience gathered from various sources. You must take into consideration the specific use conditions that will apply to your project. There will be variables that will affect the chemical resistance such as temperature, pressure, chemical concentration and external stresses that may exist in the design and construction of the system. Because of the wide variety and numeroud use conditions that are found in the process of chemical industry, the final decision is to use thermoplastic piping should be based on in-service testing and evaluation by the responsible engineer and end-user.

INTERPRETATION OF THE DATA

It is important to understand that an "R" rating does not necessarily imply that pipe, fittings and joint can be used at their water pressure rating and be expected to have the same longevity when used with a particular chemical other than water. Generally, the chemical resistance of uPVC will decrease with an increase in temperature and concentrations. This is also true for all other components in the system that will come in contact with the flow. Solvent cements, valves, instrumentation, O-rings, gaskets and other such components should be evaluated and approved by their respective manufacturers.

Chemical	uPVC		Chemical	uPVC		Chemical	uPVC	
	20 °C	60 °C		20 °C	60 °C		20 °C	60 °C
Acetaldehyde	NR	NR	Ammonium Thiocyanate	R	R	Calcium Carbonate	R	R
Acetamide	••	••	Ammonium Tartrate	••	••	Calcium Chlorate	R	R
Acetic Acid, 10%			Amyl Acetate	NR	NR	Calcium Sulfate	R	R
Acetic Acid, 20%	R	R	Amyl Chloride	NR	NR	Camphor Crystals	R	••
Acetic Acid, 50%	R	••	Aniline	NR	NR	Camphor Sugar Liquors	R	R
Acetic Acid, 80%	R	••	Aniline Chlorohydrate	NR	NR	Caprolactam	••	••
Acetic Acid, Glacial	••	NR	Aniline Hydrochloride	NR	NR	Caprolactone	••	••
Acetic Anhydride	NR	NR	Anthraquinone	R	R	Carbitol	R	••
Acetone, up to 5%	••	••	Anthraquinon Sulfonic Acid	R	R	Caprylic Acid	••	••
Acetone, greater than 5%	••	••	Antimony Trichloride	R	R	Carbon Dioxide, Wet (Non-Pressure; Vent Only)	R	R
Acetophenone	NR	NR	Aqua Regia	••	NR	Carbon Dioxide, Dry (Non-Pressure; Vent Only)	R	R
Acetyl Chloride	••	••	Aromatic Hydrocarbons	NR	NR	Carbon Disulfide	NR	NR
Acetylene			Arsenic Acid	R	R	Carbon Monoxide	R	R
Acetyl Nitrile	NR	NR	Aryl Sulfonic Acid	R	R	Carbon Tetrachloride	NR	NR
Acetyle Acid	NR	NR	Asphalt Emulsion	NR	NR	Carbonic Acid	R	R
Acrylonitrile	NR	NR	Barium Carbonate	R	R	Castor Oil	R	R
Adipic Acid, sat'd			Barium Chloride	R	R	Caustic Potash	R	R
Alcohol, Allyl	••	••	Barium Hydroxide	R	R	Caustic Soda	••	••
Alcohol, Amyl	NR	NR	Barium Nitrate	R	••	Cellosolve	R	NR
Alcohol, Benzyl	NR	NR	Barium Sulfate	R	R	Cellosolve Acetate	R	••
Alcohol, Butyl, Primary	R	R	Barium Sulfide	R	R	Chloracetic Acid	R	R
Alcohol, Butyl, Secondary	R	NR	Beer	R	R	Chloral Hydrate	R	R
Alcohol, Diacetone	••	••	Beet Sugar Liquours	R	R	Chloramine	R	••
Alcohol, Ethyl	R	R	Benzaldehyde	NR	NR	Chloric Acid	R	R
Alcohol, Hexyl	R	R	Benzalkonium Chloride	NR	NR	Chlorinated Solvents	NR	NR
Alcohol, Isopropyl	R	R	Benzene	NR	NR	Chlorinated Water, (Hypochlorite)	••	••
Alcohol, Methyl	R	R	Black Sulfate Liquor	R	R	Chlorine Gas, Dry	NR	NR
Alcohol, Propargyl	R	R	Bleach, Household (5% Cl)	R	R	Chlorine Gas, Wet	NR	NR
Alcohol, Propyl	R	R	Bleach, 12.5% Active Cl_2	R	R	Chlorine Liquid	NR	NR
Allyl Chloride	NR	NR	Bleach 5.5% Active Cl_2	R	R	Chlorine, trace in air (Non-Pressure; Vent Only)	••	••
Alum	R	R	Bleach, Industrial (15% Cl)	••	••	Chlorine dioxide, aqueous, sat'd	••	••
Alum, Ammonium	R	R	Borax	R	R	Chlorine Water, Saturated	R	R
Alum, Chrome	R	R	Boric Acid	R	R	Cloracetic Acid	R	NR
Alum, Potassium	R	R	Boric Acid, Saturated	••	••	Chloroacetyl Chloride	R	••
Alum, Acetate	••	••	Brine, Acid	R	••	Chlorobenzene	NR	NR
Alum, Chloride	R	R	Bromic Acid	R	R	Chlorobenzyl Chloride	NR	NR
Alum, Fluoride	R	NR	Bromine	••	••	Chloroform	NR	NR
Aluminium Hydroxide Solution	R	R	Bromine, Liquid	NR	NR	Chloropicrin	NR	NR
Aluminium Nitrate	R	R	Bromine, Vapour 25% (Non-Pressure; Vent Only)	R	R	Chlorosulfonic Acid	R	NR
Aluminium Oxychloride	R	R	Bromine, Water	R	R	Chromic Acid, 10%	R	R
Aluminium Sulfate Solution	R	R	Bromobenzene	NR	NR	Chromic Acid, 30%	R	••
Amines	••	••	Bromotoluene	NR	NR	Chromic Acid, 40%	R	••
Ammonia	••	••	Butadiene	R	R	Linoleic Oil	R	R
Ammonia, Gas (Non-Pressure; Vent Only)	R	R	Butane	R	R	Linseed Oil	R	R
Ammonia, Aqua, 10%	R	NR	Butanol	NR	NR	Linseed Oil, Blue	••	••
Ammonia, Liquid	NR	NR	Butyl Acetate	NR	NR	Liqueurs	R	R
Ammonium, Acetate	R	R	Butyl Alcohol	R	R	Lithium Bromide (Brine)	R	R
Ammonium Benzoate	••	••	Butyl Carbitol	••	••	Lithium Chloride	R	R
Ammonium Bifluoride	R	R	Butyl Cellosolve	R	••	Lithium Sulfate	R	R
Ammonium Bisulfide	R	R	Butyl Phthalate	NR	NR	Lubricating Oil, ASTM #1	R	R
Ammonium Carbonate	R	R	Butylene	R	R	Lubricating Oil, ASTM #2	R	R
Ammonium Chloride	R	R	Butyl Phenol	R	NR	Lubricating Oil, ASTM #3	R	R
Ammonium Citrate	••	••	Butyl Stearate	R	••	Chromic Acid, 50%	NR	NR
Ammonium Dichromate	R	••	Butyne Diol	R	NR	Chromium Nitrate	••	••
Ammonium Fluoride, 10%	R	R	Butyric Acid, up to 1%	R	NR	Citric Acid	R	R
Ammonium Fluoride, 25%	R	••	Butyric Acid, greater than 1%	••	••	Citric Acid, 10%	••	••
Ammonium Hydroxide	R	••	Cadmium Acetate	••	••	Citrus Oils	••	••
Ammonium Metaphosphate	R	R	Cadmium Chloride	••	••	Coconut Oil	R	R
Ammonium Nitrate	R	R	Cadmium Cyanide	R	R	Coke Oven Gas (Non-Pressure; Vent Only)	NR	NR
Ammonium Persulphate	R	R	Cadmium Sulfate	••	••	Copper Acetate	••	••
Ammonium Phosphate	R	R	Caffeine Citrate	R	••	Copper Carbonate	R	R
Ammonium Sulfamate	••	••	Calcium Acetate	••	••	Copper Chloride	R	R
Ammonium Sulfate	R	R	Calcium Bisulfide	••	••	Copper Cyanide	R	R
Ammonium Sulfide	R	••	Calcium Bisulfite Solution	R	R	Copper Fluoride	R	R

R : Recommended for use NR : Not Recommended •• : No Data Available, check with factory

Chemical	uPVC		Chemical	uPVC		Chemical	uPVC	
	20 °C	60 °C		20 °C	60 °C		20 °C	60 °C
Copper Nitrate	R	R	Petroleum Oils, Sour	R	••	Ketones	NR	NR
Copper Sulfate (Blue Vitriol Solution)	R	R	Petroleum Oils, Refined	R	R	Kraft Liquor	R	R
Corn Oil	••	••	Phenol	••	NR	Lactic Acid, 25%	R	R
Corn Syrup	••	••	Ferrous Hydroxide	R	••	Lactic Acid, 85%	R	••
Cottonseed Oil	R	R	Ferrous Nitrate	R	••	Lard Oil	R	R
Creosote	••	••	Ferrous Sulfate (Green Couperas Solution)	R	R	Lauric Acid	R	R
Cresol	NR	NR	Fish Solubles	R	R	Lauryl Chloride	R	R
Cresylic Acid, 50%	R	R	Fluorine Gas	NR	NR	Lead Acetate	R	R
Crotonaldehyde	NR	NR	Fluoroboric Acid	R	R	Lead Chloride	R	R
Crude Oil	R	••	Fluorosilicic Acid, 30%	R	R	Lead Nitrate	R	R
Cumene	••	••	Formaldehyde, 35%	R	R	Lead Sulfate	R	R
Cupric Fluoride	R	R	Formaldehyde, 37%	R	R	Silicone Oil	R	NR
Cupric Sulfate	R	R	Formaldehyde, 50%	R	R	Silver Chloride	••	••
Cuprous Chloride	R	R	Formic Acid, up to 25%	R	NR	Silver Cyanide Solution	R	R
Cyclohexane	NR	NR	Formic Acid, greater than 25%	••	••	Silver Nitrate	R	R
Cyclohexanol	NR	NR	Freon F-11	R	R	Silver Sulfate	R	R
Cyclohexanone	NR	NR	Freon F-12	R	R	Soaps	R	R
D-Limonene	••	••	Freon F-21	NR	NR	Sodium Acetate	R	R
Desocyephedrine Hydrochloride	R	••	Freon F-22	NR	NR	Sodium Aluminate	••	••
Detergents	R	R	Freon F-113	R	R	Sodium Arsenate	••	••
Detergent Solution (Heavy Duty)	R	R	Freon F-114	R	R	Sodium Alum	R	R
Dextrin	R	R	Fructose	R	R	Machine Oil	R	R
Dextrose	R	R	Fruit Juices, Pulp	R	R	Magnesium Carbonate	R	R
Diazo Salts	R	R	Furfural	NR	NR	Magnesium Chloride	R	R
Dibutoxy Ethyl Phthalate	NR	NR	Gallic Acid	R	R	Magnesium Citrate	R	R
Dibutyl Phthalae	NR	NR	Gasoline, Leaded	••	NR	Magnesium Fluoride	••	••
Dibutyl Sebacate	R	NR	Gasoline, Unleaded	••	NR	Magnesium Hydroxide	R	R
Dichlorobenzene	NR	NR	Gasoline, Sour	••	NR	Magnesium Nitrate	R	R
Dichloroethylene	NR	NR	Gelatine	R	R	Magnesium Oxide	••	••
Diesel Fuels	••	NR	Gin	••	••	Magnesium Salts, Inorganic	••	••
Diethylamine	NR	NR	Glucose	R	R	Magnesium Sulfate (Epsom Salts)	R	R
Diethyl Cellosolve	••	••	Glycerine	R	R	Manganese Sulfate	R	R
Diethyl Ether	R	••	Glycerine, Glycerol	R	R	Maleic Acid	R	R
Diglycolic Acid	R	R	Glycolic Acid	R	R	Maleic Acid, 50%	••	••
Dill Oil	••	••	Glycol Ether	R	R	Malic Acid	R	R
Dimethylamine	R	R	Grape Sugar (Juice)	R	R	Mercuric Acid	••	••
Dimethylformamide	NR	NR	Green Liquor	R	R	Mercuric Chloride	R	R
Dimethyl Hydrazine	NR	NR	Halocarbons Oils	••	••	Mercuric Cyanide	R	R
Dioctyl Phthalate	NR	NR	Heptane	R	R	Mercuric Sulfate	R	R
Dioxane	NR	NR	Hexane	R	••	Mercurous Nitrate	R	R
Dioxane, 1, 4	NR	NR	Hydraulic Oil	••	••	Mercury	••	••
Disodium Phosphate	R	R	Hydrazine	NR	NR	Methane (Non-Pressure; Vent Only)	R	R
Distilled Water	R	R	Hydrobromic Acid, 20%	R	R	Methane Sulfonic Acid	••	••
Divinylbenzene	NR	NR	Hydrobromic Acid, 50%	R	••	Methanol, up to 10%	••	••
Dursban TC	••	••	Hydrochloric Acid, Conc. 37% (Muriatic Acid)	R	••	Methanol, greater than 10%	••	••
EDTA, Tetrasodium	••	••	Hydrocyanic Acid	R	R	Methylene Chlorobromide	NR	NR
Epsom Salt	R	••	Hydrocyanic Acid, 10%	R	R	Methoxyethyl Cleate	R	••
Esters	NR	NR	Hydrofluoric Acid, Dilute	R	NR	Methylamine	NR	NR
Ethanol, up to 5%	••	••	Hydrofluoric Acid, 3%	••	••	Methyl Bromide	NR	NR
Ethanol, greater than 5%	••	••	Hydrofluoric Acid, greater than 3%	••	••	Methyl Cellosolve	NR	NR
Ethers	NR	NR	Hydrofluoric Acid, 30%	R	NR	Methyl Chloride	NR	NR
Ethyl Acetate	NR	NR	Hydrofluoric Acid, 40%	R	NR	Methyl Chloroform	NR	NR
Ethyl Acetoacetate	NR	NR	Hydrofluoric Acid, 50%	R	NR	Methyl Formate	••	••
Ethyl Acrylate	NR	NR	Hydrofluosilicic Acid, 30% (120F-R)	R	R	Methyl Ethyl Ketone	NR	NR
Ethyl Benzene	••	••	Hydrogen	R	R	Methyl Isobutyl Ketone	NR	NR
Ethyl Chloride	NR	NR	Hydrogen Cyanide (Non-Pressure; Vent Only)	R	R	Methyl Methacrylate	R	••
Ethyl Chlorohydrin	NR	NR	Hydrogen Fluoride, Anhydrous	NR	NR	Methyl Sulfate	R	••
Ethylene Diamine	••	••	Hydrogen Peroxide, 30%	R	••	Methyl Sulfuric Acid	R	R
Ethylene Dichloride	NR	NR	Hydrogen Peroxide, 50%	R	R	Methylene BromideNR	NR	NR
Ethylene Glycol, up to 50%	R	R	Hydrogen Peroxide, 90%	••	••	Methylene Chloride	NR	NR
Ethylene Glycol, greater than 50%	R	R	Hydrogen Phosphide	R	R	Methylene Iodine	NR	NR
Ethylene Oxide	NR	NR	Hydrogen Sulfide, Dry (Non-Pressure; Vent Only)	R	R	Methylisobutyl Carbinol	••	••
Fatty Acids	R	R	Hydrogen Sulfide, Aqueous Sol.	R	R	Milk	R	R
Ferric Acetate	R	NR	Hydroquinone	R	R	Mineral Oil	R	R
Ferric Chloride	R	R	Hydroxylamine Sulfate	R	R	Molasses	R	R
Ferric Hydroxide	R	R	Hydrochlorous Acid	R	R	Monoethanolamine	NR	NR
Ferric Nitrate	R	R	Hypochlorous Acid	••	••	Motor Oil	R	R
Ferric Sulfate Solution	R	R	Iodine	NR	NR	Muriatic Acid (see Hydrochloric Acid)	R	••
Ferrous Chloride	R	R	Iodine Solution, 10%	NR	NR	Naphtha	R	R
Palmitic Acid, 70%	R	NR	Iron Salts	••	••	Naphthalene	NR	NR
Paraffin	R	R	Isopropanol	••	••	Natural Gas (Non-Pressure; Vent Only)	R	R
Peanut Oil	••	••	Isopropyl Ether	NR	NR	Nickel Acetate	R	••
Peracetic Acid, 40%	R	NR	Isooctane	••	••	Nickel Chloride	R	R
Perchloric Acid, 10%	R	••	Jet Fuel, JP-4	••	NR	Nickel Nitrate	R	R
Perchloric Acid, 70%	R	NR	Jet Fuel, JP-5	••	NR	Nickel Sulfate	R	R
Perphosphate	R	••	Kerosene	R	••	Nicotine	R	R

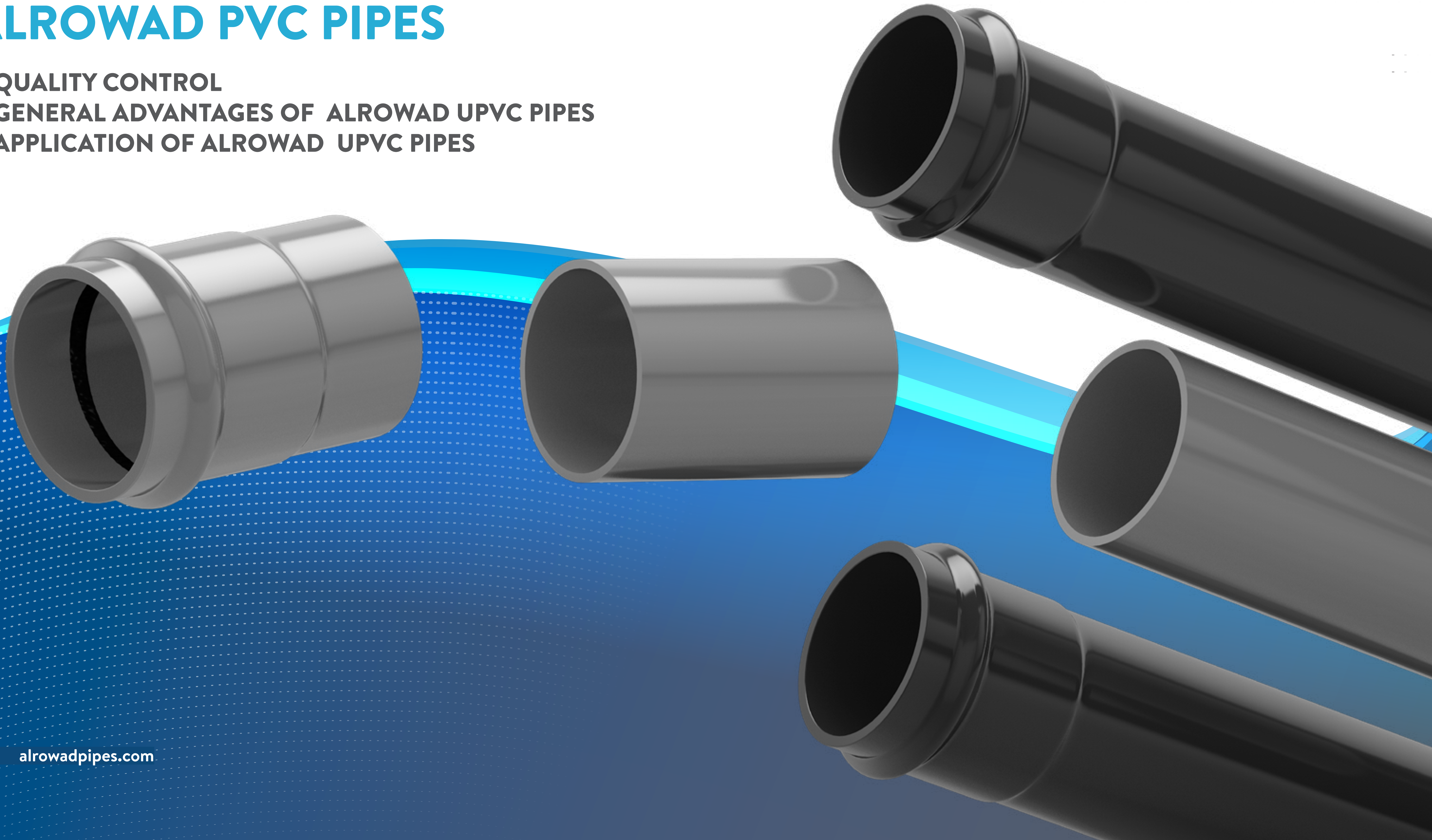
R : Recommended for use   NR : Not Recommended •• : No Data Available, check with factory

Chemical	uPVC		Chemical	uPVC		Chemical	uPVC	
	20 °C	60 °C		20 °C	60 °C		20 °C	60 °C
Nicotine Acid	R	R	Potassium Borate	R	R	Sodium Hydroxide, 10%	R	R
Nitric Acid, up to 25%	••	••	Potassium Bromate	R	R	Sodium Hydroxide, 15%	R	R
Nitric Acid, 25-35%	••	••	Potassium Bromide	R	R	Sodium Hydroxide, 25%	R	••
Nitric Acid, greater than 35%	••	••	Potassium Carbonate	R	R	Sodium Hydroxide, 30%	R	••
Nitrobenzene	NR	NR	Potassium Chlorate	R	R	Sodium Hydroxide, 50%	R	••
Nitroglycerine	NR	NR	Potassium Chloride	R	R	Sodium Hydroxide, 70%	R	••
Nitrous Acid, 10%	R	NR	Potassium Chromate	R	R	Sodium Hypobromite	••	••
Nitrous Oxide (Non-Pressure; Vent Only)	R	••	Potassium Cyanate	R	R	Sodium Hypochloride, 15%	R	••
Nitroglycol	NR	NR	Potassium Cyanide	R	R	Sodium Hypochlorite	R	••
1-Octanol	••	••	Potassium Dichromate	R	R	Sodium Iodide	••	••
Oils, Edible	••	••	Potassium Ethyl Xanthate	R	NR	Sodium Metaphosphate	R	••
Oils, Vegetable	••	••	Potassium Ferricyanide	R	R	Sodium Nitrate	R	R
Oils, Sour Crude	••	••	Potassium Ferrocyanide	R	R	Sodium Nitrite	R	R
Oleic Acid	R	R	Potassium Fluoride	R	R	Sodium Palmitrate Solution, 5%	••	••
Oleum	NR	NR	Potassium Hydroxide	R	R	Sodium Perborate	R	R
Olive Oil	••	••	Potassium Hypochlorite	R	••	Sodium Perchlorate	R	R
Oxalic Acid, Saturated	R	R	Potassium Iodide	R	••	Sodium Peroxide	R	R
Oxalic Acid, 20%	••	••	Potassium Nitrate	R	R	Sodium Phosphate, Alkaline	R	••
Oxalic Acid, 50%	R	R	Potassium Perborate	R	R	Sodium Phosphate, Acid	R	••
Oxygen (Non-Pressure; Vent Only)	R	R	Potassium Perchlorate, sat'd	R	R	Sodium Phosphate, Neutral	R	••
Sulfuric Acid, 100%	NR	NR	Potassium Permanganate, 10%, sat'd	R	R	Sodium Silicate	••	••
Sulfurous Acid	••	NR	Potassium Permanganate, 25%, sat'd	••	••	Sodium Sulfate	R	R
Tall Oil	R	R	Potassium Persulfate, sat'd	R	R	Sodium Sulfide	R	R
Tannic Acid, 10%	R	R	Potassium Phosphate	••	••	Sodium Sulfite	R	R
Tannic Acid, 30%	••	••	Potassium Sulfate	R	R	Sodium Thiosulfate	R	R
Tanning Liquors (Vegetable)	R	R	Potassium Tripolyphosphate	••	••	Sodium Tripolyphosphate	••	••
Tar	NR	NR	Propane (Non-Pressure; Vent Only)	R	R	Sour Crude Oil	R	R
Tartaric Acid	R	R	Propanol, up to 0.5%	••	••	Soyabean Oil	••	••
Terpenes	••	••	Propanol greater than 0.5%	••	••	Stannic Chloride	R	R
Tetraethyl Lead	R	••	Propionic Acid, up to 2%	••	••	Stannous Chloride, 15%	R	R
Tetrahydrodurane	NR	NR	Propionic Acid, greater than 2%	••	••	Stannous Sulfate	••	••
Tetrahydrofuran	NR	NR	Propylene Dichloride	NR	NR	Starch	R	R
Tetrasodiumpyrophosphate	R	R	Propylene Glycol, up to 25%	R	••	Stearic Acid	R	R
Texanol	••	••	Propylene Glycol, greater than 25%	R	••	Stoddard's Solvent	NR	NR
Thionyl Chloride	NR	NR	Propylene Oxide	NR	NR	Strontium Chloride	••	••
Thread Cutting Oils	R	••	Pyridine	NR	NR	Styrene	••	••
Tirpineol	••	••	Pyrogallicia Acid	R	NR	Succinic Acid	R	R
Titanium Tetrachloride	••	NR	Quaternary Ammonium Salts	••	••	Sugar	••	••
Toluene	NR	NR	Tributyl Citrate	R	••	Sulfamic Acid	NR	NR
Toluene, Toluol	NR	NR	Trichloroacetic Acid	R	R	Sulfated Detergents	••	••
Phenylhydrazine	NR	NR	Trichloroethane	NR	NR	Sulfate Liquors	••	••
Phenylhydrazine Hydrochloride	••	NR	Trichloroethylene	NR	NR	Sulfite Liquor	R	R
Phosgene Liquid	NR	NR	Triethanolamine	R	••	Sulfur	R	R
Phosgene, Gas (Non-Pressure; Vent Only)	R	••	Triethylamine	R	R	Sulfur Chloride	••	••
Phosphoric Acid, 10%	R	R	Trimethylpropane	R	NR	Sulfur Dioxide, Dry (Non-Pressure; Vent Only)	R	R
Phosphoric Acid, 25%	R	R	Trisodium Phosphate	R	R	Sulfur Dioxide, Wet (Non-Pressure; Vent Only)	R	••
Phosphoric Acid, 45%	R	R	Turpentine Oil	R	R	Sulfur Trioxide (Non-Pressure; Vent Only)	R	••
Phosphoric Acid, 70%	R	R	Urea	R	R	Sulfur Trioxide, Gas (Non-Pressure; Vent Only)	R	R
Phosphoric Acid, 85%	R	R	Urine	R	R	Sulfuric Acid, 10%	R	R
Phosphorus, Yellow	R	••	Vaseline	NR	NR	Sulfuric Acid, 20%	R	R
Phosphorus, Red	R	R	Vegetable Oils	••	••	Sulfuric Acid, 30%	R	R
Phosphorus Pentoxide	R	••	Vinegar	R	R	Sulfuric Acid, 50%	R	R
Phosphorus Trichloride	NR	NR	Vinegar, White	••	••	Sulfuric Acid, 60%	R	R
Photographic Solutions	R	R	Vinyl Acetate	NR	NR	Sulfuric Acid, 70%	R	R
Picric Acid	NR	NR	Water	R	R	Sulfuric Acid, 80%	R	••
Pine Oil	••	••	Water, Acid Mine	R	R	Sulfuric Acid, 85%	R	NR
Plating Solutions, Brass	R	••	Water, Deionized	••	••	Sulfuric Acid, 90%	R	NR
Plating Solutions, Chrome	R	••	Water, Demineralized	R	R	Water, Distilled	R	R
Plating Solutions, Copper	R	••	Sodium Benzoate	R	R	Water, Potable	R	R
Plating Solutions, Gold	R	••	Sodium Bicarbonate	R	R	Water, Salt	R	R
Plating Solutions, Lead	R	••	Sodium Bichromate	R	R	Water, Sea	R	R
Plating Solutions, Nickel	R	••	Sodium Bisulfate	R	R	Water, Sewage	R	R
Plating Solutions, Rhodium	R	••	Sodium Bisulfite	R	R	Water, Swimming Pool	••	••
Plating Solutions, Silver	R	••	Sodium Borate	R	••	WD-40	••	••
Plating Solutions, Tin	R	••	Sodium Bromide	R	R	Whiskey	R	R
Plating Solutions, Zinc	R	••	Sodium Carbonate Solution	R	R	White Liquor	R	R
Polyethylene Glycol	••	••	Sodium Chlorate	R	••	Wines	R	R
Polypropylene Glycol	••	••	Sodium Chloride	R	R	Xylene	NR	NR
Potash	R	R	Sodium Chlorite	NR	NR	Zinc Acetate	R	R
Potassium Acetate	••	••	Sodium Chromate	••	••	Zinc Bromide	R	R
Potassium Alum	R	R	Sodium Cyanide	R	••	Zinc Carbonate	••	••
Potassium Aluminium Sulfate	R	••	Sodium Dichromate	R	R	Zinc Chloride	R	R
Potassium Amyl Xanthate	R	NR	Sodium Ferricyanide	R	R	Zinc Nitrate	R	R
Potassium Bicarbonate	R	R	Sodium Ferrocyanide	R	R	Zinc Phosphate	••	••
Potassium Bichromate	R	R	Sodium Fluoride	R	••	Zinc Sulfate	R	R
Potassium Bisulfate	R	R	Sodium Formate	••	••			

R : Recommended for use   NR : Not Recommended •• : No Data Available, check with factory

ALROWAD PVC PIPES

- QUALITY CONTROL
- GENERAL ADVANTAGES OF ALROWAD UPVC PIPES
- APPLICATION OF ALROWAD UPVC PIPES



ALROWAD
INDUSTRIAL COMPLEX

QUALITY CONTROL

TENSILE STRENGTH
Measures the strength of material (Resistance) being pulled apart.

MODULUS OF ELASTICITY
Measures the stiffness of the material

ELONGATION AT BREAK
Measures the extension length of the sample until it breaks.

HYDROSTATIC STRENGTH
Determines the capability of the sample to withstand internal pressure for both long and short periods of time

LONGITUDINAL REVERSION OR EFFECTS OF HEATING
Measures change in length of the sample after exposure to high temperature and the ability to resist heat without showing delamination, cracks or blisters.

MELT FLOW
The MFR/MVR tester combines the determination of the melt flow rate (MFR) and melt volume rate (MVR) of thermoplastic materials into one test procedure under specified temperature and load conditions.

FLATTENING / STIFFNESS
Measures the ability of sample to resist deformation under load. This test is particularly useful for buried installation of pipes.

IMPACT STRENGTH
Measures the toughness of the sample against impact or the ability of the sample to absorb applied energy.

DENSITY / SPECIFIC GRAVITY
Determines the specific gravity and density to help in material identification.

GENERAL ADVANTAGES OF ALROWAD UPVC PIPES

1-Corrosion Resistance & Scale Build up

Alrowad uPVC pipes are chemically resistant to nearly all acids, alkalis, alcohols, halogens as well as many other corrosive fluids. Being non- conductor of electricity, it eliminates galvanic or electrolytic corrosion which is the cause of expensive repairs.
ALROWAD uPVC non-corroding properties ensure improved flow, lower maintenance costs and longer performance life.

2-Chemical Resistance

Alrowad uPVC pipes inhibit excellent chemical resistance against most acids, alcohols, alkalis, salt solutions and halogens. For specific applications see the Alrowad chemical resistance guide.

3-Fire Proof

Alrowad uPVC pipes do not support combustion and are self extinguishing. Pipes will not burn unless an external flame source is applied.

4-Low Bacteria Build up

Studies shows that bacteria build up with Alrowad uPVC pipes are far lower than with alternative piping materials. Alrowad uPVC piping systems are resistant to fungi and bacteria growth, particularly those which cause corrosion in metal piping systems.

5-Thermal Conductivity

Alrowad uPVC pipes have lower thermal conductivity than for metal which reduces heat losses and offer better uniform fluid temperature, prevent "sweating" formation of condensation on the pipe wall.
Insulation in certain instances, may be completely eliminated.

6-Ease of Handling, Installation & Maintenance

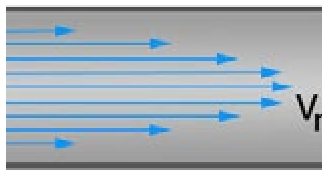
Alrowad uPVC pipes are quick and easy to install and maintained with complete range of solvent cement fittings saving time, effort and money as it is light in weight and easy to handle.

7-Reduced Additive Migration

Alrowad uPVC pipes do not allow migration of additives into water supply and hence no bad odour or taste of drinking water.

8-Mechanical Strength

Alrowad uPVC pipes are light in weight having a specific weight which is about one fifth of steel pipes. This will cut down on transportation costs and facilitate pipes installation.



8-Fluid Friction

Alrowad uPVC pipes being a mirror-smooth inner surface has lower friction loss as compared to metals, i.e. lower pressure losses.

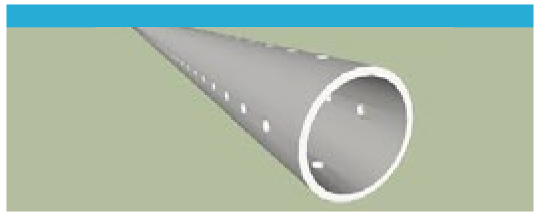
APPLICATION OF ALROWAD UPVC PIPES

- WATER SUPPLIES -

Non-toxic Alrowad uPVC pipes will not affect the taste, color or smell of drinking water. They will never corrode and are therefore extremely sanitary. Deposits and scales will not build up inside as in the case for conventional steel pipes. Their strength is greater than that of asbestos pipes. ALROWAD obtained SASO certification and NSF 61 for drinking water use.

- IRRIGATION SYSTEMS -

Alrowad uPVC pipes are ideal for agricultural irrigation and sprinkler systems. Non- corrosive ALROWAD uPVC pipes are perfect for carrying water which contains chemical fertilizers and insect inhibitors. Within a thick wall and large diameter Alrowad uPVC pipes liquids can be transported under high pressure, which is convenient for the management of large volumes.



- ALROWAD UPVC PIPES CASING & SCREEN -

Engineering difficulties and the probability of adverse chemical reactions, make it impractical to overcome corrosion and encrustation through the use of protective coating, chemical treatment or cathodic protection. Thus, Alrowad non-corrosion PVC pipes for water well casing and screen rapidly received approval by the appropriate ministry consultants and engineers.

- INDUSTRY -

Resistant to most chemicals, Alrowad uPVC pipes have an important role to play in industrial plants. Light, non-corrosive and easy to assemble they allow more complex piping work than with steel or cast-iron pipes.

- SOIL, WASTE & DRAINAGE SEWER SYSTEM -

Waste lines for corrosive gases, ventilation for office buildings and factories, drainage systems for private homes and elevated highways these are a few of the many possibilities for Alrowad uPVC pipes. A full line of uPVC fittings is available to ensure easy installation.

- MINING -

Alrowad uPVC pipes particularly are well suited for draining corrosive liquids found in mines. They make an ideal vent line for pits because they are easily installed in hard to reach places.

- ELECTRICAL & TELECOMMUNICATION CABLES PROTECTION -

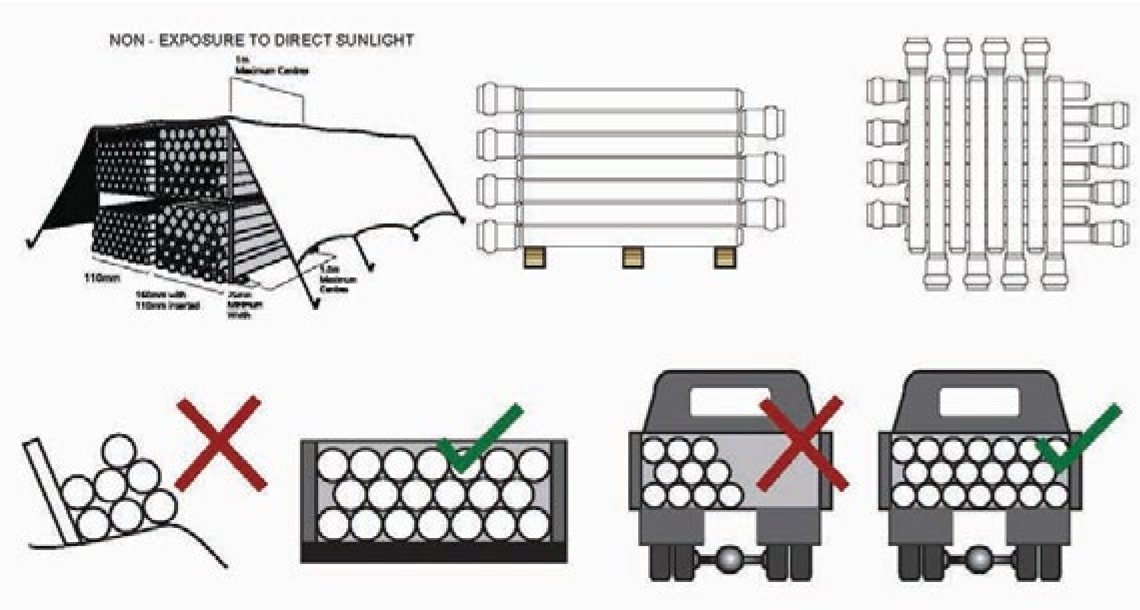
Alrowad uPVC pipes form an integral insulator, hence there is an ever increasing demand for them as electrical conduit. To facilitate work, a full line of fittings is available and fabricated from the same material as the pipes.

ALROWAD
INDUSTRIAL COMPLEX

ALROWAD PVC PIPES

- TRANSPORT, HANDLING & STORAGE
- INSTALLATION
- INSTALLATION METHODS
- HYDROSTATIC TESTING
- FLOW & FRICTION
- THERMAL MOVEMENT
- UPVC PIPE AT ELEVATED TEMPERATURE

TRANSPORT, HANDLING & STORAGE



Unplasticized PVC pipes are strong but light, its specific gravity being approximately one-fifth of cast iron. As a result, these pipes are more easily handled than their metal counterparts. Reasonable care, however, should be exercised at all times and when off loading pipes should be lowered not dropped to the ground.

Pipe should be given adequate support at all times. Pipes should not be stacked in large piles especially in warm temperature conditions as the lower layers may distort, resulting in difficulties when joining and for pipe alignment. Any pipe with ends prepared for joining (socket and spigot joints, RR joints, etc.) should be stacked in layers with the socket, placed at alternate ends of the stack and with sockets protruding to avoid lop-sided stacks and the imparting of permanent set of pipes. Particularly in the case of ring pipe, rubber rings should not be exposed to solar radiation for any length of time if they ar not coated. It is recommended to stock them in a cool and shady place. Rubber rings should not come in touch with chemicals, grease, oil and should not be stored for too long time.

For long-term storage, pipe racks should provide continuous support, but if this is not possible, timber of at least 75 mm bearing width at spacing not greater than 1m centers for pipe sizes 150 mm and above, should be placed beneath the pipes and at 2 m centers at the side, if the stacks are rectangular. These spacing apply to pipe size 160 mm and above. Closer supports will be required for sizes below 160 mm. In such pipe racks, pipes may be stored not more than seven layers or 1.5 m high, whichever is the lesser, but if different classes of pipe are kept in the same racks, then the thickest classes must always be at the bottom.

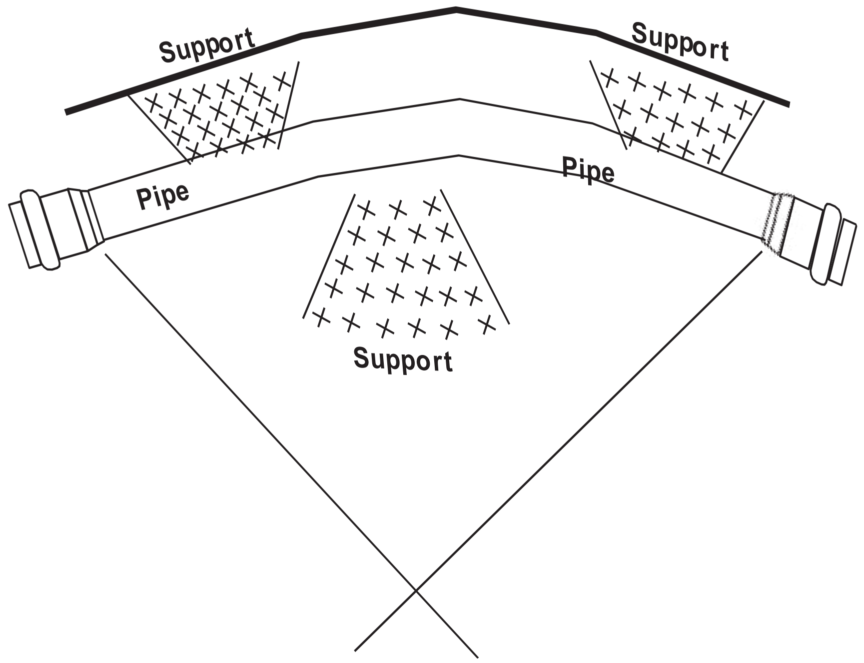
For temporary storage in the field, where racks are not provided, the ground should be level and free from coarse stones. Pipes stored thus should not exceed three layers high and should be staked to prevent movement.

Stack heights should be reduced if pipes are nested, i.e. pipes stored inside pipes of larger diameters. Reductions in height should be proportional to the weight of the nested pipe compared to the weight of the pipes normally contained in such stowage's

Since the soundness of any joint depend on the condition of the spigot and the socket, special care must be taken in transit, handling and storage to avoid damage to the ends.

When loading pipes on the vehicles, care must be taken to avoid their coming into contact with any sharp corners such as cope irons, loose nail-heads, etc., as pipes may be damaged by being rubbed against these during transit whilst in transit pipes shall be well secured over their entire length and not allowed to project unsecured over the tailboard of the lorry. Pipes may be off loaded from lorries and or by rolling them gently down timbers, care being taken to ensure that pipes do not fail one upon another nor on any hard or uneven surfaces. Fork-lift trucks will have to be used for bundles and large unit loads.

DEFLECTION



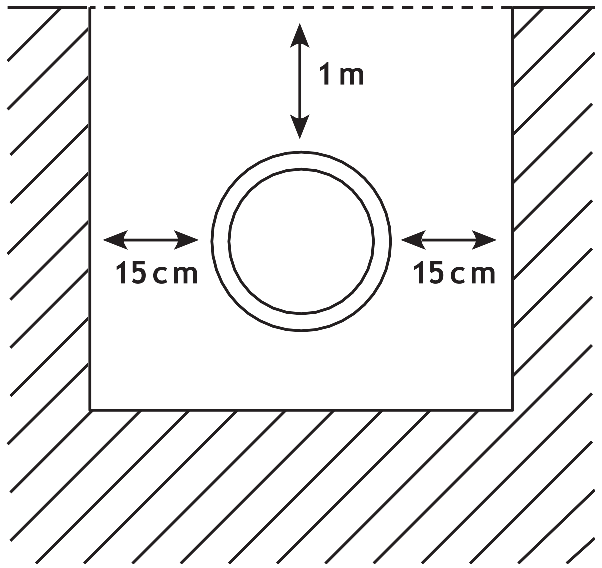
The ring integral socket permits an angular deflection at the joint of approx. 1.0 degree. The introduction of joint deflection is however, generally unnecessary flexible uPVC pipeline. Sufficient flexibility is provided by individual pipe lengths to enable gentle curves to be negotiated without imparting deflection at the joints.

As general guide the cold bending radius R of a uPVC pipe length can be calculated as follows;

R=300 X External Diameter (where a shorter radius of curvature is required, then uPVC formed bends must be introduced).

INSTALLATION

UNDERGROUND INSTALLATION TRENCH WIDTH PREPARATION COVER AND BACKFILLING



The width of trench for most purposes is enough to be 30 cm wider than the diameter of the pipe to allow enough room for jointing. Depth of cover should be at least 1 m from top of pipe to ground surface (it is wise to consider in early planning stages how future road widening plans could affect this depth of cover and to consider the frosting depth according to the local climate).

When laying ALROWAD water mains piping the usual recommendations relating to sound pipe laying practice should be followed. However, in view of the greater flexibility of uPVC (PVC) than most traditional materials, some of the procedures attain special importance.

To avoid possible damage or deformation of the pipe, its support by the ground in which it is laid should be made as uniform as possible and materials in contact with the pipe must be free from large stones, sharp edged flints or other hard objects. The trench bottom should be carefully examined for irregularities and any hard projections removed. In good uniform conditions, where the trench bottom can be readily brought to an even finish so as to support the pipes uniformly over their length no under- bedding will be necessary. Elsewhere and especially in rock or variable soils containing large stones, boulders, flints, tree roots or soft pockets a prepared bed is necessary. This bed should consist of suitable well compacted selected granular material.

The ideal material for the trench bed and for compacting is one that will pass through a tin sieve but which is free from very fine particles which may impede drainage. The thickness of bed should be a minimum of 150 mm.

In all cases, care should be taken to remove any levelling pegs or temporary packing such as wooden wedges, bricks or stones. Selected granular materials similar to the material used for bedding should then be carefully placed and compacted in uniform layers alongside and under the pipe up to a height of 150 mm or more above the crown. Any trench sheeting if used should be partially withdrawn so as to ensure that the spaces between the pipes and soil faces of the trench are completely filled with well compacted granular materials in order to provide the necessary side support for the pipes and prevent excessive deformation under load. It may be helpful especially when thin wall piping is being laid if the pipe can be full of water during this operation.

Under roads or verges or where mechanical plant is to be used for the placing and or compacting of the backfill the remainder of the first 300 mm depth of fill above the crown of the pipe should be compacted by hand and should consist of selected uniform, readily compactable material, placed and compacted in uniform layers. The remaining fill should then be placed in layers of 300 mm or more depending on the compactors used.

If piping is laid in hot weather, precautions should be taken to allow for the contraction of the line which will occur when it cools to its normal working temperature. The best method is to allow the pipe to fill with cold water from its normal supply when the trench has only been partially backfilled. This will result in the reduction of the overall length of the pipe due to shrinkage and it will therefore be necessary, before final back filling to carefully examine any detachable or other joints to see that sufficient reserve of draw is still available and that they have not become subject to any undue stress.

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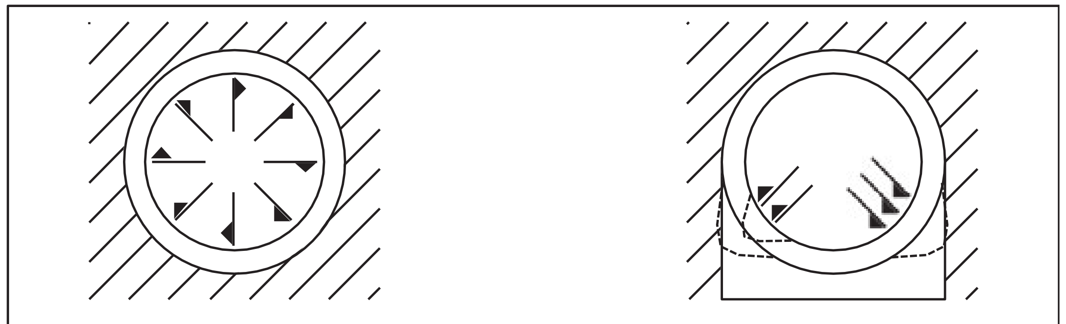
The ideal material should be free from large clay lumps (retained on a 3 in. sieve) from stones (retained on a 1 in. sieve) and sharp edged stones or flints, vegetable matter and from soil.



With uncompacted backfill | With compacted backfill

ABOVE GROUND INSTALLATION

The jointing procedure for above-ground pipelines is identical to that for underground pipe lines. Above -ground installations should be fully supported, firmly enough to avoid strain on all joints but flexible enough to allow for a certain amount of thermal expansion in a pipeline. All flanged joints should be supported on both sides. Rubber ring joints should be anchored against end trust. Pipelines should be protected from abrasion by metal supports with felt or foam rubber strips.

THRUST FORCES

When a pipeline is constructed using push-fit joints, joint separation due to internal pressure and resulting thrust forces must be prevented. This is achieved using concrete trust blocks at directional changes, branches, end caps, valves, etc. The design of uPVC pipes provided a safety

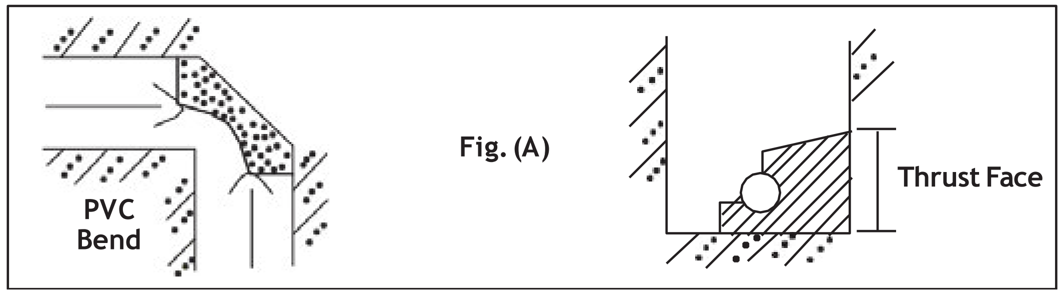


Fig. (A)

factor of 2.0 - 2.5 after a life of 50 years at maximum working pressure. In designing thrust blocks it is logical to apply a similar factor of safety after calculating thrust forces on the maximum foreseeable line pressure.

In view of the flexible nature of uPVC it is desirable to thrust block to install a design to permit the largest possible area of contact between the fitting concerned and the concrete block so that a restraint against excessive flexing as well as thrust, is provided (Fig. A). This feature, in certain soil conditions may also be applied to solvent welded pipelines which need no support against thrust but which can benefit by flexing restraint at abrupt directional changes.

Thrust block should not be allowed to
encase the fitting as the external diameter

of a uPVC pipe must be left free to distend due to pressure fluctuation. The block may be designed as shown in (Fig. A) or if total encasement is preferred the fitting should first be wrapped in several layers of heavy gauge polythene film prior to concreting to provide freedom of movement and a barrier against abrasion.

This work should be carried out in accordance with the following conditions:

- When the bridge itself is of curving construction expansion or flexible fitting such as RR joint and dresser joint. The dresser joint should be used.
- Air valve should be fixed.
- At the both ends of pipe, concrete protection should be given to protect disconnection of fitting.
- Metal hanger of pipe may or may not be required depending on the structure of bridge. However, in any case, the pipe should be fixed firm to the bridge not to sway or shake.

C. Pipe Under Railway:

- Such works should be started after due understanding with railway companies or authorities.
- Piping work should be carried without any interruption against railway operation.
- At night work, alarming yellow lamp should be provided for traffic safety purpose.
- Proper protection work or device such as protective concrete or metal casing should be given to pipe to avoid shaking.

INSTALLATION METHODS

RUBBER RING JOINTING

The following information are intended to assist Engineers and Contractors to take full advantages of the physical and mechanical properties of uPVC pipes and to achieve the desired results.

A) METHOD FOR RUBBER RING JOINT INSTALLATION

- Ensure that the mating areas of spigot and socket are thoroughly clean.
- Setting the rubber ring in grove.
- Assess the full socket depth by simple measurement and mark spigot accordingly
- Apply lubricant to the spigot side and to the inside of the joint on rubber
- Accurate axial alignment of the spigot and socket prior to jointing is important, hand feed spigot into rubber joint until resistance from the inner sealing section is felt.
- Bar and block assembly is recommended because a worker is able to feel the amount of force being used and whether the joint goes together smoothly.
- If undue resistance to pipe insertion is encountered, disassemble the joint and check the position of the rubber ring

IMPORTANT NOTICE

If pipes are cut on site, make sure that the new spigot ends are cut square with a find toothed saw and are chamfered to half pipe thickness with a coarse file before jointing. For 100 joints use the following amounts of lubricant;

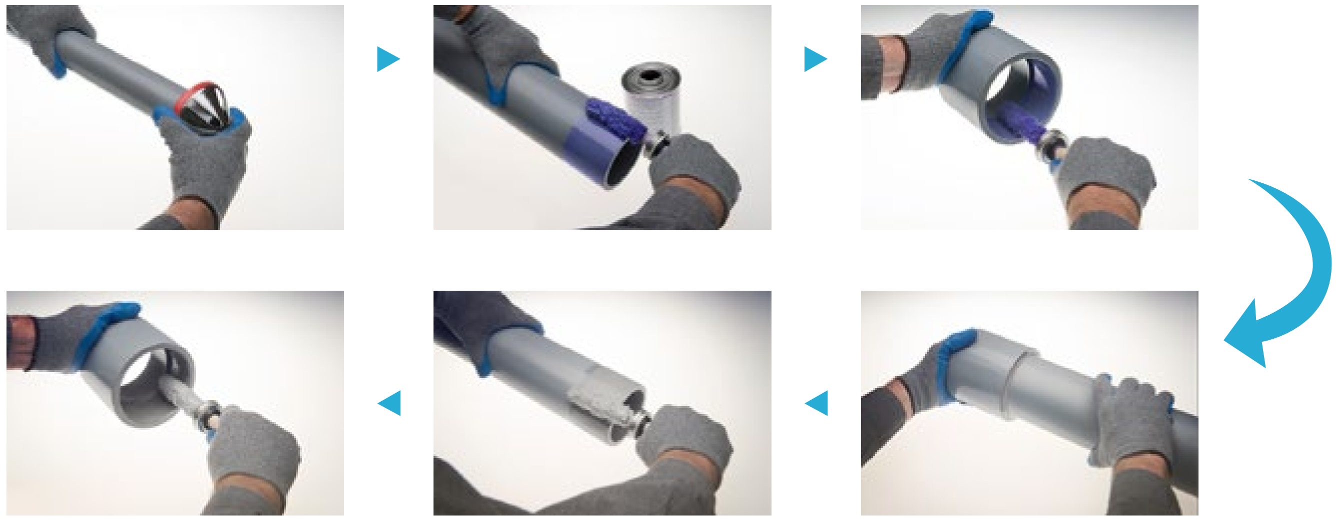
Pipe Outside Diameter DN	Dia. /mm	Kg. of Lubricant
DN 50	63	0,5
DN 80	90	0,85
DN 100	110	1,10
DN 125	125 / 140	1,35
DN 150	160	1,80
DN 200	200 / 225	2,40
DN 250	280	3,15
DN 300	315	3,85
DN 400	400	5
DN 450	450	6
DN 500	500	7

B) METHOD OF SOLVENT WELDED JOINT INSTALLATION

- Joint Preparation - Cut pipe square with axis, using a fine tooth saw with a miter box or guide. Remove all burrs and break the sharp lead edges.
- Cleaning & Priming-Surface to be joined must be cleaned and free of dirt, moisture, oil and other foreign material.

Applying Weld-On Primer :

- Mark on spigot the full length of the socket side to make sure that the spigot will fit exactly the socket length.
- Application of solvent cement - PVC solvent cement is fast drying and should applied as quickly as possible, consistently with good workmanship. Follow up the manufacturer's recommendation to both spigot and socket side with an adequate quantity of cement.
- Joint Assembly - While both the inside socket surface and the outside surface of the spigot of the pipe are wet with solvent cement, forcefully bottom the spigot in the socket. Turn the pipe or fittings 1/4 turn during assembly (but not after the pipe is bottomed) to distribute the cement evenly. Hold for a while until handling strength is developed. Assembly should be completed within 30 seconds after the last application of solvent cement.
- After assembly wipe excess cement from the pipe at the end of the socket. Gaps in the cement bead around the pipe perimeter may indicate a defective assembly. Handle the newly assembled joints carefully after 1 hour.



IMPORTANCE POINTS OF PIPE INSTALLATION WITH SOLVENT CEMENT JOINTS

- The jointing surfaces must be clean and dry
- Sufficient cement must applied to fill the gap between male and female ends
- The Assembly must be made while the surfaces are still wet and fuild
- Completed joints should not be disturbed until they have cured sufficiently to withstand handling.
- Keep the solvent cement closed and shaded when not actually in use. Discard the solvent cement when a noticeable change in viscosity occurs, when the cement does not flow freely from the brush or when the cement appears lumpy and stringy.

For 100 Joints u se the following amounts of adhesive and primer (Table No. 13)

Pipe Outside Diameter DN	O.D. Dia / mm	Primer (kg)	Adhesive (kg)
25	32	Approx. 0.5	Approx. 0.8
32	40	Approx. 0.7	Approx. 1.1
40	50	Approx. 0.9	Approx. 1.6
50	63	Approx. 1.7	Approx. 1.7
60	75	Approx. 1.3	Approx. 2.2
80	90	Approx. 1.4	Approx. 4.0
100	110	Approx. 1.7	Approx. 8.0
125	125 / 140	Approx. 2.1	Approx. 13.0
150	160	Approx. 2.5	Approx. 19.0
200	200 / 225	Approx. 4.5	Approx. 26.0
250	280	Approx. 6.5	Approx. 38.0
300	315	Approx. 10.2	Approx. 52.0
400	400	Approx. 12.9	Approx. 62.0
450	450	Approx. 14.4	Approx. 69.75
500	500	Approx. 16.0	Approx. 77.50

HYDROSTATIC TESTING

The length of test section will be determined by practical reasons such as availability of water or the number of pipes, fittings and joints to be tested. Long pipelines should be tested in sections as main laying progresses.

The pipe length to be tested may be blanked off using a blank iron or steel flange previously drilled and tapped for test equipment connection and strutted as necessary against end thrust. The blank flange may be attached to the pipeline by a Viking Johnson Flange Adapter or similar.

Testing should be preferably not be carried out against closed valves. All charging and testing should preferably be carried out from the lowest point of the under test section and all testing equipment should be located at this point. The pressure gauge also should be located at the lowest point or adjustment must be made for the level of the pressure gauge relative to the pipe's position.

Prior to testing, care should be taken to ensure that all anchor blocks have attained adequate maturity and that any solvent welded joints included in the pipe system have developed full strength. Correct support and anchorage of any above ground section of the pipeline is also necessary. Underground pipelines should be back-filled, taking particular care to consolidate around lengths which may have been deflected to negotiate curves. All joints may be left exposed until testing is completed.

With the stand pipe, valves and pressure gauge assembled, filling of the main can begin. The main should be charged slowly, preferably from the lowest point with any air cock in the open position. They should be closed in sequence from the lowest point when water, visibly free from aeration, is being discharged through them.

Satisfactorily charged, the main should be allowed to stand overnight to allow any residual air to 'settle-out' and percolate to the pipe soffit. Re-venting is then necessary and any water deficiency should be made-up.

Pressure testing can then begin by pumping slowly until the required test pressure is attained. A single or double cylinder hand pump should be used for this purpose. Mechanical pumps are not recommended unless incorporating a pre- set blow-off mechanism.

The hydrostatic test specification will be at the discretion of the responsible Engineer but should not exceed 1 1/2 times the designed working pressure of the lowest rated component in the system and a time duration of 24 hours.

A permissible water loss of 3 litres per kilometre of pipe per 25 mm nominal bore, per 3 bar of test pressure, per 24 hours, may be considered reasonable.

Air testing is not recommended if, however, for practical reasons, pneumatic testing is necessary, this should be limited to a maximum pressure of 1.5 bar.

Air leakage can be detected by applying soap solution to the joints or by pre-odourising the air with Ethyl Mercaptan. This will reduce the time duration of an otherwise long term pneumatic test.

During any air-pumping operations no one should be working on, or near, the test section and precautions should be taken to avoid heavy objects striking the main whilst under pneumatic pressure.

FLOW & FRICTION

FRICTION LOSSES

The smooth bores of uPVC pipes have better flow characteristics than those of metal pipes. The following is the co-efficient of friction given when using the Hazen-Williams formula:

$$f = 0.2083\left(\frac{100}{C}\right)^{1.85}\frac{Q^{1.85}}{di^{4.87}}$$

Q = Flow in gallons/min
di = Inside dia of pipe in inches
C = Constant for inside roughness of pipe
f = Friction head in feet of water / 100 feet of pipe

Values of C
up to 315 mm C = 137 - 150
over 315 mm C = 151

HEAD LOSSES ATTRIBUTABLE TO FITTINGS CAN BE FOUND BY APPLYING

$$h = \frac{KV^2}{2g}$$

h = Head loss (m).
K = Constant
V = Velocity of fluid (m/s)
g = Acceleration due to gravity (m/s2)

Values of K
Elbow 90° - 1.00
Elbow 45° - 0.40
Moulded Bends 90°C - 0.75
Formed Bends 90° - 0.20
Formed Bends 22 1/2° - 0.10
Flow in Line - 0.35
Flow in line to branch or branch to line - 1.20

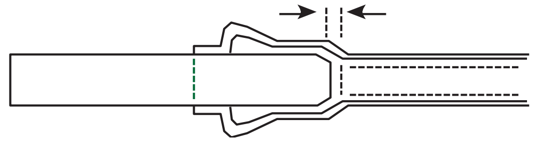
SURGE PRESSURES

Surge pressures commonly termed as “Water Hammer” are generated in any piping system when a flow changes its velocity.

$$P = \frac{4660V}{2.3g\sqrt{\frac{1+K(DR-2)}{E}}}$$

P = Surge pressure in PSI
V = Maximum velocity change in Ft/Sec.
g = Acceleration due to gravity 32.2
K = Friction head in feet of water / 100 feet of pipe
DR = Pipe outside diameter / wall thickness
E = Modulus of elasticity of the pipe in PSI. (420,000 PSI for PVC)

EXPANSION GAP



To be sure that the spigot enters the socket to within 13 -23 mm of the bottom of the socket dimension, the depth of chamber should be one third of the wall thickness of the pipe.

Calculation of pipe diameter based on required flow an velocity

$$ID = 10\sqrt{\frac{40.Q}{.V}}$$

ID = Inside diameter (mm)
Q = Flow rate in L/S orm / F
V = Velocity of Flow (M/S)

* Determination of the length changes caused by difference in temperature

ΔL = L ΔT L
ΔL = IN°C, ΔL = MM
L for uPVC = 0.05

THERMAL MOVEMENT

Where the temperature of a uPVC pipeline is likely to vary due to atmospheric temperature, it is important to plan the variations in pipeline length which may arise as a result of temperature differences. Expansion and contraction can be calculated using the formula.

$$dl = \infty \times L \times dt$$

where,
dl = Change in length in millimeters
∞ = 0.08 mm / m / C
L = Original length of pipe in meters
dt = Total temperature range in 0°C

Calculation of expansion and contraction should take account of the minimum and maximum foreseeable temperature conditions. When the total length variation of the pipeline has been established, the positioning of both support and anchor brackets can be determined.

Anchor brackets can be so arranged to sub-divide the total length variation and to control movement in a specific direction. Support brackets must allow the pipeline to move freely. It is normally possible by correct bracket arrangement to direct movement in such a manner that this is accommodated by directional changes in the line. Expansion bellows may be used to accommodate excessive movement but in such instances the pipes so connected must be restrained against possible separation.

Any line valves must be firmly anchored and independently supported so that no stresses are transmitted to the pipelines.

PIPE BRACKETS

Standard or purpose made metal pipe brackets are normally employed. These should be of the maximum possible bearing width and should have no sharp edges likely to cause pipe damage.

The brackets may be plastic coated but where this is not practical a layer of rubber felt or similar soft, non abrasive membrane must be fixed to the bearing face prior to installation.

PIPE SUPPORTS

UPVC pipes must be adequately supported. The following table shows the recommended support intervals for horizontal pipes conveying water. Where liquids of greater density are being conveyed the intervals of support should be reduced proportionately.

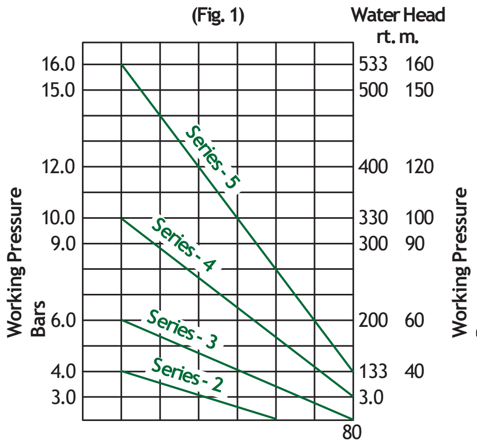
For vertical pipe runs, the support intervals may be increased to double those shown except in exposed situations where wind loading etc. may dictate adherence to the intervals tabulated below.

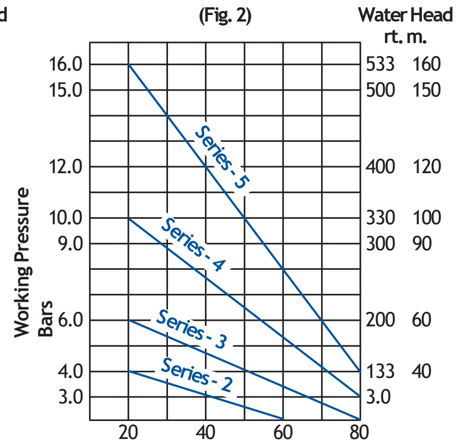
	Classes II & III		Classes IV & V	
Nom. Size	20°C	40°C	20°C	20°C
	m	m	m	m
12	-	-	0.70	0.60
20	-	-	0.77	0.70
25	-	-	0.85	0.80
32	-	-	0.90	0.85
40	-	-	1.07	0.90
50	1.07	0.92	1.15	1.00
63	1.22	1.07	1.30	1.15
75	1.30	1.15	1.37	1.22
90	1.34	1.18	1.45	1.26
110	1.37	1.22	1.52	1.30
140	1.52	1.37	1.67	1.45
160	1.60	1.45	1.82	1.60
180	1.75	1.52	2.00	1.75
200	1.82	1.60	2.05	1.82
205	1.90	1.67	2.20	1.90
250	2.05	1.75	2.37	2.05
315	2.30	2.05	2.52	2.20
355	2.37	2.20	2.67	2.42
400	2.60	2.45	2.75	2.60
450	2.90	2.75	2.97	2.82
500	3.20	3.05	-	-

UPVC PIPE AT ELEVATED TEMPERATURE

When uPVC pressure pipe operates at temperature other than the temperature at which the pipe is rated (20 or 23°C) pressure rating should be established on thermal design factors. Examples given below are for guidance only.

Pressure Temp. Relationship Ambient Variable Internal Temp. 20°C





Pressure Temp. Relationship Internal Variable Internal Temp. 20°C

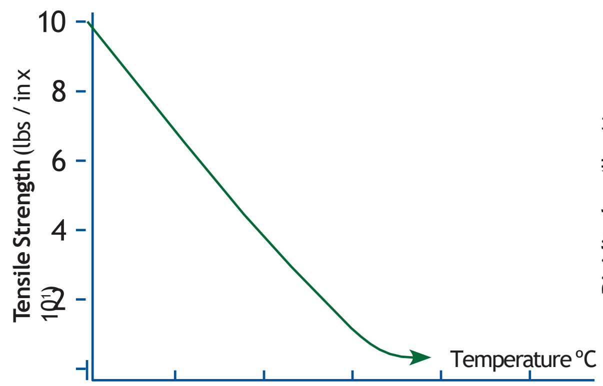
Ambient Temperature of 40°C a required working pressure of 6.0 bars use a 10 bar rated pipe

Ambient Temperature of 40°C a required working pressure of 6.0 bars use a 10 bar rated pipe

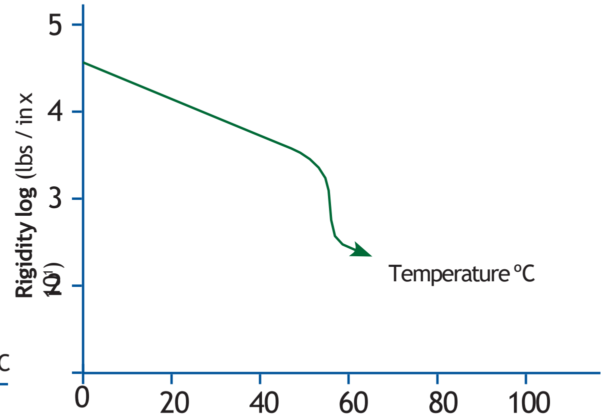
Temperature Conversion
F = 9/5(C+32) C = (F-32)5/9
Pressure Temperature Relationship

Temperature		Temperature Correction Factors
°C	°F	
21	70	1.00
27	80	0.90
32	90	0.75
38	100	0.62
43	110	0.50
46	115	0.45
49	120	0.40
52	125	0.35
60	140	0.22

Where the liquid carried in a pipeline is 20°C and the ambient temperature is higher than 20°C - the maximum working pressure should be reduced by 1 1/2 % per degree above 20°C.



Relationship between Tensile Strength & Temperature



Relationship between Rigidity & Temperature

Where liquid carried in a pipeline is 20°C and the ambient temperature is 20°C - the maximum working pressure should be reduced by 2% for every degree °C the fluid temperature is above 20°C. The aforementioned pressure reductions apply to maximum operating temperature of 60°C.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