COMPANY PROFILE

Qatar National Plastic Factory W.L.L. (QNPF) is leading manufacturer of:

(i) PVC Pipes and Fittings;
(ii) PE Pipes;
(iii) PE Construction Sheets and Warning Tapes; and
(iv) Cable Protection Tiles (PE).

Founded in 1977 (and one of the oldest industrial manufacturers in Qatar), Qatar National Plastic is now completing a QAR70 million programme of investment to modernise and expand the production range and capacity at our 22,000sqm facility in Doha-New Industrial Area. We are adding a complete range of fittings (drainage, soil & waste, pressure, conduits, spacers, etc) to our Qplast product line, manufactured to the highest international specifications and available by Q4, 2018.
We are fully approved for the sale of all products in Qatar with a 41-year record of success. We manufacture PVC pipes from 20mm to 630mm; PE pipes from 16mm to 800mm.

Our extensive indoor storage of 9,400m^2 at the factory, supplemented by additional offsite storage enables us to stock large quantities of pipes, fittings and other products away from sunlight, to give the best conditions and to enable continuous delivery.

In recent years, our general philosophy has changed. We are investing in the best technology production equipment to improve efficiency. We are introducing new technology to create a healthier water distribution network. We use no lead (Pb) in our products and we recycle as much as possible. To help improve the Qatari environment,we purchase between 2,400 and 2,700MT of Qatari waste plastic for reuse in our warning tile production, but we use none of this waste in our pipe production. We have recently terminated plastic bag production due to environmental problems, their use is causing; and we are introducing energy saving measures into our factory to reduce our pollution and carbon footprint.
Qatar National Plastic Factory is an Al Attiya family company founded by HE Brigadier Mohammed Al Attiya and still owned by his descendants and family.

u-PVC AND c-PVC pipes

Qatar National Plastic has a total capacity to manufacture more than 3,000MT per month of PVC pipe. We manufacture and stock a range of sizes of pipe (20mm to 630mm) as follows:

uPVC High Pressure Pipes (BSEN 1452, BS 3505, DIN 8062, ASTM D 1785)
uPVC Soil & Waste Pipes (BSEN 1329, prev. BS 5255);
uPVC Underground Drainage Pipes (BSEN 1401 prev. BS 4660, including perforated);
uPVC Drain, Waste & Vent Pipes (ASNZS1260-2017 and ASTM D 2665);
uPVC Electrical Conduits (BS 4607 and NEMA Standard);
uPVC Telephone & Electrical Ducts (Kahramaa, Ashghal, UGN, QAF, MOI-SSD, CRA, Vodafone and Ooredoo Specification, BS 4607).

Addition to the above, Qatar National Plastic is able to manufacture special pipes for custom orders, for example u-PVC perforated drainage pipes are manufactured on request according to QCS and international standards such as BSEN 1401.
Innovation: In Q4 2018, we will become the first company to introduce the new ChemART® uPVC technology with greater chemical resistance and increased microbial growth prevention for uPVC pipes. This pipe also have improved flow. This PVC pipe is completely

resistant to chlorine dioxide chemical attack and a cost effective solution for drinking water applications above 50mm diameter.

PVC Pipe Fittings.

The Injection Moulding Division began operating in 2016 and by Q4 2018 will have expanded to a planned capacity of 620MT per month. This will double in 2019 to reach 1,500 MT per month.

We are currently producing Qplast u-PVC fittings for use with BSEN 1329 and BSEN 1401 pipes for underground and above ground drainage systems. During 2019, this range will expand to include high pressure pipe fittings confirming to BS 3505 and DIN 8062, as well as electrical conduit fittings confirming to BS 4607 and other relevant European norms.

This production is in addition to our in-house fabrication of various u-PVC electrical duct accessories including bends and welded fittings and our range of electrical duct spacers designed particularly for the Qatari environment (interlocking HDPE Ducts spacers).

For those that require uPVC fittings and pipes with an European brand, we continue to supply:

High Pressure Pipe Fittings from EFFAST (Italy); and
Drainage Pipe Fittings from REDI (Italy).

Qatar National Plastic also manufactures both Effast and Redi pipes under license from these European manufacturers for sale with the fittings.

HDPE pipes and fittings.

Qatar National Plastic has a monthly production capacity of HDPE pipe of more than 1,000MT. Our pipes are manufactured to conform to both European and ISO standards. Pressure pipe conforming to ISO 4427, ISO 4437, DIN 8074 and 12201, drainage pipes confirming BSEN 1519, BSEN 12666. Addition, we produce HDPE ducts in accordance with the requirements of the various Qatari standards including Kahramaa, ITS, QNBN, Vodafone.

We manufacture on demand HDPE perforated pipes (half and full) in accordance with both ISO 4427 and BSEN 12666.
HDPE fittings are supplied from PLASTITALIA (Italy) or as fabricated internally.

Polyethylene Tiles (for buried cable warnings)

The PE Tile extrusion is carried our on 2 machines with a combined monthly capacity of 470MT. Qatar National Plastic products are approved by all major Qatari utilities and users such as Kahramaa and Qatar Petroleum (QP) with tile thicknesses of 6mm, 8mm and 12mm and a variety of widths. Tiles are supplied with joining pegs.

Polyethylene sheet, warning tapes and sleeves (for DI pipes).

Production capacity for films and sheet with a thickness of 0.5mm and below is more than 500MT per month. We produce the following:

UV treated greenhouse films;
agricultural mulch films;
Polyethylene Sleevings for Ductile Iron Pipes (UV Treated);

Polyethylene Sheets (Up to 2000 Gauge)
Polyethylene Trench Marker Tapes and warning tapes including;

- KAHRAMAA (water & electrical),
- Ashghal (drainage);
- Telecom;
- Street Lighting;
- Intelligent Transportation System;
- UGN;
- Ooredoo;
- Vodafone, etc.

We already hold the approval from all government end users for our sheet and film products.

Qatar National Plastic Quality Control

Quality can never be taken for granted. It requires constant commitment.

Since 2016, Qatar National Plastic has invested over QAR 2.1 million in the latest quality control test equipment and training. We believe that strict adherence to quality standards is critical: from raw material selection through to the final manufactured product. In addition, this commitment must be reflected in storage, transport and installation.

At present, the Qatari market relies for the most part on a third party test certificate to approve pipe manufacturers. There is little checking of factory facilities or actual production. This has led to a situation where companies do not invest in the necessary test equipment normally required by regulators, utilities and contractors, nor do they adhere to the chemical composition of the product necessary to comply with the relevant standard. The heavy metal Lead (Pb) is frequently used in the stabiliser, although this is in fact banned in Qatar.

Qatar National Plastic's "Qplast" brand is produced without compromise.

The product is lead (Pb) free.
Pipes and fittings are manufactured according to standard.
All batches are routinely tested according to standard.
No contaminated materials are used.
Testing is done with the latest European equipment, per standard.

In accordance with international standards the following tests must routinely be carried out on particular pipe production batches to ensure quality:

Standard	BSEN 1401	BSEN 1329	BSEN 1452	DIN 8062	QCS Duct	NEMA
Impact test	YES	YES	YES	YES	YES	YES
Reversion	YES	YES	YES	YES	YES	
Dichloromethane	YES	YES	YES	YES		
Ring Stiffness/Compression	YES					YES
Vicat Softening	YES	YES	YES	YES		
Hydrostatic Pressure/Leakage			YES	YES		YES
Tensile Strength/Elongation		YES				

In addition to the above tests, there are tests performed on the raw materials (eg: bulk density, volatile content, ash content, etc.) as well as product tests performed with less regularity such as long term pressure, ash content, long term vicat softening, opacity, etc.

Typical Properties of uPVC Pipe Material

uPVC introduction: Unplasticized polyvinyl chloride is a thermoplastics material which consists of PVC resin compounded with varying proportions of stabilizers, lubricants, fillers, pigments and processing aids. Different compounds of these ingredients have been developed to obtain specific groups of properties for different applications. However, the major part of each compound is PVC resin. The technical terminology for PVC in organic chemistry is poly (vinyl chloride): a polymer, i.e. chained molecules of vinyl chloride. PVC is a versatile polymer because it can be rigid, flexible and transparent based on the composition of chemicals with it. Rigid PVC or uPVC pipes are used widely in piping applications.

ChemART Technology: ChemART technology is unique production process of uPVC pipes which supplements additional chemical resistance, antimicrobial properties and improved flow properties. The ChemART uPVC pipes can be manufactured with sizes greater than 63mm. Using this European technology uPVC pipes are provided with improved properties without a significant increase in price. These pipes are designed for consuming water disinfected with chlorine dioxide.

General properties of PVC compounds used in pipe manufacture are given in the Table below. (Table P.1)

Property	Value	Conditions and Remarks
Physical properties		
Molecular weight (resin)	160000	cf: K57 PVC 70,000
Relative density	1.43 – 1.49	cf: PE 0.95 – 0.96, GRP 1.4 – 2.1, CI 7.2, Clay 1.8 – 2.6
Water absorption	<4mg/cm³	
Hardness	80 - 100	Shore D Durometer
Impact strength – 20°C	20 kJ/m2	Charpy 250 µm notch tip radius
Impact strength – 0°C	8 kJ/m2	Charpy 250 µm notch tip radius
Coefficient of friction	0.4	PVC to PVC
Opacity	<0.20%	
Mechanical properties		
Ultimate tensile strength	45-52 Mpa	23°C cf: HDPE 23 - 25 Mpa
Elongation at break	30 – 80%	23°C cf: HDPE 600% - 800%
Short term creep rupture	44 Mpa	Constant load 1 hour value
Long term creep rupture	28 Mpa	Constant load extrapolated 50 year value
Elastic tensile modulus	3.0 – 3.3 GPa	1% strain at 100 sec.
Elastic flexural modulus	2.7 – 3.0 GPa	1% strain at 100 sec
Long term creep modulus	0.9 – 1.2 GPa	Constant load extrapolated 50 year sec.
Shear modulus	1.0 GPa	1% strain at 100 seconds
Bulk modulus	4.7 GPa	1% strain at 100 seconds
Poisson's ratio	0.4	Increases marginally with time under load.
Compression Strength	66 Mpa	
Electrical properties		
Dielectric strength (breakdown)	15 – 21 kV/mm	
Volume resistivity	2 x 1014 Ω.m	
Surface resistivity	10^{13} – 10^{14} Ω	
Dielectric constant (permittivity)	3.9 (3.3)	50 Hz (106 Hz)
Dissipation factor (power factor)	0.01 (0.02)	50 Hz (106 Hz)
Thermal properties		
Softening point (V.S.T.)	79 – 84°C	5 kg load
Min. continuous operating temp.	0°C	
Max. continous service temp.	60°C	Not under Pressure
Coefficient of thermal expansion	6 x 10^{-5} K	cf: HDPE 18 - 19 x 10^{-5}K
Thermal conductivity	0.16 W/m.K	0 – 50°C
Specific heat	1,000 J/(kg.K)	0 – 50°C
Thermal diffusivity	1.1 x 10-7 m2/s	0 – 50°C
Heat deflection temperature	60 - 80°C	
Fire performance		
Flammability (limiting oxygen index)	0.45	ASTM D2863
Ignitability index	10 – 12 (/20)	
Smoke produced index	6 – 8 (/l0)	
Heat evolved index	0	
Spread of flame index	0	Will not support combustion due to presents of chlorine.

Unless otherwise noted, the values given are for standard unmodified formulations using K67 PVC resin. The properties of all thermoplastics are subject to significant changes with temperature, and the applicable range is noted where appropriate. Mechanical properties are subject to change resulting from stress, and are properly defined by creep functions. More detailed data pertinent to pipe applications are given the design section of this manual. For data outside of the range of conditions listed, users are advised to contact our Technical Department.

Standard: BS 3505 – also included in BSEN 1452 - Imperial

Scope:
The British standard, BSEN 1452 specifies both metric and imperial and includes the old BS 3505 which specifies uPVC pipes for the conveyance of cold portable water, irrigation, forced sewer, condensate drainage under the working pressure rating of 9, 12 or 15 bar at 20° C depending upon the size and thickness.
Colour:
Dark Grey RAL 7011
Appearance:
6 / 5.8 meter with spigot end & socket-solvent cement joint type. Rubber ring joint available 10" and above.

Nominal Size (In.)	Mean Outside Diameter (mm)		Wall Thickness (mm)					
	Minimun	Maximum	Class C (PN 9)		Class D (PN 12)		Class E (PN 15)	
			Min	Max	Min	Max	Min	Max
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
1¼″	42.1	42.4	-	-	2.2	2.2	2.7	3.2
1½″	48.1	48.4	-	-	2.5	2.5	3.1	3.7
2″	60.2	60.5	2,5	3.0	3.1	3.1	3.9	4.5
2½″	75.0	75.3	3.0	3.5	3.9	3.9	4.8	5.5
3″	88.7	89.1	3.5	4.1	4.6	4.6	5.7	6.6
4″	114.1	114.5	4.5	5.2	6.0	6.0	7.3	8.4
6″	168.0	168.5	6.6	7.6	8.8	8.8	10.8	12.5
8″	218.8	219.4	7.8	9.0	10.3	10.3	12.6	14.5
10″	272.6	273.4	9.7	11.2	12.8	12.8	15.7	18.1
*12″	323.4	324.3	11.5	13.3	15.2	15.2	18.7	21.6
*16″	405.9	406.9	14.5	16.7	19.0	19.0	23.4	27.0
*20″	507.5	508.5	18.1	20.9	-	-	-	-
*24″	609.1	610.1	21.7	25.0	-	-	-	-

(* size marked are specific order only)

Note: All Pressure ratings are based on 20° Celsius, increases in temperature will be applied pressure derating according to the factor. (see P6)
QA/QC Test: Hydrostatic pressure test (long term & short term); impact test, vicat softening temperature, opacity, dichloromethane test, longitudinal reversion, density.
uPVC Fittings and Accesories: Qplast Fittings are supplemented by Effast fittings from italy.

Standard: BSEN 1452 – Metric

Scope:
These pipes are manufactured confirm to BSEN 1452 standard for the water supply under pressure range 6 to 25 bars. The pipes are used conveyance of cold portable water, irrigation, forced sewer, condensate drainage.
Colour:
Dark Grey RAL 7011
Appearance:
6 / 5.8 mtr with spigot end & socket-solvent cement joining type. Rubber ring joint available in 315mm.

Nominal	NOMINAL WALL THICKNESS							
Outside	PIPE SERIES (S) & STANDARD DIMENSIONAL RATIO (SDR)							
Diameter (mm)	S20 (SDR 41)	S16,7 (SDR 34,4)	S16 (SDR 33)	S12,5 (SDR 26)	S10 (SDR 21)	S8 (SDR 17)	S6,3 (SDR 13,6)	S5 (SDR 11)
	NOMINAL PRESSURE PN BASED ON SERVICE (DESIGN) COEFFICENT C=2,5, AT TEMPERATURE OF 20°C							
		PN 6	PN 6	PN 8	PN 10	PN 12.5	PN 16	PN 20
20	-	-	-	-	-	-	1,5	1,9
25	-	-	-	-	-	1,5	1,9	2,3
32	-	-	-	1,5	1,6	1,9	2,4	2,9
40	-	-	1,5	1,6	1,9	2,4	3,0	3,7
50	-	1,5	1,6	2,0	2,4	3,0	3,7	4,6
63	-	1,9	2,0	2,5	3,0	3,8	4,7	5,8
75	-	2,2	2,3	2,9	3,6	4,5	5,6	6,8
90	-	2,7	2,8	3,5	4,3	5,4	6,7	8,2
	PRESSURE PN BASED ON SERVICE (DESIGN) COEFFICIENT C= 2,0,AT TEMPERATURE OF 20°C							
	PN 6	PN 7,5	PN 8	PN 10	PN 12,5	PN 16	PN 20	PN 25
110	2,7	3,2	3,4	4,2	5,3	6,6	8,1	10,0
125	3,1	3,7	3,9	4,8	6,0	7,4	9,2	11,4
140	3,5	4,1	4,3	5,4	6,7	8,3	10,3	12,7
160	4,0	4,7	4,9	6,2	7,7	9,5	11,8	14,6
180	4,4	5,3	5,5	6,9	8,6	10,7	13,3	16,4
200	4,9	5,9	6,2	7,7	9,6	11,9	14,7	18,2
225	5,5	6,6	6,9	8,6	10,8	13,4	16,6	-
250	6,2	7,3	7,7	9,6	11,9	14,8	18,4	-
280	6,9	8,2	8,6	10,7	13,4	16,6	20,6	-
315	7,7	9,2	9,7	12,1	15,0	18,7	23,2	-

QA/QC Test: Hydrostatic pressure test (long term & short term), impact test, vicat softening temperature, opacity, dichloromethane test, longitudinal reversion, density.
uPVC Fittings & Accessories: Qplast Fittings are supplemented by Effast fittings from Italy.

Qplast

Standard: DIN 8062

Scope:

The pipes are manufactured confirm to DIN 8062 is used for cold potable water, swimming pools, desalination, irrigation, forced sewer, condensated drain.

Colour:

Dark Grey RAL 7011

Appearance: 6 / 5.8 mtr with spigot end & socket-solvent cement joining type. Rubber ring joint available 315mm and above.

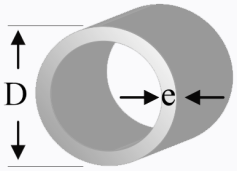
Outer Diameter In mm (DN)		Wall Thickness (e) in mm							
		PN 4 (Series 25)		PN 6 (Series 16.7)		PN 10 (Series 10)		PN 16 (Series 6.3)	
		SDR 51		SDR 34.4		SDR 21		SDR 13.6	
Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
20	20.20	-	-	-	-	-	-	1.50	1.90
25	25.20	-	-	-	-	1.50	1.90	1.90	2.30
32	32.20	-	-	-	-	1.80	2.20	2.40	2.90
40	40.20	-	-	-	-	1.90	2.30	3.00	3.60
50	50.20	-	-	1.50	1.90	2.40	2.90	3.70	4.30
63	63.30	-	-	1.90	2.30	3.00	3.60	4.70	5.40
75	75.30	1.80	1.90	2.20	2.70	3.60	4.20	5.60	6.40
90	90.30	1.80	2.20	2.70	3.20	4.30	5.00	6.70	7.60
110	110.40	2.20	2.70	3.20	3.80	5.30	6.10	8.10	9.20
160	160.50	3.20	3.80	4.70	5.40	7.70	8.70	11.80	13.20
200	200.60	3.90	4.50	5.90	6.70	9.60	10.80	14.70	16.40
225	225.70	4.40	5.10	6.60	7.50	10.80	11.10	16.60	18.50
250	250.80	4.90	5.60	7.30	8.30	11.90	13.30	18.40	20.50
315	316.00	6.20	7.10	9.20	10.40	15.00	16.80	23.20	25.80
*400	410.20	7.90	8.90	11.70	13.10	19.10	21.30	29.40	32.60
*500	501.50	9,80	11.00	14.60	16.30	23.90	26.50	-	-
*630	631.90	12.30	13.80	18.40	20.50	30.00	33.30	-	-

Note: Pressure ratings are based on 20° Celsius only, increases in temperature will be applied pressure derating according to the factor. (see P6)

(* The sizes marked with * are made to specific order only)

QA/QC Test: Tests conducted: Heat reversion (oven method); hydrostatic pressure testing, impact resistance (striker method); dichloromethane test.

uPVC Fittings & Accesories: Qplast Fittings are supplemented by Effast fittings from italy.



SDR =DN/e
SDR = Standard Dimensional Ratio
DN = Nominal Diametet
e = Wall Thinkness

Standard: ASTM D 1785/ DRAIN WASTE, VENT PIPE - ASTM D 2665

Scope:

The specification ASTM D 1785-88 covers unplasticized polyvinyl chloride (uPVC) pipes manufactured in SCH-40 and 80 for water distribution and irrigation systems, forced sewer & condensate drain. The specification ASTM D 2665- 88 covers unplasticized polyvinyl chloride (uPVC) pipes for Drain, Waste and Vent applications.

Colour:

ASTM 1785 Dark Grey RAL 7011, ASTM D2665-White RAL 9016.

Appearance:

6 / 5.8 meter with spigot end & socket-solvent cement joining type.

Nominal Size	Outside Diameter		Wall Thickness					
In inch	In mm		ASTM D 1785		ASTM D 1785		ASTM D 2665	
			Schedule 40		Schedule 80		(Drain, Waste, Vent)	
	Min	Max	Min	Max	Min	Max	Min	Max
½	21.24	21.44	2.77	3.28	3.73	4.24	-	-
¾	26.57	26.77	2.87	3.38	3.91	4.42	-	-
1	33.27	33.53	3.38	3.89	4.55	5.08	-	-
1¼	42.03	42.29	3.56	4.07	4.85	5.43	3.56	4.07
1½	48.11	48.41	3.68	4.19	5.08	5.69	3.68	4.19
2	60.17	60.47	3.91	4.42	5.54	6.20	3.91	4.42
2½	72.84	73.20	5.16	5.77	7.01	7.85	-	-
3	88.70	89.10	5.49	6.15	7.62	8.53	5.49	6.15
4	114.07	114.53	6.02	6.73	8.56	9.58	6.02	6.73
6	168.00	168.56	7.11	7.97	10.97	12.29	7.11	7.97
8	218.70	219.46	8.18	9.17	12.70	14.22	8.18	9.17

Pressure Ratings (PSI)												
Size (Inch)	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8
SCH 40	600	480	450	370	330	280	300	260	220	190	180	160
SCH 80	820	690	630	520	470	400	420	370	320	290	280	250

QA/QC Test: Heat Reversion (Oven Method); Hydrostatic Pressure Test; Dichloromethane test.

Ring stiffness of pipes

Where a calculation of the initial pipe deflection is applied, the initial ring stiffness of the pipe shall be taken from table P2

Table P.2 - Initial Ring Stiffness of Pipes

Nominal Pressure	Pipe Series S 20 (SDR 41)	S 16,7 (SDR 34,4)	S 16 (SDR 33)	S 12,5 (SDR 26)	S 10 (SDR 21)	S 8 (SDR 17)	S 6,3 (SDR 13,6)	S 5 (SDR 11)
for d_n < 90	-	PN 6	PN 6	PN 8	PN 10	PN 12,5	PN 16	PN 20
for d_n > 90	PN 6	PN 7,5	PN 8	PN 10	PN 12,5	PN 16	PN 20	PN 25
Calculated ring Stiffness in kN/m² (S_{calc})	3,9	6,7	7,6	16	31,3	61	125	250
Nominal ring Stiffness SN	4	8	-	16	32	64	128	256

The initial ring stiffness S_{calc} has been calculated using the following equation:

$$S_{calc} = \frac{E \times I}{(d_e - e_n)^3} = \frac{E}{96[S]^3}$$

where:

S_{calc} is the calculated initial ring stiffness in kilonewtons per square meter;
E is the modulus of elasticity in flexure, having the value of 3×10^6 kN/m²;
I is the moment of inertia in cubic millimeters with $\frac{1 \times e_n^3}{12}$ for 1 m pipe length;
d_e is the nominal outside diameter in millimeters;
e_n is the nominal wall thickness in millimeters;
S is the pipe series.

Note 1 In practice the initial ring stiffness is always higher than calculated, because the average wall thickness is greater than the normal wall thickness used for the calculation.
Note 2 When pipes with normal ring stiffness SN ≤ 4 are installed below ground, care should be taken to avoid excessive ovalization.

Flow Parameters of Fluids in uPVC Pipes

The flow inside the pipe is measurable with respect to nature of the surface of a pipe and the velocity of fluid that it is carrying, the flow in a pipe will either be rough turbulent, smooth turbulent or most probably in between. The Colebrook-White equation incorporates the smooth turbulent and rough turbulent conditions.

In comparison with the metal pipes and concrete pipes, uPVC pipes have low frictional loss, due to low roughness coefficient hence uPVC pipes are highly recommendable for conveying all type of fluids.

$$V = -2\sqrt{2g\,Di.}\quad \log.\ \frac{Ks}{3.7D}\quad \frac{2.5\vartheta}{D\sqrt{2g\,Di.}}$$

V = velocity
g = acceleration due to gravity (9.807 M/s2)
i = hydraulic gradient
ϑ = kinetic viscosity (1.004×10^{-6})
Ks = linear measure of roughness in mm = 0.0015mm
D = mean internal pipe diameter

Hydraulic Flow Chart

Figure P3 comprises the friction loss diagram for PVC-U pipes calculated by L-E Janson in accordance with Colebrook. For internal diameters up to 200 mm k = 0.02 mm and for larger diameters k = 0,05 mm. The temperature of the water is ± 10°C.

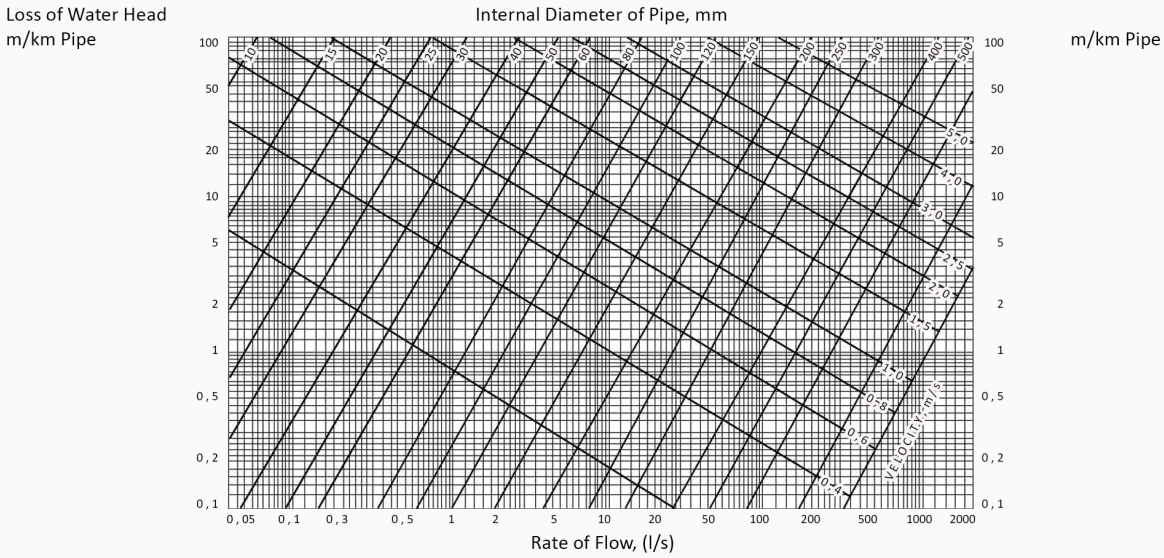


Figure P.3 - Flow Chart for Head Losses in Pipes

Head Losses

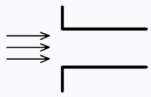
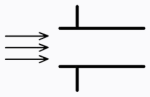
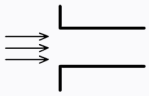
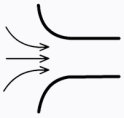
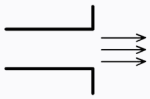
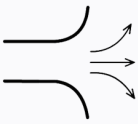
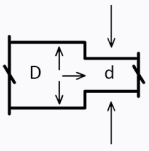
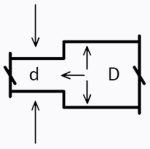
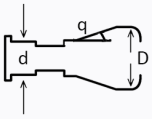
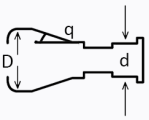
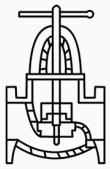
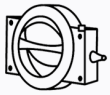
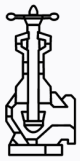
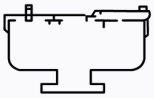
Pressure drops in pipelines are common. Whenever there is a change in the cross section or flow direction in a pipeline energy losses occur, this is a result of disturbances to the normal flow that show up as pressure drops. Pressure Drops which occur at sudden changes in section, at valves and at fittings are usually small compared with frictional losses in long pipelines.

However, they may contribute a significantlly to the total losses in short pipeline systems with several fittings. It can be shown that form losses in pipes may be expressed as a constant multiplied by the velocity head:

i.e. loss in pressure head H_L (m) $= K \frac{V^2}{2g}$

Where:
V = velocity (m/s)
K = resistance coefficient (See figure P.4)

Figure P.4 - Resistance Coefficients for Valves, Fittings and Changes in Pipe Cross Section.

Fitting Type		K
Pipe Entry Losses		
Square Inlet		0.50
Re-entrant Inlet		0.80
Slightly Rounder Inlet		0.25
Bellmouth Inlet		0.05
Pipe Exit Losses		
Square Outlet		1.00
Rounded Outlet		1.00
Tees		
(a) Flow in line		0.35
(b) Line to branch flow		1.20
Pipe Intermideate Losses		
Elbows R/D <0.6		45° 0.4 90° 1.0
Long Radius Bends (R/D > 2)		11¼° 0.05 22½° 0.20 45° 0.30 90° 0.40
Sudden Contraction		
Ratio d/D		
0.9		0.10
0.8		0.18
0.7		0.26
0.6		0.32
0.5		0.38
0.4		0.42
0.3		0.46
0.2		0.48
< 0.2		0.50
Sudden Enlargements		
Ratio d/D		
0.9		0.04
0.8		0.13
0.7		0.26
0.6		0.41
0.5		0.56
0.4		0.71
0.3		0.83
0.2		0.92
< 0.2		1.00
Gradual Enlargements		
Ratio d/D q = 10° typical		
0.9		0.02
0.7		0.13
0.5		0.31
0.3		0.42
Gradual Contractions		
Ratio d/D q = 10° typical		
0.9		0.03
0.7		0.08
0.5		0.12
0.3		0.15
Valves		
Gate Valve (fully open)		0.13
Reflux Valve		2.50
Globe Valve		10.00
Butterfly Valve (fully open)		0.30
Angle Valve		5.00
Foot Valve with Strainer		15.00
Air Valves		zero
Ball Valve		0.10

Effect of Temperature on Pressure Rating

uPVC pressure pipes are suitable for use at service temperatures up to 60°C. However, we must take into consideration in the design of the working pressure since this will be reduced with increase in the ambient temperature.

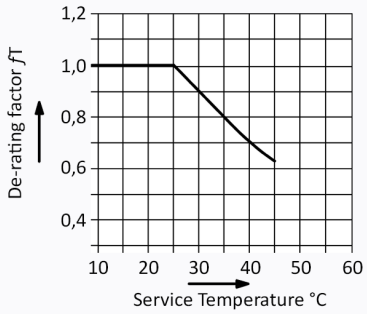
Mechanical properties of uPVC are temperature dependent. Nominal working pressures are determined at 20°C. For lower operating temperatures, the 20°C ratings are used, even though properties such as tensile strength are greater. As the temperature decreases, it is advisable to take additional care to avoid impact damage as the impact strength decreases with temperature zero degree Celsius and below.

To compensate for operates temperature above 20°C it is necessary to apply "de-rating factor" in the design. In the case of BSEN 1452 the de-rating factor (fT) for the service temperature to 45°C can be determined from the graph below (figure P5 and table P6)

If we are considering a PN 15 pipe to work at 45°C, the de-rating factor of 45°C is 0.63, so that the maximum allowable operating pressure at 45°C in the frequent use is 0.63 x 15 bar = 9.43 bar. Here the service period also plays a vital role in the design criteria. See below Table P7

For some applications, which need additional de-rating factor for e.g. more safety than the overall service (design) coefficient of 2 or 2.5 an additional factor (fA) can be chosen at the design stage.

The allowable working pressure in continuous use can be determined from the formula: (PFA) = fT x fA x [PN] Where: PFA is the allowable operating pressure; fT is the de-rating factor for the service temperature between 25°C to 45°C; fA is the de-rating factor related to the application; [PN] is the nominal pressure.



P.5

Service Temp.°C	PN4	PN6	PN9	PN10	PN12	PN15	PN16	PN20	PN25
25	4	6	9	10	12	15	16	20	25
30	3.6	5.4	8.1	9	10.8	13.5	14.4	18	22.5
35	3.2	4.8	7.2	8	9.6	12	12.8	16	20
40	2.84	4.26	6.39	7.1	8.52	10.7	11.4	14.2	17.8
45	2.52	3.78	5.67	6.3	7.56	9.45	10.1	12.6	15.8

P.6

Figure P.7 - Allowable Working Pressure for uPVC Pipes with Safety Factor (SF) =2,0

		Pipe Series S									
		63	25	20	16,7	12,5	10	8	6,3	5	4
		Standard Dimension Ratio SDR									
Temperature	Years of	127	51	41	34,4	26	21	17	13,6	11	9
°C	Service	Allowable Working Pressure[a] bar									
	5	2,6	6,5	8,2	9,8	13,0	16,3	20,4	26,1	32,5	40,9
	10	2,5	6,3	8,0	9,5	12,7	15,9	19,9	25,4	31,7	39,9
10	25	2,4	6,1	7,7	9,2	12,3	15,4	19,3	24,6	30,7	38,7
	50	2,4	6,0	7,5	9,0	12,0	15,1	18,8	24,1	30,0	37,8
	100	2,3	5,9	7,4	8,8	11,8	14,7	18,4	23,5	29,3	36,9
	5	2,2	5,5	6,9	8,2	11,0	13,7	17,1	21,9	27,3	34,4
	10	2,1	5,3	6,7	8,0	10,7	13,4	16,7	21,4	26,6	33,5
20	25	2,0	5,1	6,4	7,7	10,3	12,9	16,1	20,6	25,6	32,3
	50	2,0	5,0	6,3	7,5	10,0	12,5	15,6	20,0	25,0	32,0
	100	1,9	4,8	6,1	7,3	9,7	12,2	15,2	19,4	24,2	30,5
	5	1,8	4,4	5,5	6,6	8,8	11,1	13,8	17,7	22,0	27,8
30	10	1,7	4,3	5,4	6,4	8,6	10,7	13,4	17,1	21,3	26,9
	25	1,6	4,1	5,2	6,2	8,2	10,3	12,9	16,5	20,6	25,9
	50	1,6	4,0	5,0	6,0	8,0	10,0	12,4	15,9	19,9	25,0
	5	1,3	3,4	4,2	5,1	6,8	8,5	10,6	13,5	16,9	21,2
40	10	1,3	3,2	4,1	4,9	6,5	8,2	10,2	13,0	16,3	20,5
	25	1,2	3,1	3,9	4,6	6,2	7,8	9,7	12,4	15,5	19,5
	50	1,2	3,0	3,8	4,5	6,0	7,5	9,4	12,0	15,0	18,8
	5		2,4	3,0	3,6	4,8	6,0	7,4	9,5	11,9	14,9
50	10		2,3	2,9	3,4	4,6	5,7	7,1	9,1	11,4	14,3
	25		2,1	2,7	3,2	4,3	5,4	6,8	8,6	10,8	13,6
	5		1,5	1,9	2,2	3,0	3,8	4,7	6,0	7,5	9,4
60	10		1,4	1,8	2,1	2,8	3,6	4,4	5,7	7,1	8,9
	25		1,3	1,7	2,0	2,6	3,3	4,1	5,3	6,6	8,3

The Allowable working pressure have been calculated on the basis of the strength values specified in DIN 8061 for uPVC. The allowable working pressure is normally lower in the actual pipeline systems, as they comprise pipes, fittings, valves, and various connection techniques. In order to satisfy special users requirements, overall service (design) coefficient, C, other than 2,5 and 2,0 but not lower than 1,6 may be applied.

Jointing Operations

(i) Solvent cement adhesives and cleaning fluids are flammable, it is important that smoking is prohibited in the area in which these materials are being used. Solvent cement operations should be carried out in a well-ventilated area. Solvent cements and cleaning fluids can be detriminal to health if inhaled or come in contact with the skin.

(ii) The pipe end to be jointed shall be cut square to its axis and free from irregularities such as burrs and swarf. It should be chamfered as in accordance with relevant specification to prevent excessive amounts of adhesive being scraped off the socket including. When the chamfer is applied on site.

(iii) Both the spigot and socket should be thoroughly cleaned and roughed with glass paper or emery cloth. Excessive abrasion must be avoided.

(iv) The surfaces to be jointed should be clean, dry and free from grease. It is recommended that a degreasing agent is used for this purpose.

(v) The solvent cement should be applied in an even layer and in a longitudinal direction to both spigot and socket joining surfaces.

(vi) The application of the solvent cement should be performed quickly and carefully. For diameters greater than 110 mm, two persons are necessary to apply the adhesive, one to the spigot end and one to the socket simultaneously.

(vii) Immediately and without twisting, the spigot should be pushed into the socket to the required depth. Excessive amounts of adhesive around the socket mouth should be removed as soon as the joint has been made. Once the joint is made, leave to dry without disturbing for at least 8 minutes for sizes up to and including 63mm, and 40 minutes for all sizes greater than 63mm.

(viii) The joint will be timely fixed, however Cement Joint required a time 'cure' period before become fully able to withstand pressure. Do not apply pressure before 24 hours (up to 110mm) and 36 hours (above 110mm).

Note: Solvent cementing is not recommended at temperatures of 0°C and below.

Cold Bending on Site (See recommendation of BSEN 1452)

It is permitted for pipes to deviate from one continuous straight line by either of the following techniques:

a.) Means of a slight deflection within a elastomeric ring joint.
b.) The gradual curvature of each pipe length.

To ensure that the efficiency of the elastomeric ring seal is not impaired, deflection within the joint would normally be limited to a maximum of 1°. For greater deflections, special designs of joint should be used and the Qatar National Plastic advice obtained. The radius of curvature, R, of a cold-formed bend over the length of a 6 m pipe shall not be less than 300 times the external diameter of the pipe (see figure P.8). Table P.9 gives useful dimensions for cold-bent pipes up to and including a d of 160 mm.

Pipes of diameters greater than 160 mm are regarded as rigid pipes and should not be subjected to cold bending. Fore changes in direction of pipelines greater than 180 mm diameter long-radius pre-formed bends should always be used. Pipes should not be subjected to cold bending when ambient temperatures are less than 5°C.

$\emptyset$ = Max. OD pipe
R = 200 $\emptyset$
$\alpha^\circ = \frac{180L}{\pi R}$
$S = 2R \times \sin\frac{\alpha^\circ}{2}$
$A = S \times \sin\frac{\alpha^\circ}{2}$
$B = R - R \times \cos\frac{\alpha^\circ}{2}$

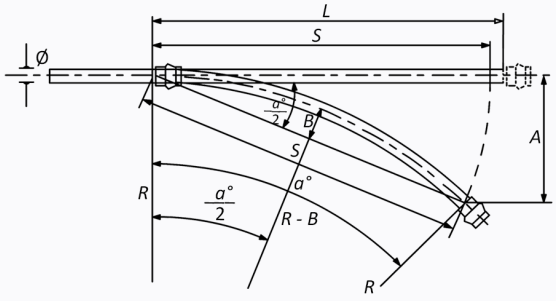


Figure P.8 - Dimentions Relating to Pipe Curvature

Table P.9 - Minimum Radius of Curvature, *R*, for Pipes Cold Bent on Site

Nominal Outside Diameter d_n mm	Minimum radius R m	Angle $\alpha/2$ degree	Chord S [1] m	Deflection A [1] m
63	12,6	13,64	5,94	1,40
75	15,0	11,50	5,98	1,19
90	18,0	9,55	5,97	0,99
110	22,0	7,81	5,98	0,81
125	25,0	6,87	5,98	0,72
140	28,0	6,14	5,99	0,64
160	32,0	5,37	5,99	0,56

The figures in column '*S*' and '*A*' apply to pipes of 6 m effective length only.

Installation Above Ground

It is strongly recommended that uPVC pipes and fittings systems installed above ground or in service ducts constructed below ground are jointed by the solvent cement method.

Fluids contained within uPVC pipes and not be allowed to freeze 0°C . Care should be taken to drained and or insulation should be provided to protect against frost.

The coefficient of linear expansion of uPVC is approximately 0,06 (mm/m)/K. The following equation is used for calculating dimensional variation:

$$\Delta L = 0{,}06\ L \times \Delta T$$

Where:

ΔL is the variation in length, in millimeters
L is the initial length, in meters
ΔT is the change in temperature of the pipe wall, in degrees (or Celsius)

Example: For a temperature difference of 20°C, a uPVC pipe of 10 m long will have a variation in length = 12mm (0.06 x 10 x 20)

Where ambient temperatures are reasonably constant, the change in pipe wall temperature can be taken as being equal to the change in fluid temperature. The expansion or contraction for temperature changes of 10°C to 45°C and pipe lengths of 1 m to 20 m is shown in figure P.10. The minimum free length of pipe required to accommodate the movement caused by thermal expansion or contraction is shown in figure P.12. Pipes should be installed in a way to ensure that the minimum amount of stress is induced in the system from movement caused by expansion or contraction or any forces. Examples of correct and incorrect arrangements are shown in figure P.11.

As a general rule, uPVC pipes should not be restrained in the hoop direction by straps or clamps made from unyielding material. Where such means of securing pipes is to be adopted, a compressible material (e.g. rubber) between the pipe and the clamp is recommended. Numerous methods exist for supporting pipes in the horizontal and vertical planes in above ground applications.

Important features for consideration are the following:

- Pipes should be free to move in the longitudinal direction unless otherwise fixed for expansion/contraction control.
- Recommended distances between horizontal or vertical support center lines for systems operating up to 45°C, as given in table P.13, should not be exceeded.

uPVC pipes should be installed at a sufficient distance from hot objects to prevent damage by radiant heat. All control device (such as values) should be correctly supported so that the pipe is not subjected to any operational torsional strain. In addition, the support provided should be sufficiently robust to prevent bending and direct stresses being induced by the weight of the device. uPVC pipes and fittings installed above ground should be protected from direct sunlight.

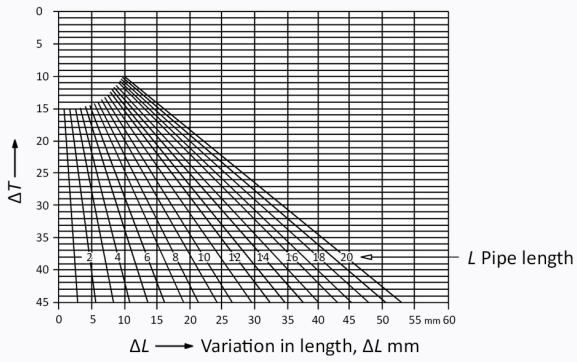


Figure P.10 - Thermal Expansion/Contraction of Pipes

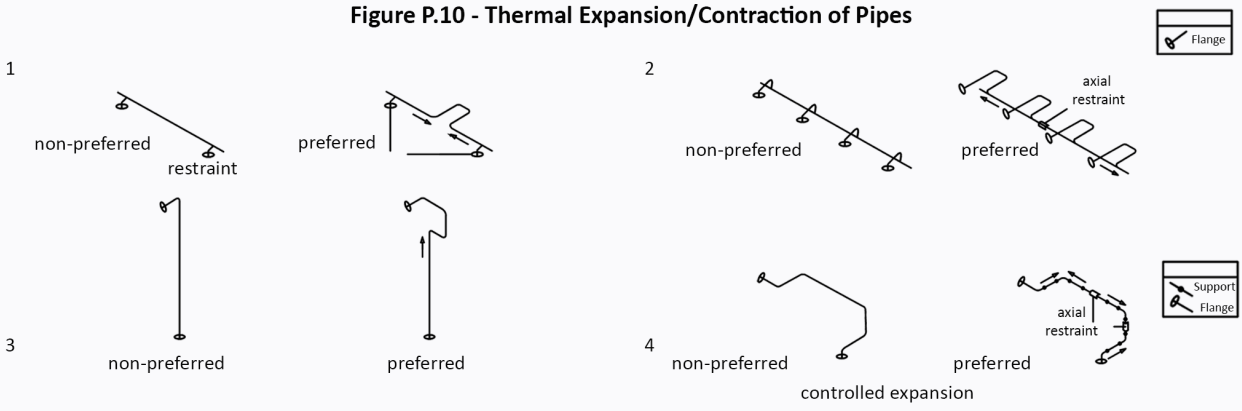


Figure P.11 - Examples of Correct and Incorrect Positioning of Supports for Above Ground Installations

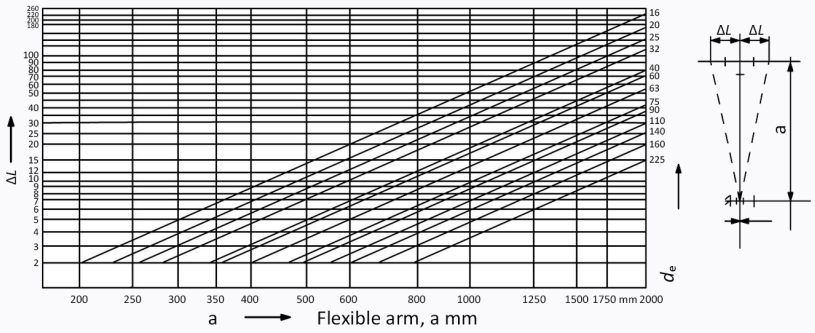


Figure P.12 - Minimum Free Lengths, *a*, of Flexible Arm

Example: For pipe with expansion of 10 mm and an outside diameter of 50 mm the length of the arm, *a*, shall be atleast 750 mm.

Table P.13 - Horizontal and Vertical Pipe Supporting Centers — Dimensions in Millimeters

Outside Diameter of Pipe	Distance Between Supporting Centers for Water at Temperatures for Horizontal Pipes					Vertical Pipes	
d_e	20°C	25°C	30°C	35°C	40°C	45°C	20°C to 45°C
16	750	670	600	500	400	-	800
20	850	770	700	600	500	-	900
25	900	820	750	650	550	500	1000
32	1000	920	850	750	650	570	1200
40	1100	1050	1000	900	800	700	1400
50	1250	1200	1150	1050	950	820	1600
63	1400	1350	1300	1200	1100	970	1800
75	1500	1450	1400	1300	1200	1070	2000
90	1650	1600	1550	1450	1350	1200	2200
110	1850	1800	1750	1650	1550	1370	2400
140	2150	2100	2050	1950	1850	1720	2500
160	2250	2200	2150	2070	2000	1850	2500
225	2500	2450	2400	2320	2250	2120	2500

Installation Below Ground

Pipes and fittings with elastomeric ring seal joints are recommended for installations below ground. Solvent cement joints can also be used for below ground applications and special advice from Qatar National Plastic should be obtained.

Typical trench and backfill details for uPVC pressure pipe installations are shown in figure P.14.

Whilst not essential, it is good practice to lay pipes with the spigot entered into the socket in the same direction as the intended flow of water. The internal surfaces of the pipe should be kept as clean as possible during the laying and joining operation. To assist in this respect, the trench should be kept as dry as possible using appropriate dewatering techniques.

Suitable material for both bedding and side fill may be available by selection from the 'as dug' excavated material. Such as soil as free draining coarse sand, gravel and soils of a friable nature are considered suitable (should be referred to Qatar National Plastic or should be sought from a contractor.)

'As dug' material should be free from boulders, sharp stones, flints, lumps of clay, chalk or frozen earth. Contaminated soil and any organic matter should be discarded. Where excavated material is not suitable, imported granular material should be used. Under no circumstances should froze, backfill or imported aggregates be used as bedding or sidefill materials.
The pipes should never be encased in concrete.
Note: Encasing in concrete transforms a flexible pipe into a rigid structure with no flexural strength, which is likely to fracture in the event of settlement or other movements of the earth.

For high static and/or surcharge loads, it is important to use pipes of an appropriate stiffness in order to ensure the initial deformation of the pipe is maintained within a limit of 5% maximum. Longer-term deformation will be affected by the operation of the system. Systems continuously subjected to internal water pressure will deform less than those left for long periods of time at zero pressure.

The minimum depth of cover recommended for buried water pipes 0,9 m. (Note: where applicable that pipes should always be laid at a frost-free depth, therefore where local climatic conditions so dictate the minimum depth of cover may be in excess of 0,9 m.)
Pipes laid beneath heavily trafficked areas, where a minimum cover depth of 0,9 m cannot be maintained, will require additional protection. In such circumstances the pipe Qatar National Plastic advice should be obtained.

The base of the trench should be carefully levelled and cleared of any sharp objects, edges and stones. If this is not possible, suitable material should be imported and laid as bed of 0,1 m minimum thickness. The trench bottom or bedding material should be excavated locally to accommodate the larger diameter of the joints.

The pipes are laid on the prepared bed. Where push-fit elastomeric sealing ring joints are used, the spigot should be introduced into the socket and the insertion completed up to the mark on the spigot pipe by use of a block of wood and a lever. Where mechanical means are used to push together large diameter pipes, care should be taken to avoid damaging the materials or displacing the elastomeric sealing ring. On completion of pipe laying and partial backfilling it is advisable to defer final tie-in connections until thermal equilibrium of the pipeline has been attained.

Elastomeric ring seal joints will not sustain thrust caused by internal pressure. Properly designed concrete anchor blocks or appropriate end-load-bearing joints should be provided at all changes of direction, tees, blank ends, large reductions in diameter and valves. Where concrete anchor blocks are used, the purpose of the anchor block is to transfer the total thrust to the trench sides. It is therefore important to take account of the load-bearing capacity of the surrounding ground. Where concrete would be in direct contact with the pipes or fittings, these should be wrapped with a compressible material to accommodate creep and prevent the occurrence of high local stress concentrations. The compressible material should not contain substances, which could attack the pipe, e.g. plasticizers.

Where it is permitted to include end-load-bearing joints as an alternative to concrete anchor blocks, the end-load-bearing joints should be provided at all connections to the components (e.g. tees, blank ends, bends, large reducers and valves) and additionally at the first joint in the straight pipes immediately adjacent to and on all sides of the fitting. This should be considered a minimum requirement. In some cases it can be necessary to provide more than one end-load-bearing joint in the straight pipes. If in doubt, Qatar National Plastic advice should be obtained.

A recommended sequence for placing sidefill and surround material is shown in figure P.14. Where selected material is returned to the trench, it should be placed in layers. The first sidefill layer should be placed and compacted under the lower quadrants of the pipe and up to the spring level of the pipe. For pipes up to nominal outside diameter 225 mm “trampling” or “heeling” is usually an effective means of achieving adequate compaction. Successive layers of 75 mm thickness may then be placed and compacted to height above the crown of not less than 150 mm. Light vibrating machinery may be used but not directly above the pipe.

Where imported granular material is used this should be able to flow around the pipe and be easily raked into position to form a complete, self-compacting, surround. With carefully controlled pouring the whole surround up to 150 mm above the crown may be placed on one pass.

Where side sheeting trench support has been employed, this should be partially withdrawn during the placing of the sidefill and surround so that no voids are left between the pipe and the trench walls.

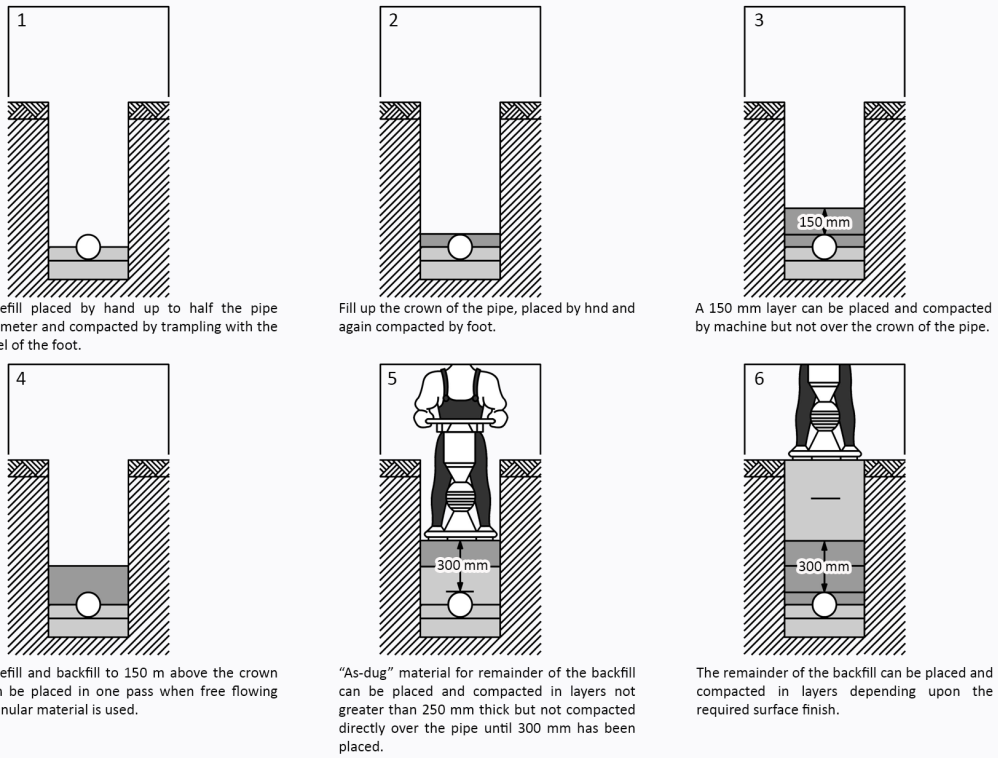
On completion of the surround to the pipe, suitable excavated material may then be replaced as backfill in 250 mm compacted layers up to the top of the trench. No heavy compaction equipment should be employed until there is atleast 300 mm of fill above the crown of the pipe.

All joints should be left open for inspection during the pressure testing operation.
The horizontal distance of the pipeline from foundations and similar underground installations should not be less than 0,4 m in normal circumstances.

Where there is lateral proximity or where the pipeline runs parallel to their pipelines or cables, the distance in the horizontal projection between them should not be less than 0,40 m. At points of congestion a distance of 0,2 m should be maintained unless steps are taken to prevent direct contact. These steps might have to be agreed with the relevant authorities.

Drinking water pipelines should not be located below drainage or sewerage pipelines.

At the end of each working period the pipeline should be temporarily capped to prevent the ingress of surface water, vermin or debris. The site should be left tidy and safe against accident, vandalism or flooding.



1 Sidefill placed by hand up to half the pipe diameter and compacted by trampling with the heel of the foot.

2 Fill up the crown of the pipe, placed by hnd and again compacted by foot.

3 A 150 mm layer can be placed and compacted by machine but not over the crown of the pipe.

4 Sidefill and backfill to 150 m above the crown can be placed in one pass when free flowing granular material is used.

5 “As-dug” material for remainder of the backfill can be placed and compacted in layers not greater than 250 mm thick but not compacted directly over the pipe until 300 mm has been placed.

6 The remainder of the backfill can be placed and compacted in layers depending upon the required surface finish.

Figure P.14 - Typical Trench and Backfill Details

Storage

uPVC pipes are light and easy to handle and consequently more likely to be mistreated for that reason than metallic pipes. Appropriate precautions should be taken during handling and storage to ensure that pipes are not damaged. When unloading pipes it should not be released and allow to fell with out control.

uPVC pipes should be stacked on a surface sufficiently flat and free from sharp objects, stones or projections in order to avoid deformation or damage to the pipes.

Lateral supports to pipe stacks should be provided at maximum intervals of 1,5 m. These supports can be timber posts at least 50 mm wide.

Pipes should be supported evenly over their whole length. If this is not possible, the bottom layer of pipes should be supported on wooden battens of at lest 50 mm usable width, and spaced not greater than 2 m apart. If the pipes are in bundles of approximately 1 m x 1 m, supports may be spaced up to 3 m apart. Pipes of different diameters and different thicknesses should be stacked separately. If this is not possible, the largest and thickest pipes should be placed at the bottom.

When stacking pipes with integral sockets at one end, the sockets should be alternated within the pile and should project sufficiently for the pipes to be correctly supported along their whole length.

Where pipes are supplied with end caps, plugs or wrappings, these should not be removed before the pipes are put in place. Contact with fuels, solvents and paints should be avoided.

In depots or stores, bundled pipes should be stacked no more than three units or 2 m high, whichever is the lower. At the construction site, bundles should be stacked no more than two units or 1 m high, whichever is the lower. If the bundles are timber framed, they should be stacked timber to timber. Provision should be made for the side supports, to prevent stack collapse, when banding or framing is removed. Side supports should be spaced at centers not greater than 3 m (see figure P.15).

Individual pipes in stacks in depots or stores should not exceed **seven layers** in height with a maximum height of 1,5 m, but on a construction site stacks should have a maximum **height of 1 m.**

The width of the bottom layer should not exceed 3 m. The method of stacking should ensure that there is uniform support along the pipe (e.g. spigot and socket pipes should be placed with the socket protruding at alternate ends of the stack.) The bottom layer of pipes can require thicker timber bearers at spacing's not greater than 2 m, so that the sockets do not bear directly on the ground, Stout timber vertical supports and chocks should be provided as required to prevent accidental slipping, rolling or collapse of the stack

Prolonged exposure to strong ultra-violet light (sunlight) can slightly reduce the impact strength of uPVC pipes and cause discoloration. Nevertheless, the resistance to internal water pressure is not reduced. Suitable protection by a free-venting opaque cover (canvas or polyethylene sheeting) is recommended if the total exposed storage time is like to exceed 12 months.

Pipes should be stored away from any heat source out of direct sunlight and should not be in contact with any other potential hazards such as diesel oils, paints or solvents.

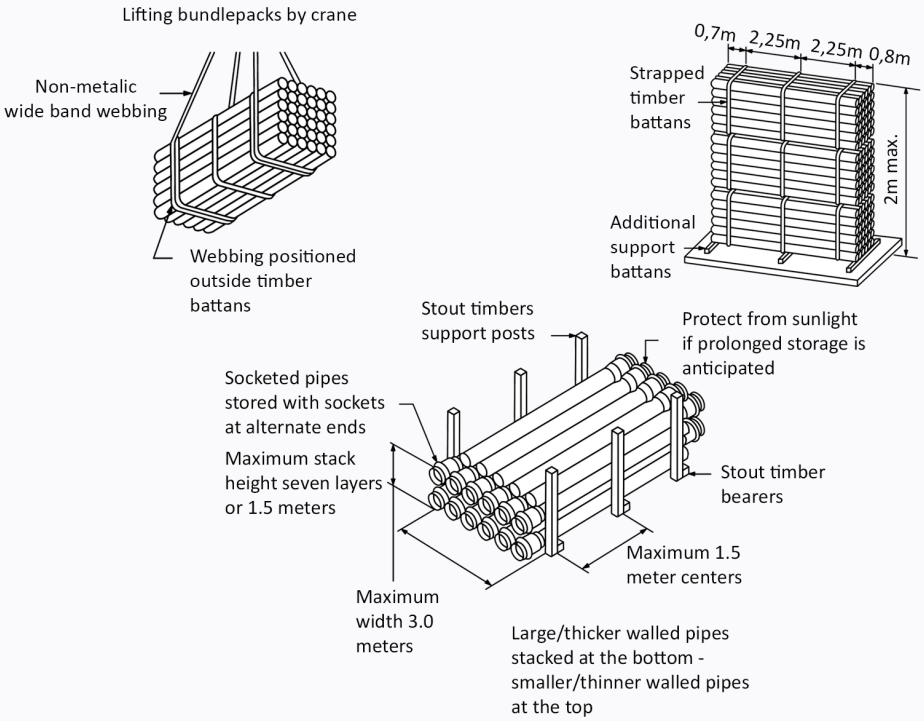


Figure P.15 - Handling and Storing in Depot

Handling

When pipes are to be handled individually, they should be lowered, lifted and carried in a controlled fashion and should never be thrown, dropped or dragged (See figure P.16). Single pipes up to nominal size 250 mm can be handled by two men without difficulty. Pipes of larger nominal size can require lifting apparatus, as with bundles.

Unloading bundled pipes require the use of appropriate mechanical equipment. The chosen technique should not cause damage to the pipes, e.g. forklift truck with flat protected forks or suitable crane with spreader bars. uPVC pipes should never be lifted using wire ropes and slings or metal hooks and chains. Slings should be non-metallic, e.g. rope webbing.

If the pipes have been telescoped (nested) for transporting, the inner pipes should always be removed first and stacked separately.

The impact resistance of uPVC pipes is reduced in cold weather and more care needs to be taken when handling the material at temperatures below 0°C. If temperatures fall below -15°C, special instructions from the manufacturer should be obtained.

Transportation of Loose Pipes

When transporting pipes, flat bed vehicles should be used. The bed should be free from nails and other projections. When practicable, pipes should rest uniformly on the vehicle over their whole length.

The vehicles should have side supports appropriately spaced approximately 2 m apart, and the pipes should be secured effectively during transport. All posts should be flat with no sharp edges.

When loading socketed pipes, the pipes should be stacked on the vehicle so that the sockets do not take excessive loads.

Where pipes overhang the vehicle, the amount of overhang should not exceed 1 m.

High stiffness pipes should be placed at the bottom of the load and low stiffness pipes ate the top.

Care should be taken to avoid positioning the pipes near to any exhaust systems or any other potential hazards such as diesel oil, paints or solvents.

Pipes should be inspected by the purchaser or his representative prior to offloading.

When Pipes are transported in bundles, the bundles should be secured effectively and off loaded.

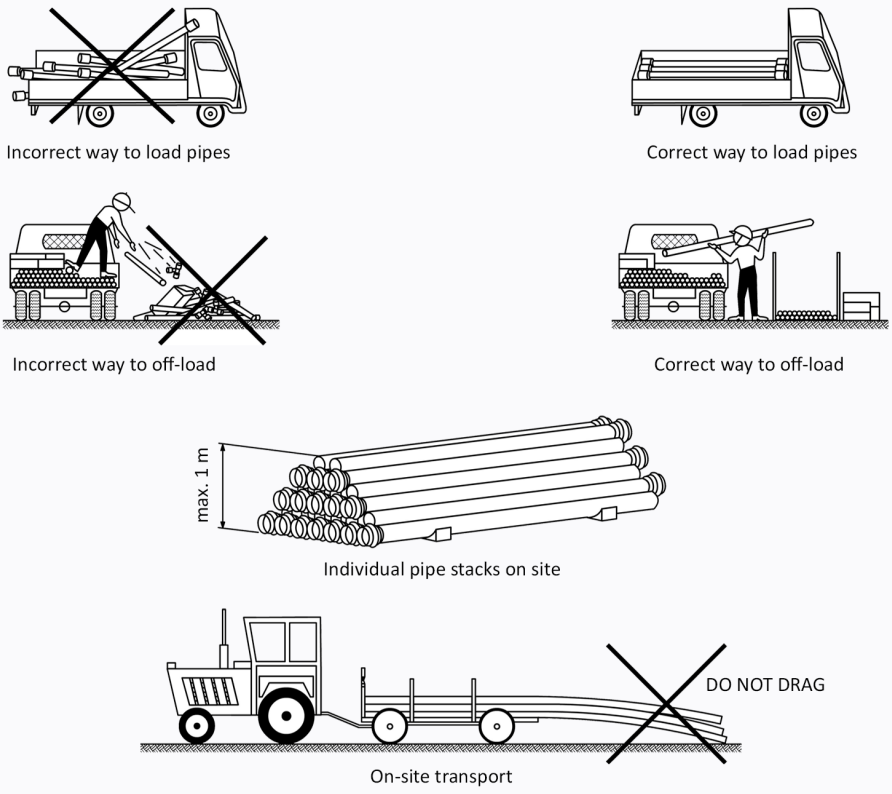


Figure P.16 - Handling and Storing on Site

Qatar National Plastic Factory produces a full range of uPVC pipes according to various Qatari and International Standards. These includes:

BS EN 1401 UD
DIN 19534
BSEN 1329 BD

These pipes are designed for underground drainage and sewerage evacuation.

In addition, Qatar National Plastic produces these pipes using the new chemART technology designed to improve the properties of uPVC pipes without a significant increase in cost. These pipes are available for diameters greater than 63 mm.

Introducing chemART Technology for uPVC Pipes

"ChemART" technology is a new Chemical and Antimicrobial Resistance Technology for uPVC pipes. It is applied to standard uPVC pipes to increase resistance to biological attack, to resist degradation from chemical attack from acids, greases and disinfectants, and especially resists Chlorine Dioxide degradation. It has been extensively tested and is completely harmless, providing better protection and increasing the life of the pipes.
Qatar National Plastic will commence the manufacture of pipes using chemART from January 2019.

Resistance to Biological attack with chemART

uPVC pipes using ChemART will not deteriorate or break down under biological attack, as the internal walls of the treated uPVC does not serve as a nutrient for micro or macro organisms. Also there is no proof to discover a single case in which buried uPVC pipe products have suffered degradation or deterioration due to biological attack. Once uPVC pipe has been installed underground in normal water and sewer systems, it is not susceptible to the normal processes of deterioration found in nature. It does not slime as readily as many other materials and will usually require less maintenance in comparison with clays and metal pipes.

General Chemical Resistance of uPVC chemART

In general, uPVC is suitable to convey most strong acids, alkalis and aqueous solutions (except strongly oxidising solutions). However, uPVC should not be used with aldehydes, ethers, esters, aromatics, chlorinated hydrocarbons, ketones, benzene mixtures or similar solvents[1]. The application of chemART technology enhances resistance and provides increased resistance to solvent attack.

Resistance to corrosion acid/ gases with chemART

The sewer contains inorganic gases created by action of anaerobic bacteria on sewage and sludge. Hydrogen sulfide, ammonia, carbon dioxide, methane, hydrogen and nitrogen are all released by this process with the major portion being hydrogen sulfide. This gas reacts to form dilute sulfuric and sulfurous acids especially in turbulent areas. chemART PVC pipes have increased resistance to hydrogen sulfide and sulfuric acid and have a life span of 30-50 year under normal operating conditions.

Resistance to chlorinated water with chemART

chemART exhibits excellent resistance to chlorinated water. When chlorine is added to water for disinfection it turns to hypochlorous acid. Hypochlorous acid is strong oxidiser that breaks the carbon-to-carbon bond in polyolefin pipes (HDPE, PPR). This leads eventually polymer chain disintegration inner wall erosion in pipes. In PVC the comparatively large chlorine atom surrounding the carbon chain provides protection from hypochlorous acid attack. chemART increases this protection and it is for this reason chemART pipes are preferable for potable water applications.

Abrasion Resistance

Various European studies evaluating abrasion resistance using river sand and gravel in unlined concrete pipe, lined concrete pipe, glazed vitrified clay pipe and uPVC pipe have demonstrated higher abrasion resistance of uPVC pipes. With minimal wear at 260,000 cycles and less accelerated than vitrified clay pipes and concrete pipes.

Low frictional losses

chemART pipes exhibit low frictional losses especially compared to metal pipe. The coefficient of flow velocity degree of smoothness of pipe inner wall is higher than other piping materials, which resulting low frictional losses.

[1] Temperature, length of exposure and concentration are the variables that dictate the rate of degradation. Given the normal operation of pipe systems the rate of degradation is very slow in PVC pipes and is only significant if exposure is prolonged, concentrated, or at elevated temperature. If highly stressed, deterioration can involve absorption of the corroding medium, which leads to swelling, a reduction in tensile strength, reduction in ring stiffness and a change in elongation at break

Standard: BS EN1401 - SDR 51, SDR 41, SDR 34

Scope: The standard BS EN 1401 specify the requirement for pipes in the field of non pressure underground drainage and sewerage, both outside the building structure and those buried in ground within the building structure.
Colour: Terracotta RAL 8023
Appearance: 6 / 5.8 meter with spigot end and socket push fit rubber ring / solvent cement type.

Mean Outside Diameter		SN 2 (2000N/m²)		SN 4 (4000N/m²)		SN 8 (8000N/m²)	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
mm	mm	mm	mm	mm	mm	mm	mm
110.0	110.3	-	-	3.2	3.8	3.2	3.8
160.0	160.4	3.2	3.80	4.0	4.6	4.7	5.4
200.0	200.5	3.9	4.50	4.9	5.6	5.9	6.7
250.0	250.5	4.9	5.60	6.2	7.1	7.3	8.3
315.0	315.6	6.2	7.10	7.7	8.7	9.2	10.4
400.0	400.7	7.9	8.90	9.8	11.0	11.7	13.1
500.0	500.9	9.8	11.0	12.3	13.8	14.6	16.3
630.0	631.1	12.3	13.8	15.4	17.2	18.4	20.5

QA/QC Test: Heat reversion, vicat softening point, impact resistance, dichloromethane test, long term hydrostatic pressure test, Ring stiffness.
Fittings: Please refer Qatar National Plastic fittings catalogue.

Standard: DIN 19534

Scope: Underground Drains and Sewerage
Colour: Terracotta RAL 8023
Appearance: 5.8 meter with spigot end and socket solvent cement type.

Nominal Size	Mean Outside Diameter		Wall Thickness	
In mm	Minimum mm	Maximum mm	Minimum mm	Maximum mm
110 mm	110	110.3	3.0	3.5
160 mm	160	160.4	3.6	4.2

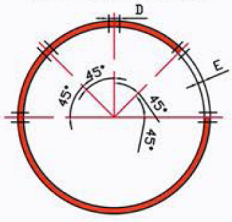
QA/QC Test: Long term hydrostatic pressure test, vicat softening point, heat reversion, dichloromethane test.

Semi / Fully Perforated Pipes

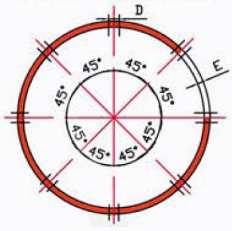
Scope: Perforated pipes are manufactured from solid uPVC pipes conforming BSEN 1401 or any relevant standard. This pipe are used as soakways / french drains. Qatar National Plastic standard perforation details are provided below table and figure UGD 1-1. However, perforation are 100% customizable upon client request. The minimum water inlet area for straight and staggered row type will be the same.
Colour: Terracotta RAL 8023
Appearance: 6 / 5.8 meter with spigot end and socket push fit rubber ring / solvent cement type.

UGD 1-1

Semi Perforated Pipe

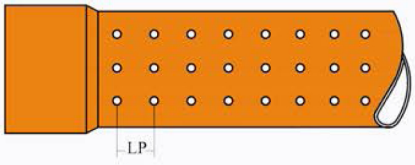


Fully Perforated Pipe

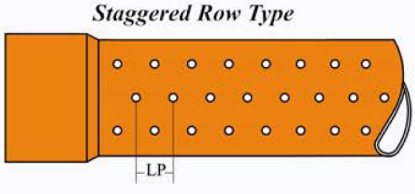


			Type 'A' with Perf. Hole Diameter 10mm			Type 'B' with Perf. Hole Diameter 13mm		
Outside Diameter	Wall Thickness	Angular Pitch	Longitudinal Pitch	Min. Water Inlet Area Semi Perf.	Min. Water Inlet Area Fully Perf.	Longitudinal Pitch	Min. Water Inlet Area Semi Perf.	Min. Water Inlet Area Fully Perf.
mm	mm	Degree	mm	Cm²/meter	Cm²/meter	mm	Cm²/meter	Cm²/meter
110	3.2	45°	200	19	31	180	34	54
160	4.0	45°	200	19	31	180	34	54
200	4.9	45°	200	19	31	180	34	54
250	6.2	45°	200	19	31	180	34	54
315	7.7	45°	200	19	31	180	34	54
400	9.8	45°	200	19	31	180	34	54
500	12.3	45°	200	19	31	180	34	54
630	15.4	45°	200	19	31	180	34	54

Straight Row Type



Staggered Row Type



Pipe deflection (Vertical)

$$\Delta/D = \frac{K_x\{(D_L P_e) + P_s\}}{8EI/D^3 + 0.061E'}$$

Where:

- Δ = Pipe diameter change
- D = Pipe diameter
- K_x = Deflection coefficient (see table UGD 1)
- D_L = Deflection lag factor
- P_e = Vertical soil pressure or soil load
- P_s = Surcharge pressure or Traffic load (see table UGD 2 and 3)
- E = Flexural modulus of elasticity of Pipe material
- I = Second moment of area of unit length of pipe wall
- E' = Overall modulus of soil reaction

Vertical Soil Pressure Pe

Pe= ℓ H

Where:

- ℓ = Unit weight of soil
- H = Depth of cover to top of pipe

Table UGD 1 Flexible and semi-rigid pipe embedment properties

Embedment class as table UGD4 and deflection coefficient K_x	Compaction *Mp* (See NOTE 3) %	Modulus of soil E'^{2} MN/m²	Deflection lag factor D_L [2]	Strain factor D_f for various pipe stiffness [1] kN/m² 1.25	2.5	5.0	10	15	30 or more
Class S1	Uncompacted	5	1.5	4.7	4.5	4.3	4.0	3.75	3.0
K_x=0.083	80	7	1.25	4.7	4.5	4.3	4.0	3.75	3.0
	85	7	1.0	4.7	4.5	4.3	4.0	3.75	3.25
	90	10	1.0	4.7	4.5	4.3	4.0	3.75	3.5
	95	14	1.0	--	--	--	--	3.75	3.5
Class S2	Uncompacted	3	1.5	4.7	4.5	4.3	4.0	3.75	3.0
K_x=0.083	80	5	1.25	4.7	4.5	4.3	4.0	3.75	3.0
	85	7	1.0	4.7	4.5	4.3	4.0	3.75	3.25
	90	10	1.0	4.7	4.5	4.3	4.0	3.75	3.5
	95	20	1.0	--	--	--	--	3.75	3.5
Class S3	85	5	1.5	6.2	5.5	4.75	4.25	4.0	3.25
K_x=0.100	90	7	1.25	7.75	6.6	5.5	4.7	4.25	3.5
	95	14	1.0	--	--	--	--	4.75	3.5
Class S4	85	3	1.5	6.2	5.5	4.75	4.25	4.0	3.5
K_x=0.100	90	5	1.25	7.75	6.6	5.5	4.7	4.25	3.5
	95	10	1.0	--	--	--	--	4.75	3.5
Class S5	85	1	3.0	--	--	--	--	4.0	3.5
K_x=0.100	90	3	2.0	--	--	--	--	4.25	3.5
	95	7	1.25	--	--	--	--	4.5	3.5
Class B1	85	5	1.5	--	--	--	5.0	4.0	3.5
K_x=0.083	90	7	1.25	--	--	--	5.5	4.25	3.5
Class B2	85	3	2.0	--	--	--	5.5	4.25	3.5
K_x=0.083	90	5	1.75	--	--	--	6.0	5.0	3.5

1) Pipe stiffness referred to this table are initial values.
2) Where the designer can be certain that initial pressurization will take place within one year backfilling, a value of 1.0 may be taken for deflection lag factor.
Note1: For construction details of embedment classes see table UGD 4.
Note2: Quoted values E'_2 assume pipeline will be installed below groundwater.
Note3: *Mp* indicates modified Proctor density and corresponds to the heavy compaction test in BS 1377.

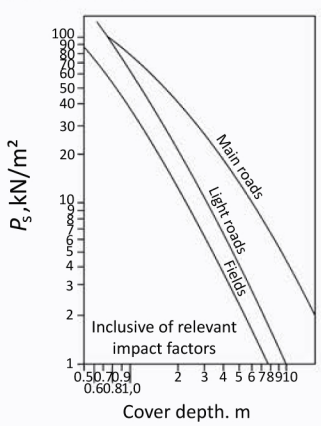


Figure UGD 2 Surcharge pressure P_s due to vehicle wheels

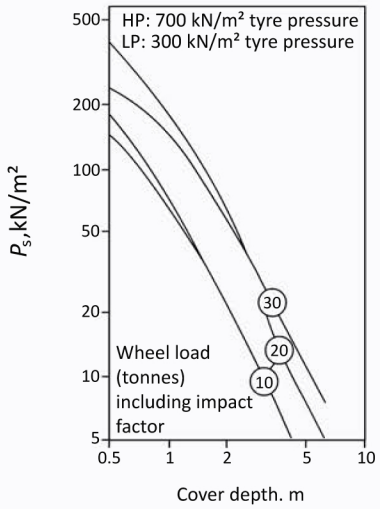
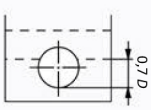


Figure UGD 3 Surcharge pressure P_s due to construction vehicle

Table UGD 4 Semi-rigid and flexible pipe embedments			
Embedment class	Embedment configuration	Bed and sidefill materials	Notes
S1 and S2		Class S1: Gravel (single size) Class S2: Gravel (graded)	Normally processed grannular materials
S3 and S5		Class S3: Sand and coarse grained soil with more than 12% fines Class S4: Coarse grained soil with more than 12% fines OR Fine grained soil, liquid limit less than 50% medium to no plasticity and more than 25 % coarse grained material Class S5: Fine grained soil, liquid limit less than 50% medium to no plasticity and less than 25 % grained material	These represents 'as dug' soils and require particularly close control when used with low stiffness pipes. Class S5 only recommended for use with semi-rigid pipes.
B1 and B2		Class B1: Upper surround as for S3 and S4 Lower surround as for S1 or S2 Class B2: upper surround as for S5 Lower surround as for S1 and S2	Class B embedments not recommended for use with pipes of less than 10kN/m² stiffness
D		Classes S1 to S5	Only suitable for semi-rigid pipes with high beam strength. Soil properties from table UGD 1 except K_x = 0.110

Flow Rate: Hydraulic Capacity

The hydraulic capacity of a pipe system is dependent on the layout design, and influenced by pipe wall roughness and pipe deformation. Qatar National Plastic Factory uPVC pipes exhibit excellent flow properties. Below figures illustrate the flow capacity with K values of 0.25 and 0.4 for straight line pipe and pipe with fittings respectively. See figure UGD 5 & 6.

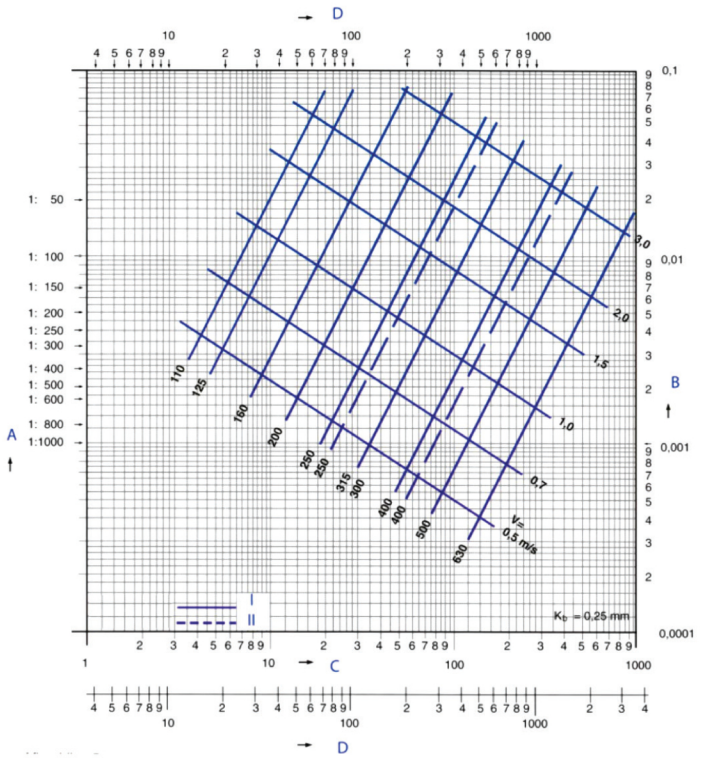


Figure : UGD 5 Flow capacity charts using k = 0,25

Where:

A downslope [m/m]
B Pressure loss [m/m]
C flow capacity[l/s]
D flow capacity[m3/h]
I outer diameter (Pipe OD)
II Inner diameter (pipe ID)

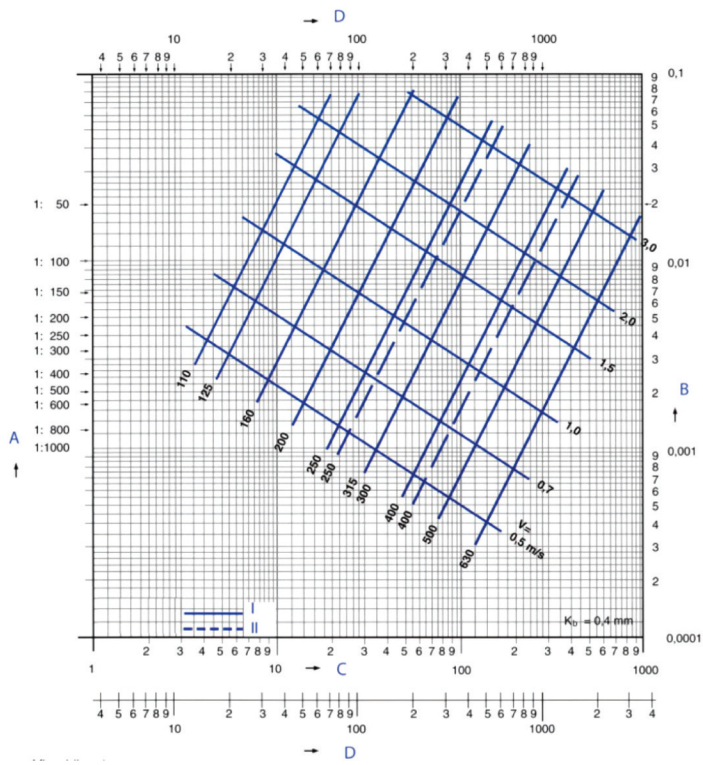


Figure : UGD 6 Flow capacity charts using k = 0,4

Where:

A downslope [m/m]
B Pressure loss [m/m]
C flow capacity[l/s]
D flow capacity[m3/h]
I outer diameter (Pipe OD)
II Inner diameter (pipe ID)

Rubber Ring Seal Joint Method





- Clean the pipe spigot.
- Ensure the ring groove and rubber ring are clean.
- Insert the rubber ring with the sealing lip facing inwards and the ring evenly and fully housed in the groove.
- Inspect the chamfered end (15°- 45°) of the pipe and mark the insertion length with reference to the socket length.
- lubricant the chamfered end. Do not lubricate rubber ring groove.
- Align the two pipes for both line and graded before making the insertion.
- Enter the spigot into the socket mouth, being careful not to introduce any dirt.
- Firmly push the pipe into the socket up to the insertion mark. Do not use excessive force. If excessive force is required to make the joint, disassemble and check the following:
    - The ring is facing the correct direction.
    - The ring and spigot are clean and have been lubricated.
    - The ring and pipe spigot are correctly seated.
- If the pipe is pushed past the insertion mark withdraw immediately; if the lubricant is left to dry it will be much more difficult to withdraw.
- To ensure an even graded, the bedding should be removed in the pipe socket area to accommodate the wider socket.
- Jointing may be assisted with a crow bar or shovel and a block of wood. Do not attempt to force the assembly. Machinery should only be used on larger pipe sizes, if necessary, and then only with extreme caution.

Allowable Deviation from Straightness

Qatar National Plastic uPVC pipe should be installed in a straight line or using fittings to alter direction. However, uPVC pipes are flexible, and under following conditions, deviations are possible. Special care must be taken to avoid any stress on the socket joint. See figure UGD 7.

If nominal diameter (dn) ≤200mm: the radius of the permitted bend (R) ≥300dn

If nominal diameter (dn) >200mm: the radius of the permitted bend (R) ≥500dn

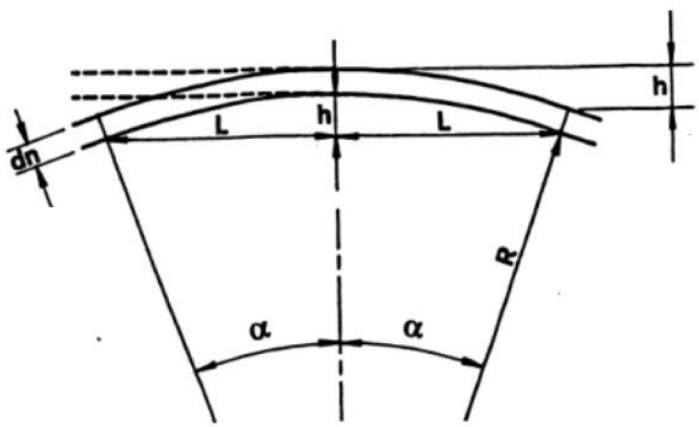


Figure : UGD 7

Note : Approximately $h = L^2/2R$ and $\alpha = L/R$.

Permitted angular deflection:

2° for pipe with a nominal diameter of ≤315mm

1.5° for pipe with a nominal diameter of 315mm and nominal diameter ≤630mm

1° for pipe with a nominal diameter of >630mm

Fall/Gradients in Drainage Pipe

The gradient in foul water drainage pipes are designed to give a filling degree of 75% (i.e. to contain 25% air) thus ensuring that the pipe bore velocity shall not be less than 0.70m/s and will therefore be self-cleaning. Gradients are given in the table below. For Example: 110mm foul drain pipe should have gradient of 1:40 to ensure a correct discharge rate of 1 l/s (ie.25mm per meter).

Peak flow(a) liters/second	Pipe size (mm)	Minimum gradient
<1	110	1:40
>1	110	1:80 (Min.1WC)
	160	1:150 (Min.5WC)

Excavation

Trenches prepared for underground drainage and sewerage pipe must not be kept open for an extended period. Pipe should be laid and trenches backfill as quickly as possible to avoid trench collapse and side fall that creates an uneven, inconsistent trench bottom. Trench width should as be narrow as possible, but not less than 300mm plus pipe diameter to accommodate a good backfill (example: 315mm pipe should have minimum trench width 615mm, ie150+315+150). Please refer to the figure below.

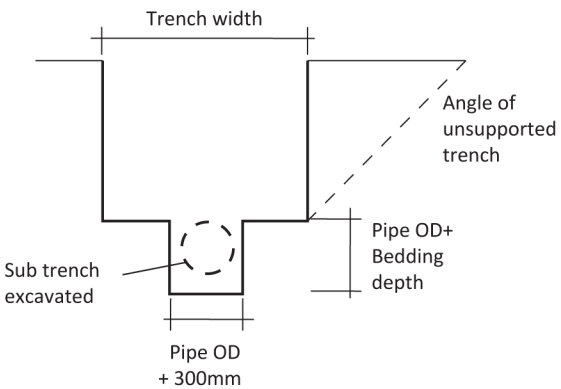


Figure : UGD 8

Pipe Bedding and Surround Materials

Trenches should be excavated to allow for the depth of the bedding material. Before any pipework is installed the bedding material should be laid evenly along the bottom of the trench. The side fill material must be the same as the bedding material and extend to the crown of the pipe and be thoroughly compacted. Where the backfill above the pipe contains stones larger than 40mm or where the pipework is deeper than 2m in poor ground, the granular material must extend at least 100mm above the pipe crown. Alternatively, backfill material can be graded to eliminate stones exceeding 40mm and this selected material used for the first 300mm above the pipe. If the pipes are to be laid in rock, compacted sand or gravel, or in very soft or wet ground requiring mechanical means of trimming, a minimum of 100mm bedding should be maintained. See figure UGD 9.

Nominal pipe size	Granular material size
110mm	10mm nominal single size 14-5mm course graded
160mm	10-14mm nominal single size. 14-5mm course graded
225mm and above	10,14, or 20mm nominal single size 14 or 20 to 5mm course graded

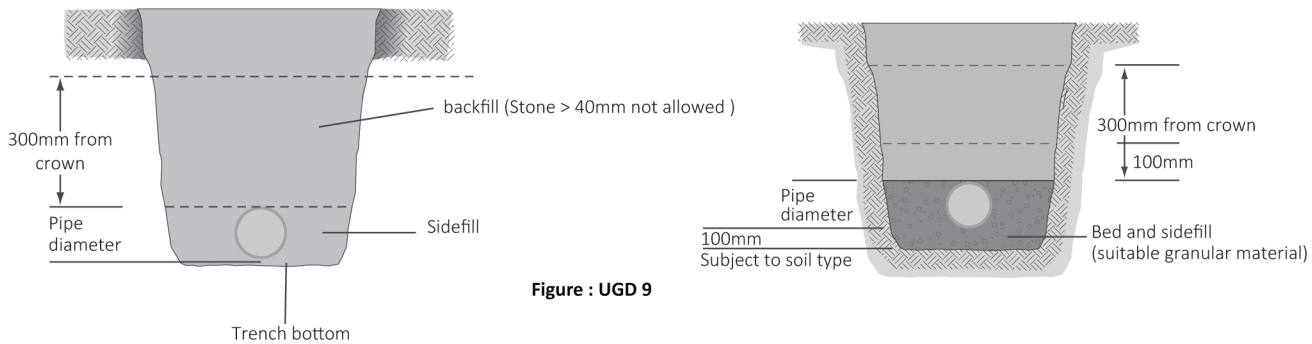


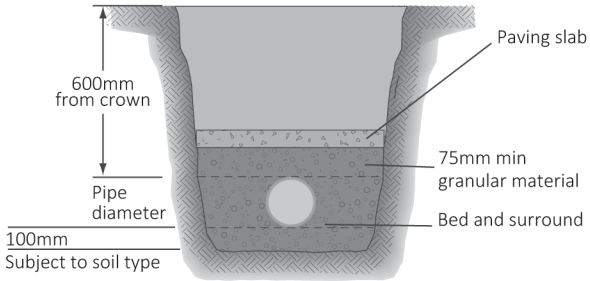
Figure : UGD 9

Laying Shallow Domestic Drains

Domestic drains are often shallow laid. This is acceptable provided the pipe is not under a road and is protected against damage by placing a layer of concrete, paving slabs or similar over the pipes. A minimum 75mm cushioning layer of granular material must also be placed between the pipes and the slabs or the concrete. Where there is a danger from construction vehicles or heavy transport, concrete slabs must be used. See figure UGD10

This method is preferred for pipe laid at less than 600mm of depth.

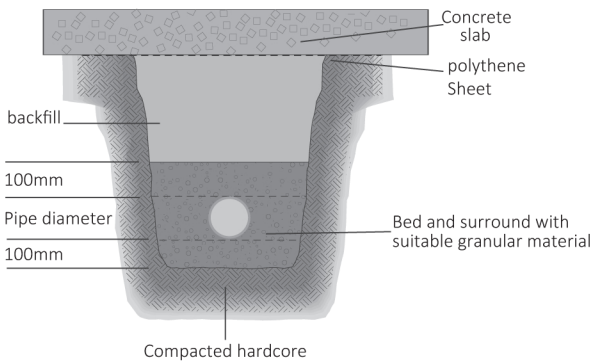
Figure : UGD 10



Laying Drains Under Solid Ground Floors or Building Premises

Where pipes are to be laid under solid floors or building premises, especially where intended to connect sanitary drainage, it is essential the ground must be initially compacted with deep hardcore material within the foundation boundaries. A trench for the pipe should then be excavated, and suitable material employed for the bedding and backfilling operation. If trenches are dug from the original ground, pipes may be laid and surrounded as necessary before the top layer of hardcore is formed. If the pipe passes through a wall or foundation of a building, a duct or sleeve should be built-in to provide clearance around the pipe. See figure UGD 11.

Figure : UGD 11



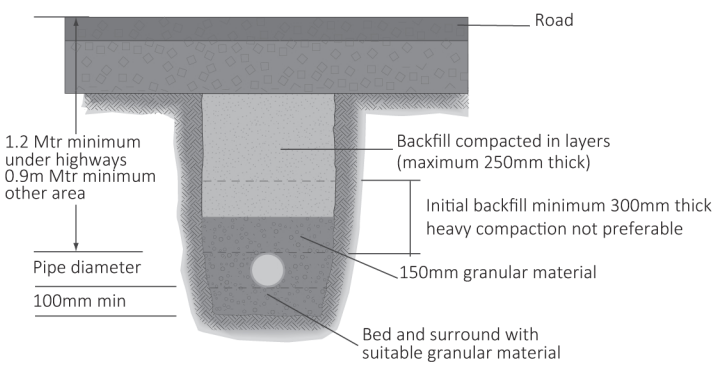
Laying for Heavy Protection (Concrete Bed and Surround)

It is never recommended to lay uPVC pipe on a concreate bed and surround. uPVC pipes are flexible and thermal movement will result in stress. In cases where the use of concrete beds and surrounds are unavoidable, it is recommended that pipes are laid in 3 - 3.5 meter lengths and a compressible board is shaped to fit around each joint. Pipes should also be wrapped with polythene to prevent the penetration of cement grout into rubber ring seal joints.

Laying for Sewer Lines

For Sewer lines, given the importance of flows and the inconsistency of the effluent, must obligatorily to be studied and designed correctly based on project specification and structural analysis of pipes. The minimum cover under public roads should be 1.2m to the crown of the pipe. Certain cover specifications are shown in figure below for reference purposes only. Please refer to UGD 12 .

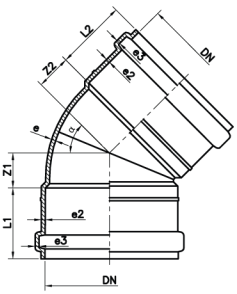
Figure : UGD 12



Standard: BSEN1401
SDR: 41
SN: 4

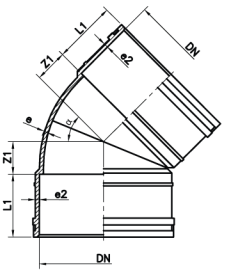
Colour: Terracotta RAL 8023
Application: "UD" under ground
F/F: Female/Female socket

M/F: Male/Female socket
RRJ: Rubber Ring Joint
SCJ: Solvent Cement Joint



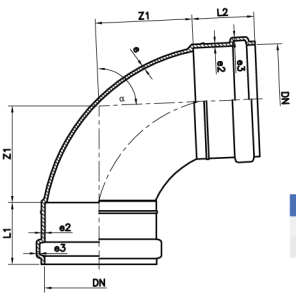
Elbow 45° F/F RRJ

DN	α	e	e2	e3	L1	L2	Z1	Z2
110	45°	3.2	2.9	2.4	61	61	30	30
160	45°	4	3.6	3	83	83	44	44
200	45°	4.9	4.4	3.7	79.5	79.5	68.5	68.5



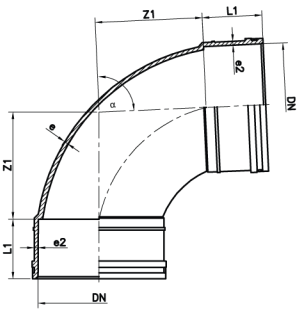
Elbow 45° F/F SCJ

DN	α	e	e2	L1	L2	Z1	Z2
110	45°	3.2	2.9	54	54	28	28
160	45°	4	3.6	76	76	44	44



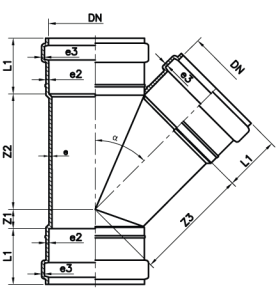
Bend 87.5° Swept F/F RRJ

DN	α	e	e2	e3	L1	L2	Z1	Z2
110	87.5°	3.2	2.9	2.4	61	61	99	99
160	87.5°	4	3.6	3	83	83	127	127



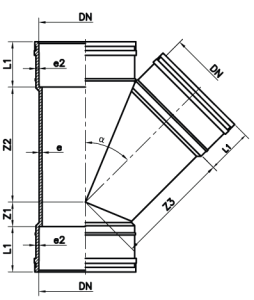
Bend 87.5° Swept F/F SCJ

DN	α	e	e2	L1	Z1
110	87.5°	3.2	2.9	54	97
160	87.5°	4	3.6	76	127



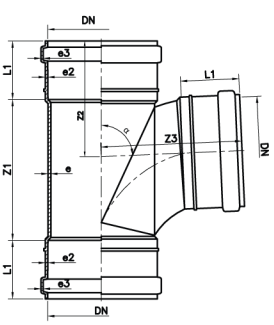
TEE 45° F/F RRJ

DN	α	e	e2	e3	L1	Z1	Z2	Z3
110	45°	3.2	2.9	2.4	61	23	138	138
160	45°	4	3.6	3	83	44	197.5	197.5



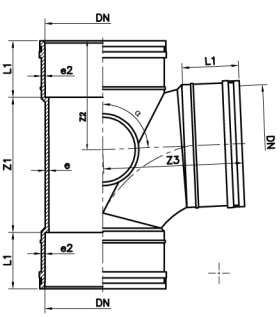
TEE 45° F/F SCJ

DN	α	e	e2	L1	Z1	Z2	Z3
110	45°	3.2	2.9	54	29	137	137
160	45°	4	3.6	76	44	197.5	197.5



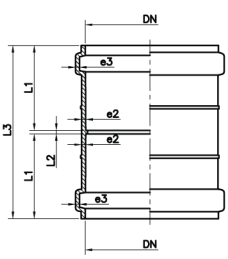
TEE 87.5° Swept F/F RRJ

DN	α	e	e2	e3	L1	Z1	Z2	Z3
110	87.5°	3.2	2.9	2.4	61	131	111	142
160	87.5°	4	3.6	3	83	212	169	207



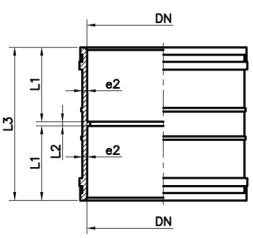
TEE 87.5° Swept F/F SCJ

DN	α	e	e2	L1	Z1	Z2	Z3
110	87.5°	3.2	2.9	54	127	104	133
160	87.5°	4	3.6	76	212	162	200



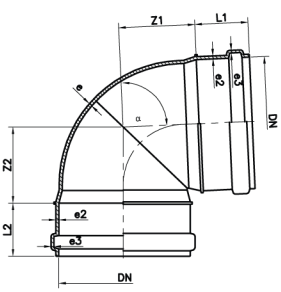
Coupler F/F RRJ

DN	e2	e3	L1	L2	L3
110	2.9	2.4	71	3	145
160	3.6	3	85	4	174
200	4.4	3.7	94	5.5	193.5



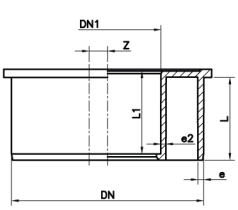
Coupler F/F SCJ

DN	e2	L1	L2	L3
110	2.9	54	3	111
160	3.6	78	4	160



Bend 87.5° Unswept F/F RRJ

DN	α	e	e2	e3	L1	L2	Z1	Z2
200	87.5°	4.9	4.4	3.7	79.5	79.5	119	119



Reducer Bush M/F SCJ

Size	DN	DN 1	e	e2	L	L1	Z
160 x110	160	110	4	2.9	76.8	54	20.6

Standard: BSEN 1329

Scope:
The British standard BS EN 1329 specifies the requirement for uPVC pipes for soil and waste discharge (low and high temperature). These pipes are applicable for the discharge of soil waste inside the building and for soil and waste discharge buried within the building area.
Colour:
Light Grey RAL 7042
Appearance:
6 / 5.8 / 4 meter with spigot end and socket-solvent cement joint. Push fit joint are available in 110mm and above on request.

Nominal Size (mm)	Mean Outside Diameter (mm)	Wall Thickness (mm)			
		Inside Building Area (B)		Inside Building Area & buried within building (BD)	
		Min	Max	Min	Max
32	32	3.0	3.5	-	-
40	40	3.0	3.5	-	-
50	50	3.0	3.5	-	-
63	63	3.0	3.5	-	-
75	75	3.0	3.5	3.0	3.5
80	80	3.0	3.5	3.0	3.5
82	82	3.0	3.5	3.0	3.5
90	90	3.0	3.5	3.0	3.5
110	110	3.2	3.8	3.2	3.8
160	160	3.2	3.8	4.0	4.6
200	200	3.9	4.5	4.9	5.6
250	250	4.9	5.6	6.2	7.1
315	315	6.2	7.1	7.7	8.7

(SERIES BASED ON EACH DIMENSIONS)

Nominal Size (In.)	Mean Outside Diameter (mm)	Wall Thickness (mm) Inside Building Area (B)
Inch./mm	mm	mm
1 1/4″ / 36	36	3,0
1 1/2″ /43	43	3,0
2″ / 56	56	3.0

			3.5
			3.5
			3.5

QA/QC Test: Long term hydrostatic pressure test; vicat softening point; heat reversion; dichloromethane test; impact test.
uPVC Fitting & Accessories: Please refer to Qatar National Plastic fittings Catalogue.

Standard: BS 5255

Scope: Domestic Waste Pipe - Above Ground Drainage System and Venting System.
Colour: Light Grey RAL 7042
Appearance: 4 meter with spigot end and socket-solvent cement joint.

Nominal Size (In.)	Mean Outside Diameter (mm)		Wall Thickness	Unit Length
	Minimum	Maximum		
1¼	35.15mm	36.45mm	2.2mm	4 meters
1 ½	42.75mm	43.05mm	2.3mm	4 meters
2″	55.75mm	56.05mm	2.4mm	4 meters

QA/QC Test: Heat reversion, impact test, vicat softening temperature.

Standard: BS 4514

Scope: Soil, Vent and Waste Pipe
Colour: Light Grey RAL 7042
Appearance: 5.8 / 4 meter with spigot end and socket-solvent cement joint.

Nominal Size (In.)	Mean Outside Diameter (mm)		Extreme Outside Diameter (mm)		Wall Thickness	Unit Length
	Minimum	Maximum	Minimum	Maximum		
82mm (3″)	82.4mm	82.8mm	81.0mm	84.3mm	3.2mm	4 meters
110mm (4″)	110.0mm	110.4mm	108.0mm	112.4mm	3.2mm	5.8 meters
160mm (6″)	160.0mm	160.6mm	157.1mm	163.5mm	3.2mm	5.8 meters

QA/QC Test: Heat reversion, impact test, vicat softening temperature.

Standard: AS / NZS 1260

Scope: Drain, Waste and Vent application.
Colour: Grey RAL 7042
Appearance: 4 meter with spigot end and socket-solvent cement joint.

Nominal Size		Mean Outside Diameter (mm)		Wall Thickness (mm)	
Inch	DN	Minimum	Maximum	Minimum	Maximum
1 1/4	32	36.2	36.5	1.9	2.3
1 1/2	40	42.8	43.1	2.0	2.4
2	50	55.7	56.0	2.2	2.6
3	80	82.3	82.7	2.9	3.4

QA/QC Test: Heat reversion; impact test; vicat softening temperature; pipe stiffness.

Qplast

Continuous Operating Temperature

u-PVC pipe properties are depended on temperature range. The Vicat Softening Temperature of u-PVC is 78-80 degree Celsius. The proposed maximum frequent operational temperature for u-PVC pipes is 60°C, this limitation refers to the complete pipe wall being at 60°C and would apply for continuous flow of a fluid at 60°C.

For intervallic flow, the fluid temperature can be higher due to the lower thermal conductivity of Qplast drainage pipes. The duration and volume of the discharge determines the maximum temperature, which should be considered in terms of a 60°C limitation average across the pipe wall thickness. Generally, higher temperature discharges are limited to a small volumes and short durations satisfactory. Thermal cycling for u-PVC drainage pipes require the ability to withstand alternating 90 seconds cycles of 35 liters of water at 93°C with 35 liters of water at 12°C without leakage or excessive deformation. However, Qatar National Plastic technical advice has to be obtained for sophisticated applications.

Low Temperature Application

The Impact properties of u-PVC pipe are reduced at zero degree celcius and below. Special care has to take when applications at this temperature by means of any kind of protection like encased in duct. u-PVC pipes should not be used at temperature where water freezes.

Thermal expansion

Thermal expansion for above ground pipe is 6mm for 10mtr pipe for each 10°C rise in temperate. It is mandatory to keep an expansion ring seal joint in between two solvent joints to avoid the stress in pipes and to allow the pipe to expand and contract smoothly. The maximum distance between expansion joints would be 4mtr for diameters ranging 75mm-160mm and 2mtr for 32mm-63mm.

Chemical resistance

Qplast branded u-PVC drainage pipes are resistant to public sewer discharge acids. However, with elevated service temperature (ie increase above 60 degrees celsius) may reduce the chemical resistance. Please refer Qatar National Plastic “Chemical resistance chart”

Exposure to Ultra violet rays

Long time exposure of UV rays on u-PVC pipes may create discoloration, but will not significantly affect the performance of pipes. To minimize the UV degradation Qatar National Plastic u-PVC pipes are manufactured with titanium dioxide which will reflect UV rays. The depth of penetrating degradation would range between 0.025-0.076mm. In case of stronger protection is required pipe and fitting may have painted with white colour acrylic based latex paint or made be opaque with any other shield to avoid penetration UV rays.

Installation

When installing of u-PVC sanitary drainage pipes it is necessary to keep supporting brackets in between the pipe work. This supporting brackets could be plastic coated or using any other suitable materials fit for that purpose. Special care must be taken to ensure pipe surfaces should not be damaged while tightening the supports in to the wall. Where anchor points are required to control thermal movement, supporting brackets are usually fitted on the pipe sockets between special ribs. Intermediate guide brackets fitted to the pipe barrel should allow thermal movement to take place.

Maximum distance between supports

The maximum distance between vertical and low gradient supports shall not be exceed values from the below table. In vertical pipe runs there should be at least one pipe support bracket at each storey height, fixed behind a collar to support the vertical load, avoid downward movement of the pipes and loss of expansion gaps.

Supports should be adjacent to joints and of adequate strength to carry the weight of the pipe plus contents. Where the layout requires shorter lengths than the maximum, support distances should be adjusted to suit these shorter lengths and provision of lateral bracing should be considered when pipes are flexibly jointed.

Pipe DN(mm)	Vertical pipes (m)	Low gradient pipes (m)
32 to 40	1,2	0,5
50	1,2	0,6
75 to 100	2,0	1,0
150	2,0	1,2

Types of Above Ground Drainage Systems

System I

Single discharge stack system with partly filled branch discharge pipes

Sanitary appliances are connected to partly filled branch discharge pipes. The partly filled branch discharge pipes are designed with a filling degree of 0.5 (50 %) and are connected to a single discharge stack.

System II

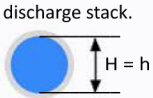
Single discharge stack system with small bore discharge branch pipes

Sanitary appliances are connected to small bore branch discharge pipes. The small bore branch discharge pipes are designed with a filling degree of 0.7 (70 %) and are connected to a single discharge stack.

System III

Single discharge stack system with full bore branch discharge pipes

Sanitary appliances are connected to full bore branch discharge pipes. The full bore branch discharge pipes are designed with a filling degree of 1.0 (100 %) and each branch discharge pipe is separately connected to a single discharge stack.



System IV

Separate discharge stack system

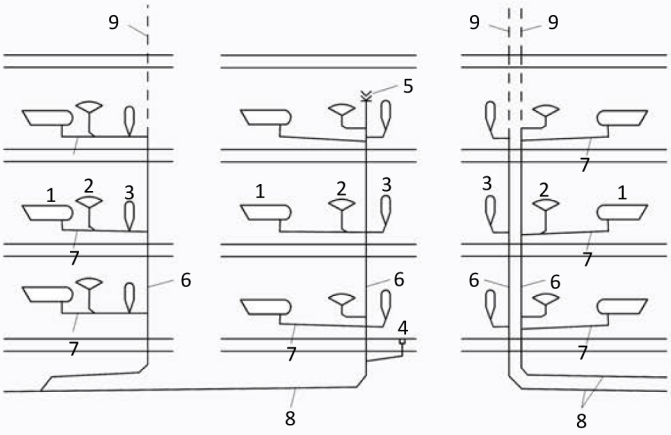
Drainage systems type I, II and III may also be divided into a black water stack serving WC’s and urinals and a grey water stack serving all other appliances.

Configurations

Each system may be configured in a number of ways, governed by the need to control pressure in the pipework in order to prevent foul air from the waste water system entering the building. The principal configurations are described below but combinations and variations are often required.

(a) Primary ventilated system configurations

Control of pressure in the discharge stack is achieved by air flow in the discharge stack and the stack vent (Please refer Figure: AGD 1). Alternatively, air admittance valves may be used.



Legend:

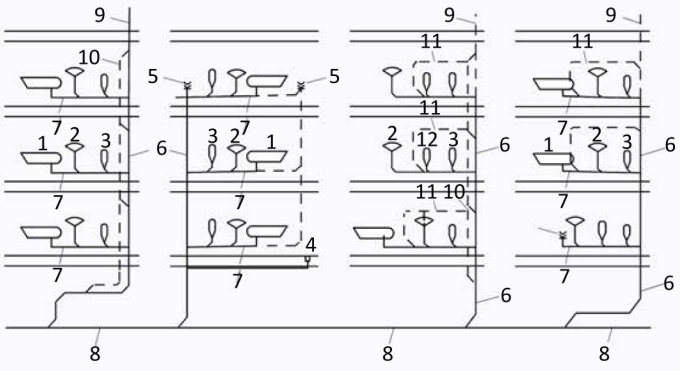
1 Bath
2 Wash basin
3 WC
4 Floor gully
5 Air admittance valve
6 Stack
7 Branch discharge pipe
8 Drain
9 Stack vent

Figure: AGD 1

(b) Secondary ventilated system configurations

Control of pressure in the discharge stack is achieved by use of separate ventilating stacks and/or secondary branch ventilating pipes in connection with stack vents (Please refer Figure AGD 2).

Alternatively, air admittance valves may be used.



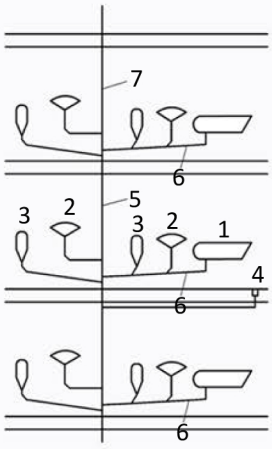
Legend:

1 Bath
2 Wash basin
3 WC
4 Floor gully
5 Air admittance valve
6 Stack
7 Branch discharge pipe
8 Drain
9 Stack vent
10 Ventilating stack
11 Branch ventilating pipe
12 Urinal

Figure: AGD 2

(c) Unventilated discharge branch configurations

Control of pressure in the discharge branch is achieved by air flow in the discharge branch (Please refer Figure AGD 3).



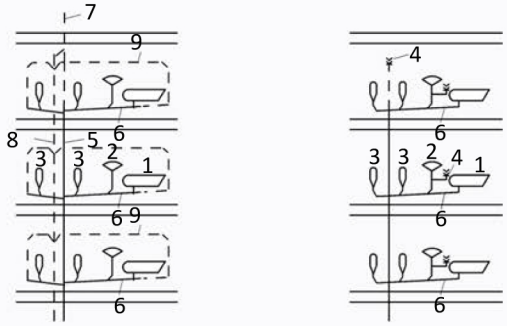
Legend:

1 Bath
2 Wash basin
3 WC
4 Floor gully
5 Stack
6 Branch discharge pipe
7 Stack vent

Figure: AGD 3

(d) Ventilated discharge branch configurations

Control of pressure in the discharge branch is achieved by ventilation of the discharge branch (Please refer Figure: AGD 4). Alternatively, air admittance valves may be used.



Legend:

1 Bath
2 Wash basin
3 WC
4 Air admittance valve
5 Stack
6 Branch discharge pipe
7 Stack vent
8 Ventilating stack
9 Branch ventilating pipe

Figure: AGD 4

Nominal diameters (DN) and related minimum internal diameters (di min)

Nominal Diameter	Minimum Internal Diameter
DN	*di* min (mm)
30	26
40	34
50	44
56	49
60	56
70	68
80	75
90	79
100	96
125	113
150	146
200	184
225	207
250	230
300	290

Table AGD 5

Table AGD 6: Discharge Unit (DU) values

Appliance	System I	System II	System III	System IV
	DU	DU	DU	DU
	l/s	l/s	l/s	l/s
Wash basin, bidet	0,5	0,3	0,3	0,3
Shower without plug	0,6	0,4	0,4	0,4
Shower with plug	0,8	0,5	1,3	0,5
Single urinal with cistern	0,8	0,5	0,4	0,5
Urinal with flushing valve	0,5	0,3	-	0,3
Slab urinal	0,2*	0,2*	0,2*	0,2*
Bath	0,8	0,6	1,3	0,5
Kitchen sink	0,8	0,6	1,3	0,5
Dishwasher (household)	0,8	0,6	0,2	0,5
Washing machine up to 6 kg	0,8	0,6	0,6	0,5
Washing machine up to 12 kg	1,5	1,2	1,2	1,0
WC with 4,0 l cistern	**	1,8	**	**
WC with 6,0 l cistern	2,0	1,8	1,2 to 1,7***	2,0
WC with 7,5 l cistern	2,0	1,8	1,4 to 1,8***	2,0
WC with 9,0 l cistern	2,5	2,0	1,6 to 2,0***	2,5
Floor gully DN 50	0,8	0,9	-	0,6
Floor gully DN 70	1,5	0,9	-	1,0
Floor gully DN 100	2,0	1,2	-	1,3

* Per person.
** Not permitted.
*** Depending upon type (valid for WC's with siphon flush cistern only).
\- Not used or no data.

Discharges from non-domestic sanitary appliances (e.g. commercial kitchen) should be determined individually.

Calculation of Waste water flowrate (Qww)

Qww is the expected flowrate of waste water in a part or in the whole drainage system where only domestic sanitary appliances are connected to the system.

$$Qww = K\sqrt{\sum DU}$$

where:
Qww= Waste water flowrate (l/s)
K = Frequency factor

SDU = Sum of discharge units

Typical frequency factors (K)

Usage of appliances	K
Intermittent use, e.g. in dwelling, guesthouse, office	0,5
Frequent use, e.g. in hospital, school, restaurant, hotel	0,7
Congested use, e.g. in toilets and/or showers open to public	1,0
Special use, e.g. laboratory	1,2

Waste water flow rates (Qww) Using different frequency factors (K)

Sum of Discharge Units	K 0,5	K 0,7	K 1,0	K 1,2
ΣDU	Qww	Qww	Qww	Qww
	l/s	l/s	l/s	l/s
10	1,6	2,2	3,2	3,8
12	1,7	2,4	3,5	4,2
14	1,9	2,6	3,7	4,5
16	2,0	2,8	4,0	4,8
18	2,1	3,0	4,2	5,1
20	2,2	3,1	4,5	5,4
25	2,5	3,5	5,0	6,0
30	2,7	3,8	5,5	6,6
35	3,0	4,1	5,9	7,1
40	3,2	4,4	6,3	7,6
45	3,4	4,7	6,7	8,0
50	3,5	4,9	7,1	8,5
60	3,9	5,4	7,7	9,3
70	4,2	5,9	8,4	10,0

Sum of Discharge Units	K 0,5	K 0,7	K 1,0	K 1,2
SDU	Qww	Qww	Qww	Qww
	l/s	l/s	l/s	l/s
80	4,5	6,3	8,9	10,7
90	4,7	6,6	9,5	11,4
100	5,0	7,0	10,0	12,0
110	5,2	7,3	10,5	12,6
120	5,5	7,7	11,0	13,1
130	5,7	8,0	11,4	13,7
140	5,9	8,3	11,8	14,2
150	6,1	8,6	12,2	14,7
160	6,3	8,9	12,6	15,2
170	6,5	9,1	13,0	15,6
180	6,7	9,4	13,4	16,1
190	6,9	9,6	13,8	16,5
200	7,6	9,9	14,1	17,0
220	7,4	10,4	14,8	17,8
240	7,7	10,8	15,5	18,6
260	8,1	11,3	16,1	19,3
280	8,4	11,7	16,7	20,1
300	8,7	12,1	17,3	20,8
320	8,9	12,5	17,9	21,5
340	9,2	12,9	18,4	22,1
360	9,5	13,3	19,0	22,8
380	9,7	13,6	19,5	23,4
400	10,0	14,0	20,0	24,0

Table AGD 7

Calculation of Total flowrate (Qtot)

Qtot is the design flowrate in a part or in the whole drainage system where sanitary appliances, appliances with continuous flow and/or waste water pumps are connected to the system.

Continuous flows and pump discharge rates shall be added to the waste water flowrate without any reduction.

Qtot = Qww + Qc + Qp
Qtot = Total flowrate (l/s)
Qww = Waste water flowrate (l/s)
Qc = Continuous flowrate (l/s)
Qp = Pumped water flowrate (l/s)

Layout of branches

Unventilated discharge branches
Below table can be used for sizes and limitations upon the use of unventilated discharge branches are given in Tables AGD 8 and AGD 9. Where the limitations cannot be met, discharge branches shall be ventilated.

Table AGD 8 — Hydraulic capacity (Qmax) and nominal diameter (DN)

*Q*max	System I	System II	System IV
l/s	DN	DN	DN
0,40	*	30	30
0,50	40	40	40
0,80	50	*	*
1,00	60	50	50
1,50	70	60	60
2,00	80**	70**	70**
2,25	90***	80****	80****
2,50	100	90	100

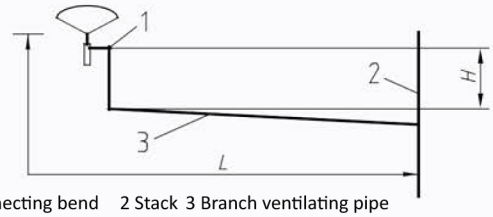
* Not permitted.
** No WC's.
*** Not more than two WC's and a total change in directions of not more than 90°.
**** Not more than one WC.

Qplast

Table AGD 9 - Limitations

Limitations	System I	System II	System IV
Maximum length (L) of pipe	4,0 m	10,0 m	10,0 m
Maximum number of 90° bends	3*	1*	3*
Maximum drop (H) (45° or more inclination)	1,0 m	**6,0 m DN > 70 **3,0 m DN = 70	1,0 m
Minimum gradient	1 %	1,5 %	1 %

* Connection bend not included.
** If DN < 100 mm and a WC is connected to the branch no other appliances can be connected more than 1 m above the connection to a ventilated system.



1 Connecting bend 2 Stack 3 Branch ventilating pipe

Table AGD 10 — Limitations for unventilated branch - discharge - pipes in system III.

Appliance	Diameter	Min. trap seal depth	Max. length (L) of pipe from trap outlet to stack	Pipe gradient	Max number of bends	Max. drop (H)
	DN	mm	m	%	No.	m
Washbasin, bidet (30 mm diameter trap)	30	75	1,7	2,2[1])	0	0
Washbasin, bidet (30 mm diameter trap)	30	75	1,1	4,4[1])	0	0
Washbasin, bidet (30 mm diameter trap)	30	75	0,7	8,7[1])	0	0
Washbasin, bidet (30 mm diameter trap)	40	75	3,0	1,8 to 4,4	2	0
Shower, bath	40	50	No Limit[2])	1,8 to 9,0	No Limit	1,5
Bowl urinal	40	75	3,0[3])	1,8 to 9,0	No Limit[4])	1,5
Trough urinal	50	75	3,0[3])	1,8 to 9,0	No Limit[4])	1,5
Slab urinal[5])	60	50	3,0[3])	1,8 to 9,0	No Limit[4])	1,5
Kitchen sink (40 mm diameter trap)	40	75	No Limit[2])	1,8 to 9,0	No Limit	1,5
Household dishwasher or washing machine	40	75	3,0	1,8 to 4,4	No Limit	1,5
WC with outlet up to 80 mm[6])	75	50	No Limit	1,8 Min.	No Limit[4])	1,5
WC with outlet greater than 80 mm[6])	100	50	No Limit	1,8 Min.	No Limit[4])	1,5
Food waste disposal[7])	40 Min.	75[8])	3,0[3])	13,5 Min.	No Limit[4])	1,5
Sanitary towel disposal unit	40 Min.	75[8])	3,0[3])	5,4 Min.	No Limit[4])	1,5
Floor drain	50	50	No Limit[3])	1,8 Min.	No Limit	1,5
Floor drain	70	50	No Limit[3])	1,8 Min.	No Limit	1,5
Floor drain	100	50	No Limit[3])	1,8 Min.	No Limit	1,5
4 basins	50	75	4,0	1,8 to 4,4	0	0
Bowl urinals[8])	50	75	No Limit[3])	1,8 to 9,0	No Limit[4])	1,5
Maximum of 8 WC's[6])	100	50	15,0	0,9 to 9,0	2	1,5
Up to 5 spray tap basins[9])	30 Max.	50	4,5[3])	1,8 to 4,4	No Limit[4])	0

1) Steeper gradient permitted if pipe is less than maximum permitted length.
2) If length is greater than 3 m noisy discharge may result with an increased risk of blockage.
3) Should be as short as possible to limit problems with deposition.
4) Sharp throated bend should be avoided.
5) For slab urinal for up to 7 persons. Longer slabs to have more than one outlet.
6) Swept-entry branches serving WC's.
7) Includes small potato-peeling machines.
8) Tubular not bottle or resealing traps.
9) Spray tap basin shall have flush-grated wastes without plugs.

Ventilated discharge branches

Below table can be used sizes and limitations upon the use of ventilated discharge branches are given in Table AGD 11 and AGD 12. Limitations .

Table AGD 11 — Hydraulic capacity (Qmax) and nominal diameter (DN)

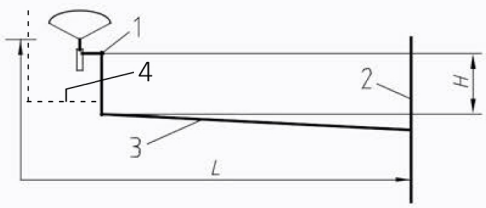
Qmax	System I	System II	System IV
l/s	DN	DN	DN
	Branch/Vent	Branch/Vent	Branch/Vent
0,60	*	30/30	30/30
0,75	50/40	40/30	40/30
1,50	60/40	50/30	50/30
2,25	70/50	60/30	60/30
3,00	80/50**	70/40**	70/40**
3,40	90/60***	80/40****	80/40****
3,75	100/60	90/50	90/50

* Not permitted.
** No WC's.
*** Not more than two WC's and a total change in directions of not more than 90°.
**** Not more than one WC.

Table AGD 12 — Limitations

Limitations	System I	System II	System IV
Maximum length (L) of pipe	10,0 m	No Limit	10,0 m
Maximum number of 90° bends*	No Limit	No Limit	No Limit
Maximum drop (H) (45° or more inclination)	3,0 m	3,0 m	3,0 m
Minimum gradient	0,5 %	1,5 %	0,5 %

* Connection bend not included.



1 Connection bend 2 Stack
3 Branch discharge pipe 4 Branch ventilating pipe

Figure AGD 13 — Limitations for ventilated discharge branches in system I, II and IV

Table AGD 14 — Limitations for ventilated branch discharge pipes in system III

Appliance	Diameter	Min. trap seal depth	Max. length (L) of pipe from trap outlet to stack	Pipe gradient	Max number of bends	Max. drop (H)
	DN	mm	m	%	No.	m
Washbasin, bidet (30 mm diameter trap)	30	75	3,0	1,8 Min.	2	3,0
Washbasin, bidet (30 mm diameter trap)	40	75	3,0	1,8 Min.	No Limit	3,0
Shower, bath	40	50	No Limit[2])	1,8 Min.	No Limit	No Limit
Bowl urinal	40	75	3,0[3])	1,8 Min.	No Limit[4])	3,0
Trough urinal	50	75	3,0[3])	1,8 Min.	No Limit[4])	3,0
Slab urinal5)	60	50	3,0[3])	1,8 Min.	No Limit[4])	3,0
Kitchen sink (40 mm diameter trap)	40	75	No Limit[2])	1,8 Min.	No Limit	No Limit
Household dishwasher or washing machine	40	75	No Limit[3])	1,8 Min.	No Limit	No Limit

Appliance	Diameter	Min. trap seal depth	Max. length (L) of pipe from trap outlet to stack	Pipe gradient	Max number of bends	Max. drop (H)
	DN	mm	m	%	No.	m
WC with outlet up to 80 mm[6]) and [14])	75	50	No Limit	1,8 Min.	No Limit[4])	1,5
WC with outlet greater than 80 mm[6]) and [14])	100	50	No Limit	1,8 Min.	No Limit[4])	1,5
Food waste disposal[7])	40 Min.	75[8])	3,0[3])	13,5 Min.	No Limit[4])	3,0
Sanitary towel disposal unit	40 Min.	75[8])	3,0[3])	5,4 Min.	No Limit[4])	3,0
Bath drain, floor drain	50	50	No Limit[3])	1,8 Min.	No Limit	No Limit
Floor drain	70	50	No Limit[3])	1,8 Min.	No Limit	No Limit
Floor drain	100	50	No Limit[3])	1,8 Min.	No Limit	No Limit
4 basins[9])	50	75	7,0	1,8 to 4,4	[2])	0
10 basins[9]) and [10])	50	75	10,0	1,8 to 4,4	No Limit	0
Bowl urinals[9]) and [11])	50	75	No Limit[3])	1,8 Min.	No Limit[4])	No Limit
More than 8 WC's[6])	100	50	No Limit	0,9 Min.	No Limit	No Limit
Up to 5 spray-tap basins[12])	30 Max.	50	No Limit[3])	1,8 to 4,4	No Limit[4])	0

1) For maximum distance from trap to vent;
2) If length is greater than 3 m, noisy discharge may result with an increased risk of blockage.
3) Should be as short as possible to limit problems with deposition.
4) Sharp throated bends should be avoided.
5) For slab urinal for up to 7 persons. Longer slabs to have more than one outlet.
6) Swept-entry branches serving WC's.
7) Includes small potato-peeling machines.
8) Tubular not bottle or resealing traps.
10) Every basin shall be individually ventilated.
11) Any number.
12) Spray tap basins shall have flush-grated wastes without plugs.
13) The size of ventilating pipes to branches from appliances can be DN 25 but, if they are longer than 15 m or contain more than five bends, a DN 30 pipe shall be used.
14) If the connection of the ventilating pipe is liable to blockage due to repeated splashing or submergence, it should be DN 50, up to 50 mm above the spill-over level of the appliance.

Layout of discharge stacks

Primary ventilated discharge stacks
Below table can be used sizes and limitations of primary ventilated discharge stacks.

Table AGD 15 — Hydraulic capacity (*Q*max) and nominal diameter (DN)

Stack and Stack Vent	System I, II, III, IV	*Q*max (l/s)
DN	Square Entries	Swept Entries
60	0,5	0,7
70	1,5	2,0
80*	2,0	2,6
90	2,7	3,5
100**	4,0	5,2
125	5,8	7,6
150	9,5	12,4
200	16,0	21,0

* Minimum size where WC's are connected in system II.
** Minimum size where WC's are connected in system I, III, IV.

Secondary ventilated discharge stacks
Sizes and limitations of secondary ventilated discharge stacks are given in Table AGD 16.

Table AGD 16 — Hydraulic capacity (*Q*max) and nominal diameter (DN)

Stack and Stack Vent	Secondary Vent	System I, II, III, IV	*Q*max (l/s)
DN	DN	Square Entries	Swept Entries
60	50	0,7	0,9
70	50	2,0	2,6
80*	50	2,6	3,4
90	50	3,5	4,6
100**	50	5,6	7,3
125	70	7,6	10,0
150	80	12.4	18,3
200	100	21,0	27,3

* Minimum size where WC's are connected in system II.
** Minimum size where WC's are connected in system I, III, IV.

Capacities of drains pipes

Table AGD 17 — Capacity of drains Filling degree 50 %, (h/d = 0,5)

Slope	DN 100		DN 125		DN 150		DN 200		DN 225		DN 250		DN 300	
i	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,50	1,8	0,5	2,8	0,5	5,4	0,6	10,0	0,8	15,9	0,8	18,9	0,9	34,1	1,0
1,00	2,5	0,7	4,1	0,8	7,7	0,9	14,2	1,1	22,5	1,2	26,9	1,2	48,3	1,4
1,50	3,1	0,8	5,0	1,0	9,4	1,1	17,4	1,3	27,6	1,5	32,9	1,5	59,2	1,8
2,00	3,5	1,0	5,7	1,1	10,9	1,3	20,1	1,5	31,9	1,7	38,1	1,8	68,4	2,0
2,50	4,0	1,1	6,4	1,2	12,2	1,5	22,5	1,7	35,7	1,9	42,6	2,0	76,6	2,3
3,00	4,4	1,2	7,1	1,4	13,3	1,6	24,7	1,9	39,2	2,1	46,7	2,2	83,9	2,5
3,50	4,7	1,3	7,6	1,5	14,4	1,7	26,6	2,0	42,3	2,2	50,4	2,3	90,7	2,7
4,00	5,0	1,4	8,2	1,6	15,4	1,8	28,5	2,1	45,2	2,4	53,9	2,5	96,9	2,9
4,50	5,3	1,5	8,7	1,7	16,3	2,0	30,2	2,3	48,0	2,5	57,2	2,7	102,8	3,1
5,00	5,6	1,6	9,1	1,8	17,2	2,1	31,9	2,4	50,6	2,7	60,3	2,8	108,4	3,2

Table AGD 18 — Capacity of drains Filling degree 70 %, (h/d = 0,7)

Slope	DN 100		DN 125		DN 150		DN 200		DN 225		DN 250		DN 300	
i	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v	Qmax	v
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,50	2,9	0,5	4,8	0,6	9,0	0,7	16,7	0,8	26,5	0,9	31,6	1,0	56,8	1,1
1,00	4,2	0,8	6,8	0,9	12,8	1,0	23,7	1,2	37,6	1,3	44,9	1,4	80,6	1,6
1,50	5,1	1,0	8,3	1,1	15,7	1,3	29,1	1,5	46,2	1,6	55,0	1,7	98,8	2,0
2,00	5,9	1,1	9,6	1,2	18,2	1,5	33,6	1,7	53,3	1,9	63,6	2,0	114,2	2,3
2,50	6,7	1,2	10,8	1,4	20,3	1,6	37,6	1,9	59,7	2,1	71,1	2,2	127,7	2,6
3,00	7,3	1,3	11,8	1,5	22,3	1,8	41,2	2,1	65,4	2,3	77,9	2,4	140,0	2,8
3,50	7,9	1,5	12,8	1,6	24,1	1,9	44,5	2,2	70,6	2,5	84,2	2,6	151,2	3,0
4,00	8,4	1,6	13,7	1,8	25,8	2,1	47,6	2,4	75,5	2,7	90,0	2,8	161,7	3,2
4,50	8,9	1,7	14,5	1,9	27,3	2,2	50,5	2,5	80,1	2,8	95,5	3,0	171,5	3,4
5,00	9,4	1,7	15,3	2,0	28,8	2,3	53,3	2,7	84,5	3,0	100,7	3,1	180,8	3,6

where:

Qmax = Capacity of drains (l/s)

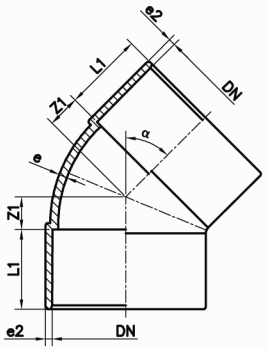
v = Velocity (m/s)

Above calculation based on
effective roughness of kb = 1.0 mm
clean water with a viscosity of n = 1.31 x 10^{-6} m^2/s

Standard: BSEN 1329 B & BD
Colour: Light Grey RAL 7042
Application: BD (SN4) Above ground and under ground
B Above ground

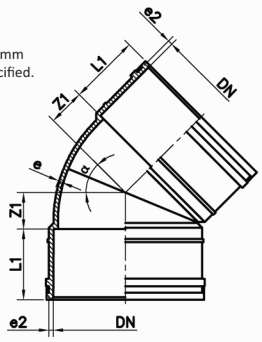
F/F: Female/Female socket
M/F: Male/Female socket
RRJ: Rubber Ring Joint
SCJ: Solvent Cement Joint

Note : All dimensions are in mm unless otherwise specified.



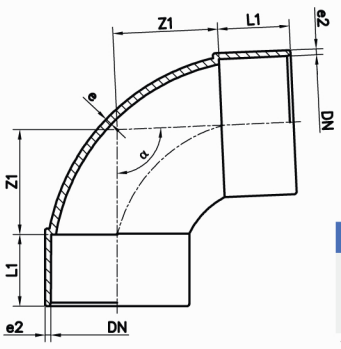
Elbow 45° Unswept F/F SCJ - B

DN	α	e	e2	L1	Z1
43	45°	3	2.3	28	17
56	45°	3	2.3	30.5	12.5



Elbow 45°Unswept F/F SCJ - BD

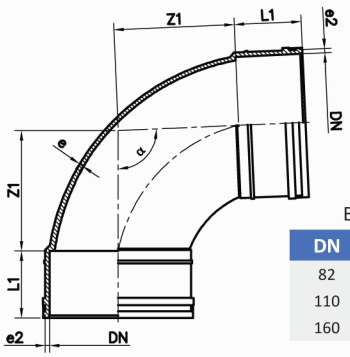
DN	α	e	e2	L1	Z1
82	45°	3	2.3	45	22
110	45°	3.2	2.4	54	28
160	45°	4	3	76	44



Bend 92.5° Swept F/F SCJ - B

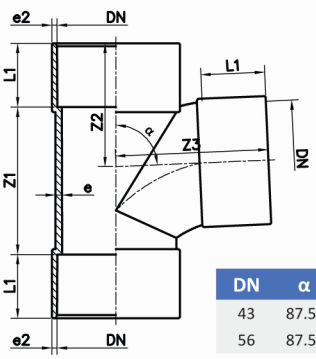
DN	α	e	e2	L1	Z1
*36	92.5°	3	2.3	26	24
43	92.5°	3	2.3	28	33
56	92.5°	3	2.3	30.5	44.5

** Unswept type*



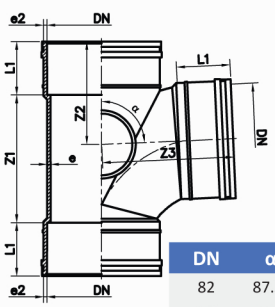
Bend 92.5° Swept F/F SCJ - BD

DN	α	e	e2	L1	Z1
82	92.5°	3	2.3	45	56
110	92.5°	3.2	2.4	54	97
160	92.5°	4	3	76	127



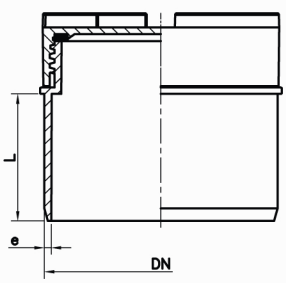
TEE 87.5° Swept F/F SCJ - B

DN	α	e	e2	L1	Z1	Z2	Z3
43	87.5°	3	2.3	28	59	50	62
56	87.5°	3	2.3	30.5	70.5	57.5	73



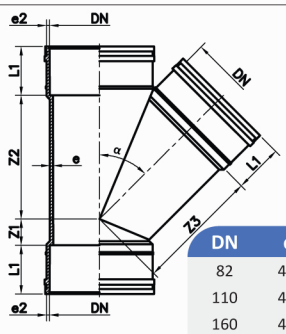
TEE 87.5° Swept F/F SCJ - BD

DN	α	e	e2	L1	Z1	Z2	Z3
82	87.5°	3	2.3	45	110	88.5	108
110	87.5°	3.2	2.4	54	127	104	133
160	87.5°	4	3	76	212	162	200



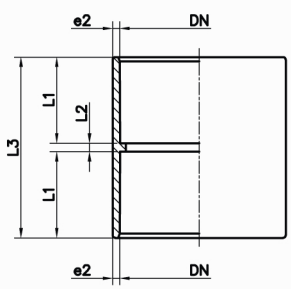
Access Cap SCJ -B

DN	e	L
36	3	28
43	3	30
56	3	32.5
82	3	47
110	3.2	56



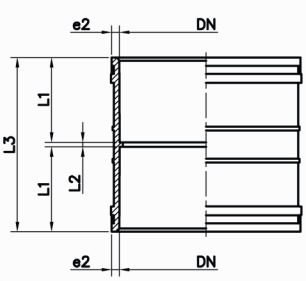
TEE 45° F/F SCJ - BD

DN	α	e	e2	L1	Z1	Z2	Z3
82	45°	3	2.3	45	24	102	102
110	45°	3.2	2.4	54	29	137	137
160	45°	4	3	76	44	197	197



Coupler F/F SCJ - B

DN	e2	L1	L2	L3
36	2.3	24	2.6	50.6
43	2.3	28	2.6	58.6
56	2.3	30.5	3	64



Coupler F/F SCJ - BD

DN	e2	L1	L2	L3
82	2.3	45	3	93
110	2.4	54	3	111
160	3	78	4	160

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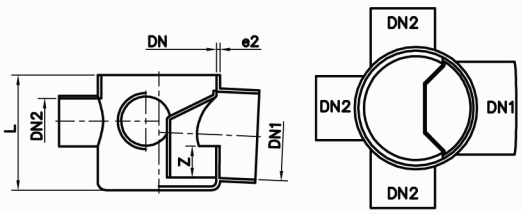
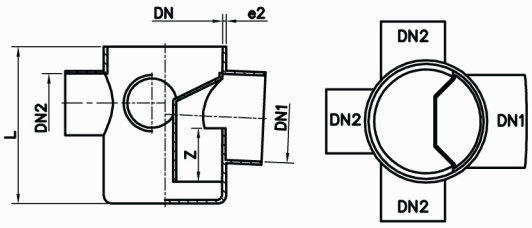
Note : All dimensions are in mm unless otherwise specified.



Trapped Floor Gully - Water Seal 30mm SCJ

DN	DN1	DN2	e2	L	Z
110	82	43/56	2.4	110	30

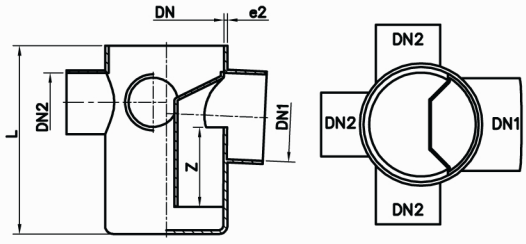
DN2 can be customized as per requirement. BD application.



Trapped Floor Gully - Water Seal 50mm SCJ

DN	DN1	DN2	e2	L	Z
110	82	43/56	2.4	150	50

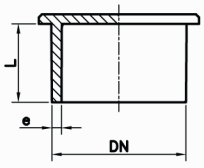
DN2 can be customized as per requirement. BD application.



Trapped Floor Gully - Water Seal 76mm SCJ

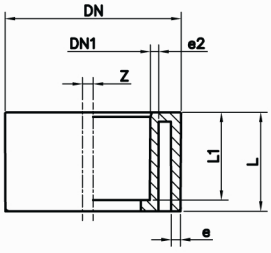
DN	DN1	DN2	e2	L	Z
110	82	43/56	2.4	180	76

DN2 can be customized as per requirement. BD application.



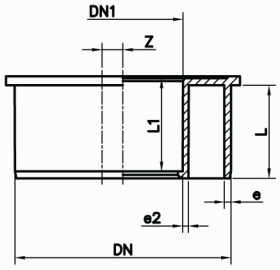
End Plug SCJ - B

DN	e	L
43	3	30
56	3	32.5



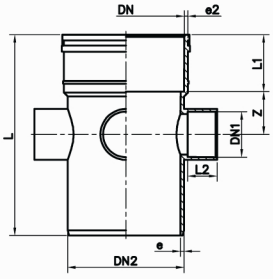
Reducing Bush M/F SCJ -B

SIZE	DN	DN1	e	e2	L	L1	Z
56x43	56	43	3	2.3	31.5	28	3.4
43x36	43	36	3	2.3	28	24.5	0



Reducing Bush M/F SCJ -BD

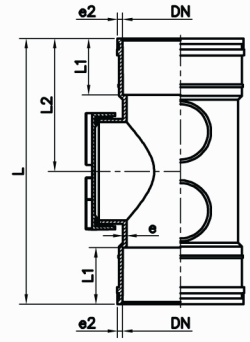
SIZE	DN	DN1	e	e2	L	L1	Z
160x110	160	110	4	2.4	76.8	54	20.63
110x82	110	82	3.2	2.3	47.5	46	10.65
82x56	82	56	3	2.3	44.8	43.3	9.9



Boss Pipe M/F SCJ -BD

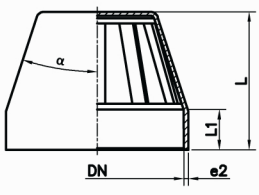
DN	DN1	DN2	e	e2	L	L1	L2	Z
110	43/56	110	3.2	2.4	190	54	28	40.5

DN1 can be customized as per requirement.



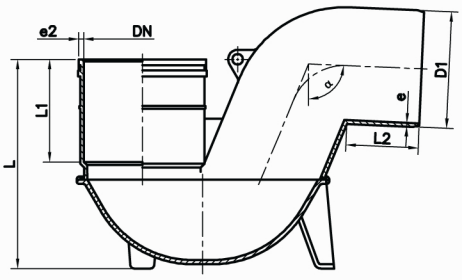
Access Pipe Coupler F/F SCJ - BD

DN	e	e2	L	L1	L2
110	3.2	2.4	254	54	127



Vent Cowl SCJ-B

DN	α	e2	L	L1
110	18°	2.4	88	25.7



P Trap M/F RRJ - BD

DN	D1	α	e	e2	L	L1	L2
110	110	87.5°	3.2	2.9	197	97	68

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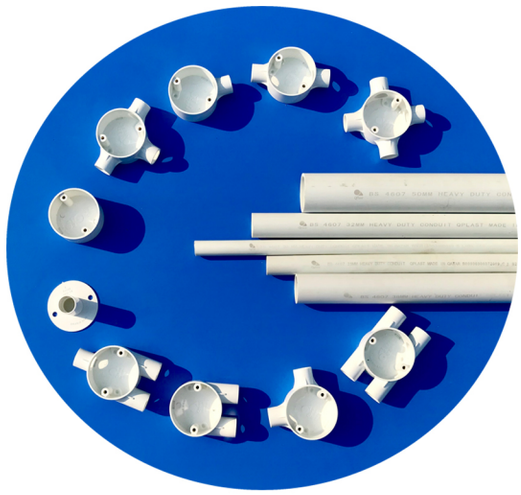
uPVC Electrical Conduit and Fittings — Specifications

u-PVC is the best material available for the manufacturing of Electrical Conduits because its superior insulation properties and low cost.

QNPF manufactures its u-PVC pipe twin extrusion German Technology with full automation to ensure the optimal productivity and quality. Our u-PVC Conduit Fittings are manufactured with Austrian Technology under a fully automated injection moulding process.

All our products are independently certified and production batches are subjected to routine internal testing in accordance with relevant manufacturing codes. Our Conduits and Fittings meet the requirements of BS 4607, BS EN 61386-1:2008, BS EN 61386-21: 2004+A11:2010 and BS EN 61386-25:2011 where applicable.

Features and Benefits of Qplast u-PVC Conduits and Fittings

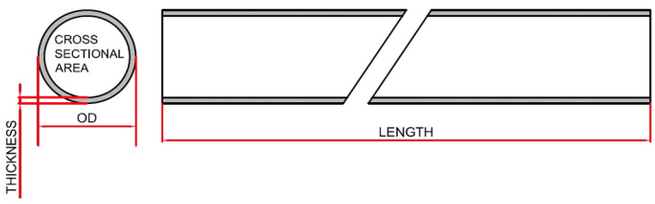


- Excellent Cold Bending Properties
- Good Tensile Strength
- Good Compression Strength
- Good Impact Strength
- Suspended Load Capacity
- Self-extinguishing
- Anti-corrosive
- Excellent Dielectric Strength and Insulation Resistance
- Light weight
- Life span more than 50 years

u-PVC Heavy Duty Conduits BS 4607 / Q.C.S.

Outside Diameter OD (mm)	Inside Diameter ID (mm)	Wall Thickness Minimum (mm)	Cross Section Area (mm^2)	Unit Length (L) (m)
20	16.4	1.8	211	2.9
25	21.2	1.9	353	2.9
32	27.4	2.3	589	2.9
38	33.0	2.5	855	2.9
50	43.8	3.1	1506	2.9

Colour: White RAL 9016 or Black RAL 9055



u-PVC Conduits BS 6099-1982

Outside Diameter OD (mm)	Light Duty ID (mm)	Light Duty Wall Thickness (Min) (mm)	Light Duty Cross Section Area (mm^2)	Medium Duty ID (mm)	Medium Duty Wall Thickness (Min) (mm)	Medium Duty Cross Section Area (mm^2)	Heavy Duty ID (mm)	Heavy Duty Wall Thickness (Min) (mm)	Heavy Duty Cross Section Area (mm^2)	Unit Length (L) (m)
20	17.4	1.3	238	16.9	1.55	224	15.8	2.1	196	2.9
25	22.1	1.45	383	21.4	1.8	359	20.6	2.2	333	2.9
32	28.6	1.7	642	27.8	2.1	607	26.6	2.7	555	2.9
50	45.1	2.45	1597	44.3	2.85	1541	43.2	3.4	1465	2.9

Colour: White RAL 9016 or Black RAL 9055

The length of Qplast conduits are 2.9m, however custom lengths may be ordered according to customer requirements.

Electric Wiring Regulations

Qplast conduit systems comply with all relevant requirements of the latest edition of the BS 7671 IEE Wiring Regulations.

Conduit Fittings

Material:	u-PVC
Light Fixing Centre:	50.8 mm
Junction Box Pillar Thread Sizes:	M4 Brass insert
Load Suspension:	3 kg at 60° C maximum
Colour:	White RAL 9016 or Black RAL 9055

Recyclability

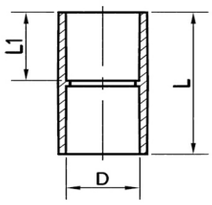
QNPF manufactured u-PVC pipes and fittings are 100% recyclable. Also, all our products are being manufactured using Lead (Pb) free compounds.

Qplast

uPVC Electrical Conduit and Fittings

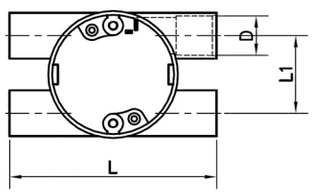
Specifications

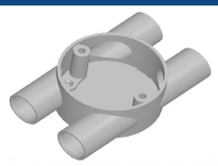
Coupler



Size	D	L	L1
20	20	41	19.7
25	25	52	25
32	32	66.2	32.2
50	50	103.5	50.2

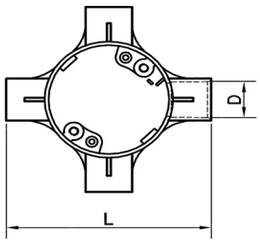
Junction Box H Way

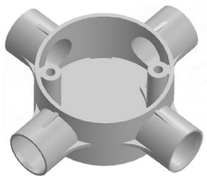




Size	D	L	L1
20	20	104.5	40
25	25	113.5	35

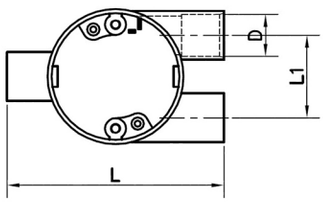
Junction Box 4 Way

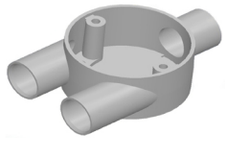




Size	D	L
20	20	104.5
25	25	113.5

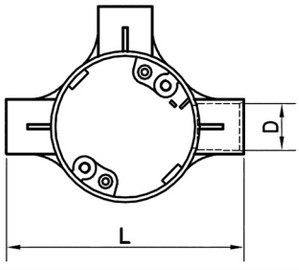
Junction Box Y Way

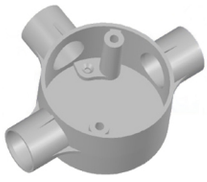




Size	D	L	L1
20	20	104.5	40
25	25	113.5	35

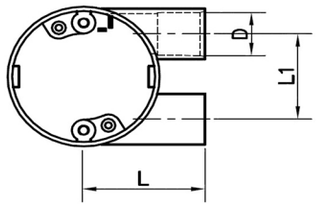
Junction Box 3 Way

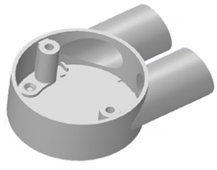




Size	D	L
20	20	104.5
25	25	113.5

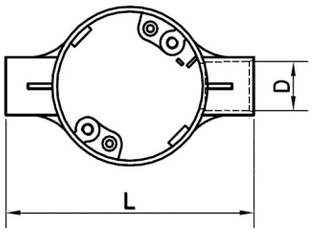
Junction Box U Way

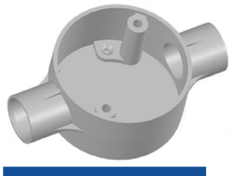




Size	D	L	L1
20	20	52.25	40
25	25	56.75	35

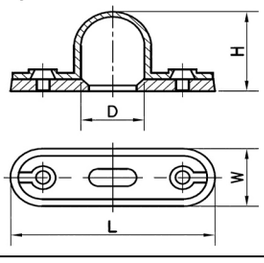
Junction Box 2 Way (Straight)





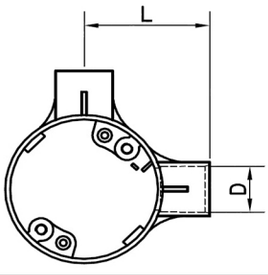
Size	D	L
20	20	104.5
25	25	113.5

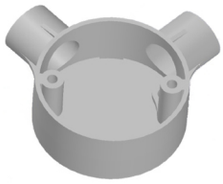
Space Bar Saddle



Size	D	H	L	W
20	20	27.6	64.5	20
25	25	32	64.5	20
32	32	38.6	69.5	19.5
50	50	57.9	85.5	19.5

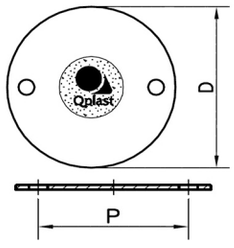
Junction Box 2 Way (Angle)

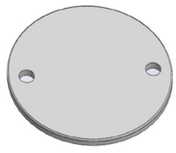




Size	D	L
20	20	52.25
25	25	56.75

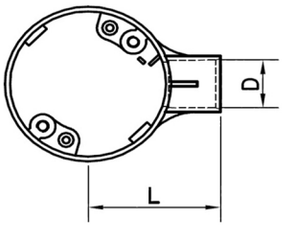
Circular Lid

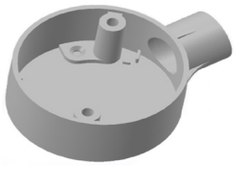




Size	D	P
20	65.6	50.8
25	65.6	50.8

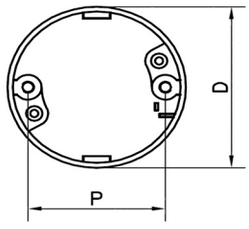
Junction Box 1 Way

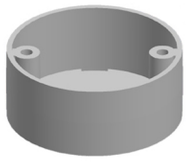




Size	D	L
20	20	52.25
25	25	56.75

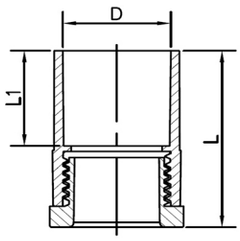
Loop in Box



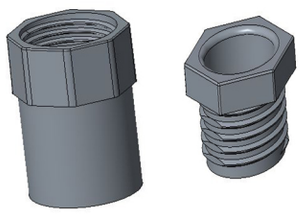


Size	D	P
20	65.6	50.8
25	65.6	50.8

Female Threaded Adaptor



Size	D	L	L1
20	20	38	20.5
25	25	42.5	25
32	32	49.5	32.2
50	50	69	50



Fire performance

Qplast u-PVC Conduits and Fittings are non-flame propagating in accordance with BS EN 50086, BS EN 61386 and BS 6099. Conduit pipes are tested in accordance with BS 467: part 7 resulting Class 1Y classification. Conduit fittings are tested in accordance with IEC 695-2-1 at a severity of 75°C.

Thermal Characteristics

Coefficient of Linear Expansion:	6 x 10-5 for every 10°C temperature rise (ambient temperature greater different expansion coupler must be used)
Thermal Conductivity:	0.19W/m/k
Operating Temperature:	-5°C to 60°C
Softening Temperature (V.T.S.):	79-83°C
Self-extinguishing	

Chemical Resistance

Qplast Conduits and Fittings display excellent resistance to mineral acids, alkalis and detergents, and good resistance to alcohols. These products are non-corrosive and are not affected by seawater or sea air conditions. PVC conduits show some susceptibility to attack from certain solvents such as keystones, aromatics and hydrocarbons. Please request QNPF if detailed chemical resistance chart required.

Electrical Properties

Dielectric strength:	17-20 KV/mm
Dielectric constant (permittivity):	2.9- 3.9 at 1Hz
Volume resistivity:	2 x 10^{14} Ω cm
Electric dissipation:	0.013 at 1Hz

Mechanical Performance

Conduit classification based on BS EN 61386

Conduit Type	Compression Force (N)	Tensile Force (N)	Suspended Load (N)	Impact (Kg)
Light	320	250	30	1
Medium	750	500	150	2
Heavy	1250	1000	450	2

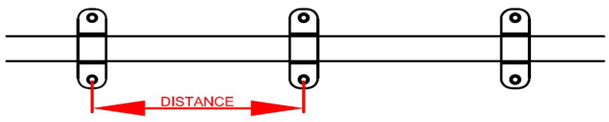
Cable Capacities of Conduit

Extract from Appendix A of the 16th Edition of the I.E.E. Wiring Regulations Selection and Erection of Equipment Guidance Note 1. This describes a method that can be used to determine the size of conduit or trunking necessary to accommodate cables of the same size, or different ring sizes, providing the means of compliance with Regulation 522-08.

Distance Between Saddles

The distance between saddles at 25°C should not exceed that stated in the following table; less in hot temperatures.

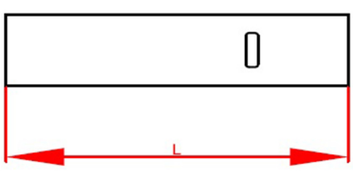
Conduit (OD) (mm)	Maximum Distance Between Supports	
	Horizontal (m)	Vertical (m)
16-25	1.50	1.75
25-40	1.75	2.00
40 and above	2.00	2.00

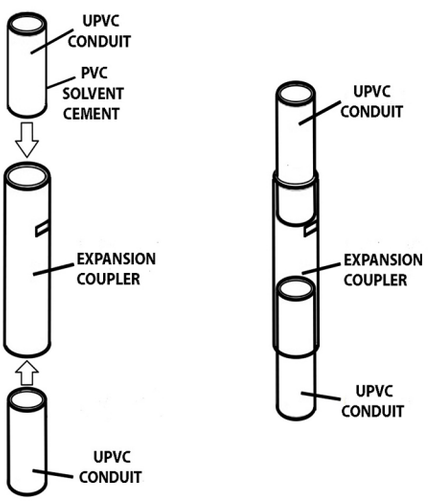


Expansion Couplers

- In order to accommodate thermal movement on non-concealed installations, it is recommended that expansion couplers be used at a maximum distance of 6m intervals.
- In areas of high ambient temperature or where rapid changes in temperature are likely, this distance should be reduced.

For Conduit (OD) (mm)	Length (L) (mm)
20	109
25	110
32	125
38	148
50	166





Expansion Coupler Assembly

Qplast

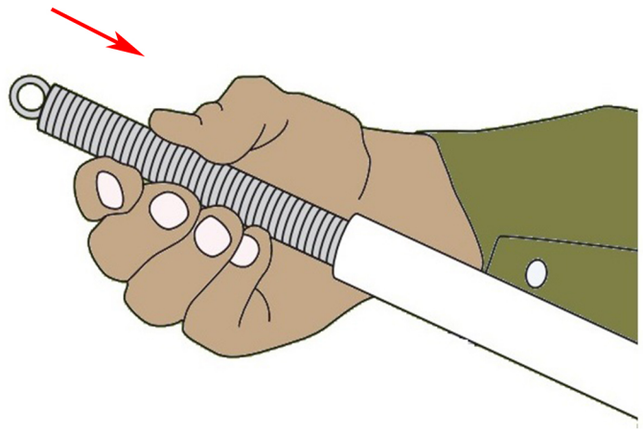
Bends

Care should be taken not to make bends too tight. Attention is drawn to BS 7671:2001 (Wiring Regulations) 522-08-03. The radius of every bend in a wiring system shall be such that conductors and cables shall not suffer damage.

Cold Bending 20-25mm u-PVC Conduit

Cold bending may be carried out on all conduit sizes up to 25mm in diameter using the correct size and gauge of bending spring.

- Heavy gauge springs carry a green colour-band at the tip.
- Make sure springs are not damaged in any way as this can fracture or kink the conduit making removal of the spring difficult.
- In cold weather, warm the conduit by rubbing with a rag before bending.

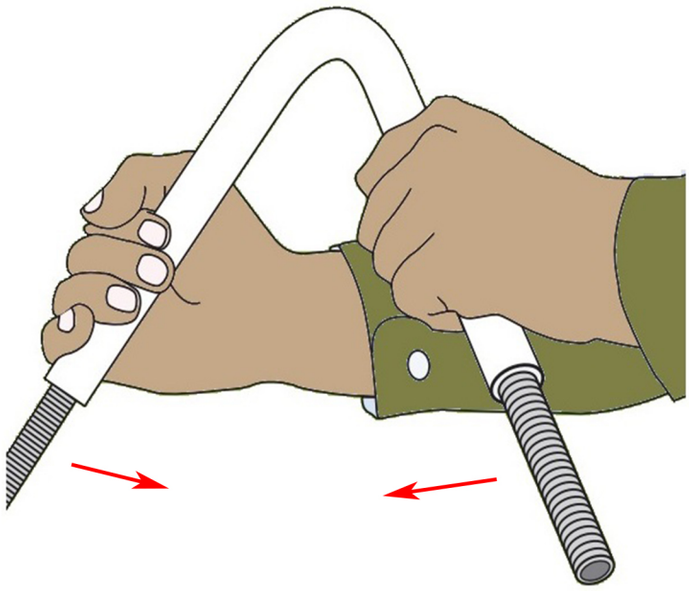


Procedure

- Insert the spring to the desired position, grip the conduit on either side of bend and bring slowly together to form the bend. For reference use QPlast approved springs.
- Cold bending of 20mm and 25mm conduit should be done with the correct / undamaged spring inserted and bent over knee to initiate the bend. Springs should remain inserted until the desired angle is achieved. (Under no circumstance should bends be increased or decreased without correct spring inserted). Failure to follow the above procedure could increase possibility of product failure.
- Do make the bend more acute than necessary to allow for uPVC to 'recover' after bending.
- To remove the spring, twist anti-clockwise (to reduce its diameter) whilst turning the conduit clockwise and gently pulling the conduit and the spring apart.
- If spring fails to release, do not pull too hard or damage to the spring may occur.
- Repeat the removal procedure until they come apart.
- The conduit should then be fastened into position as quickly as possible to prevent further 'recovery'.

Hot Bending

Hot bending should be carried out on all conduit sizes over 25mm in diameter using the correct size and gauge of bending spring.



Procedure

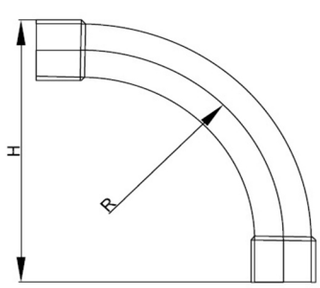
- Insert the spring to the desired position as described in 'cold bending' above and commence gently heating the conduit with a hot air torch (not too close and with movement), hot water or by other suitable indirect heating means.
- Avoid direct application of flame to the conduit.
- When the conduit is in a pliable state, slowly bend around a suitable form, holding in position until set.
- To remove the spring, twist anti-clockwise (to reduce its diameter) while turning the conduit clockwise and gently pulling the conduit and the spring apart.
- If the conduit is bent too fast or on an unstable place (the knee), there is a risk of damage to conduit and spring.
- Once the bend has been made, it should not be re-bent backwards, but allowed to 'recover' naturally.

Solvent Cement Joining

For installation in wet of high humidity areas it is mandatory to secure joints with PVC solvent cement. Qplast branded solvent cement is the ideal solution for making the bonds of the system. Please refer Qplast technical catalogue for joining methods with solvent cement.

Prefabricated Bends

Outside Diameter (OD) (mm)	Socket Inside (ID) (mm)	Height (H) (mm)	Radius (R) (mm)
20	20	110	52
25	25	160	82
32	32	225	112
38	38	260	142
50	50	325	170



Qplast

uPVC Electrical Duct and Conduits — Specifications

Qplast uPVC Duct and Conduit features

- Lightweight
- Low stress in pipes high impact strength
- Excellent structural strength
- Superior aging and weathering characteristics
- Manufactured for high modulus PVC compound
- Superior Dieletric Strength
- Electrolytic or galvanic resistant
- Smooth interior and exterior pipe wall

Standard: Qatar Construction Standard (QCS), DIN 8062 and BS 3506 (Dimensionally)

Scope: Installation of High Voltage (HV) power cables, Medium Voltage (MV) power cables and Low Voltage (LV) power cables. Qplast branded ducts are used inside building structure underground and under roads in infrastructure.
Colour: Black RAL 9005, Grey RAL 7042, Dark Grey RAL 7011
Appearance: 6/ 5.8 mtr with spigot end and socket with solvent cement joint/ dry fit.

Min. OD	Max. OD	Class L		Class M		Class H	
(mm)	(mm)	Wall Thickness (mm)		Wall Thickness (mm)		Wall Thickness (mm)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
50	50.2	1.8	2.2	2.4	2.8	3.4	3.9
75	75.3	2.4	2.8	3.2	3.8	-	-
110	110.4	2.4	2.8	3.2	3.8	3.4	3.9
160	160.4	3.2	3.8	3.6	4.0	4.7	5.4
200	200.6	3.9	4.5	4.2	4.8	-	-
250	250.8	4.9	5.6	-	-	-	-

QA/QC Test: Impact test; heat reversion; vicat softening point.

Standard: Teleduct, Unified Government Network (UGN), Vodafone, Qatar Armed Force (QAF), ICT

Scope: Underground communication systems, telecommunication and ELV ducts.
Colour: Black or as per client request.
Appearance: 5.9/ 5.8/ 3 mtr spigot end and socket with solvent cement joint/dry fit.

Description	Min. OD	Max. OD	Wall Thickness (mm)		Average
	(mm)	(mm)	Minimum	Maximum	Wall Thickness (mm)
54D	96.3	96.7	3.05	3.45	3.25
56A	56.3	56.7	3.05	3.45	3.25

QA/QC Test: Impact test; heat reversion; sulphuric acid test; vicat softening temperature.

Standard: NEMA TC2 EPC 40 & EPC 80

Scope: NEMA TC2 EPC 40 & EPC 80 Electrical uPVC Conduit of types EPC 40 designed for normal duty applications above ground and concrete encased applications or direct burial and EPC 80 designed for heavy duty (areas of physical damage) applications above ground and concrete encased applications or direct burial.
Colour: Light Grey RAL 7042, Dark Grey RAL 7011 and Black RAL 9055
Appearance: 6 mtr spigot end and socket with solvent cement joint.

Nominal Size (In.)	Mean Outside		EPC 40		EPC 80	
	Diameter (mm)		Wall Thickness (mm)		Wall Thickness (mm)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1/2”	21.24	21.44	2.77	3.28	3.73	4.24
3/4”	26.57	26.77	2.87	3.38	3.91	4.42
1”	33.27	33.53	3.38	3.89	4.55	5.08
11/4”	42.03	42.29	3.56	4.06	4.85	5.43
1 1/2”	48.11	48.41	3.68	4.19	5.08	5.69
2”	60.17	60.47	3.91	4.42	5.54	5.20
2 1/2”	72.84	73.20	5.16	5.77	7.01	7.85
3”	88.70	89.10	5.49	6.15	7.62	8.53
4”	114.07	114.53	6.02	6.73	8.56	9.58
6”	168.00	168.56	7.11	7.98	10.97	12.29

QA/QC Test: Impact test; deflection resistance; leakage test on joint; flattening test; heat reversion.

Standard: NEMA TC6 & TC8

Scope: Installation underground communication ducts, traffic signal cables and electrical cable ducts.
Colour: Light Grey RAL 7042, Dark Grey RAL 7011 and Black RAL 9055
Appearance:

Nominal Size (In.)	Mean Outside		TC6 & TC8				
	Diameter (mm)		Wall Thickness (mm)				
	Minimum	Maximum	EB-20	EB-35	DB-60	DB-100	DB-120
2”	60.18	60.48	1.52	1.52	1.52	-	1.96
3”	88.70	89.10	1.55	1.93	2.34	2.84	3.00
4”	114.07	114.53	2.08	2.54	3.07	3.68	3.91
6”	168.00	168.56	3.18	3.86	4.62	5.41	5.77

EB-35, DB-60 and DB-100 production only for bulk quantity only.

EB : Encased Burial
DB : Direct Burial

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Duct Stiffness : F /△Y

Class	psi	kPa
EB - 20	20	138
EB - 35	35	241
DB - 60	60	414
DB - 100	100	689
DB - 120	120	827

Distance Between Supports in Above Ground Installation

Nominal Sizes (In)	Maximum Distance Between Supports (ft)
1 1/4" to 2"	5
2 1/2" to 3"	6
4" to 5"	7
6"	8

Common Conduit Separation Criteria in Duct Bank

Duct Bank Application	Separation Distance	
	Inches	mm
Communication	1"	25.4
Power	1 1/2"	38.1
Power	2"	50.8
Power	3"	76.2
Between Power and Communications	1 1/2"	38.1
Between Power and Communications	2"	50.8
Between Power and Communications	3"	76.2
Fiber Optics	1"	25.4

Table ED1. Thermal Expansion Values

Expansion and Contraction in uPVC Conduits

uPVC will expand and contract with temperature variations. The amount of movement due to temperature changes can be determined from the table ED1. The coefficient of thermal expansion for Qatar National Plastic uPVC conduit is $6x10^{-5}K$. If major temperature variations are expected, the use of expansion joints should be considered and should be installed in accordance with the engineer's design or Qatar National Plastic advises.

Temperature Change (°C)	Length change of uPVC Conduit (mm/m)	Temperature Change (°C)	Length change of uPVC Conduit (mm/m)
5	0.3	55	3.3
10	0.6	60	3.7
15	0.9	65	4
20	1.2	70	4.3
25	1.5	75	4.6
30	1.8	80	4.9
35	2.1	85	5.1
40	2.4	90	5.5
45	2.7	95	5.8
50	3	100	6.1

Trenches for Ducts and Conduits

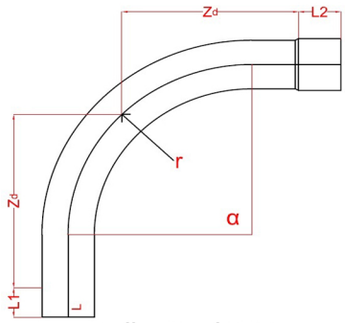
Trench must be graded true and free from stones and soft spots. Backfill should also be free of stones and be firmly tamped around the sides of the conduit/duct to develop maximum supporting strength. Tamping on top of the conduit is not recommended.

Backfill and Surroundings

A selected backfill should be put in before laying the conduit. Selected backfill (not tamped) at least 150mm over the top of the conduit is recommended. After final backfill is placed, tamping may be used to finish the grade. The method of direct burial varies with soil condition, load conditions and project specification. A common practice is to lay one tier at a time, backfill and repeat with the desired spacing of ducts being made as ducts are layered. This method is advisable where limited load occurs.

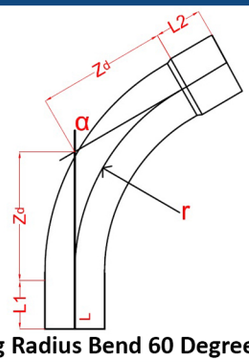
Underground Duct Spacers

Qatar National Plastic manufactured electrical duct bank spacers which allow telecommunications and power utility providers to quickly and easily install underground lines within trenches for proper spacing beneath roadways, rail lines or any other structure. These duct bank spacers are commonly produced from HDPE off white or black colour. Duct spacers ensures well-organized design which improves the ease of installation and improves identification for any future installations and repairs. Qatar National Plastic manufactured duct spacers are robust and HAT (High Ambient Temperature) designed. With the specially formulated raw materials and structural stability oriented design. These spacersare carry heavy load while installation.



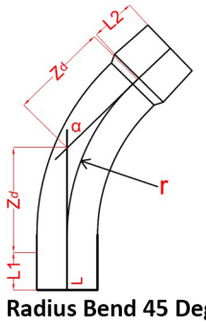
Long Radius Bend 90 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	194	31	36	455
56.5	198	220	34	40	514
63	221	246	38	44	573
75	263	293	44	50	680
90	315	351	51	59	812
96.5	337	376	54	63	869
110	385	429	61	71	990
160	560	624	86	100	1434
200	700	780	106	123	1789



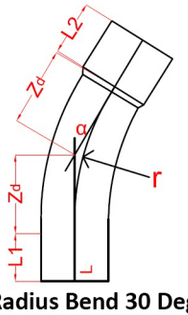
Long Radius Bend 60 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	123	31	36	313
56.5	198	138	34	40	350
63	221	153	38	44	387
75	263	182	44	50	458
90	315	218	51	59	546
96.5	337	234	54	63	585
110	385	266	61	71	664
160	560	387	86	100	960
200	700	484	106	123	1197



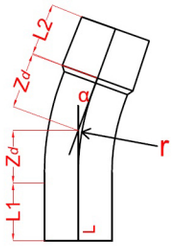
Long Radius Bend 45 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	93	31	36	253
56.5	198	105	34	40	284
63	221	117	38	44	315
75	263	139	44	50	372
90	315	166	51	59	442
96.5	337	178	54	63	473
110	385	203	61	71	538
160	560	296	86	100	778
200	700	370	106	123	969



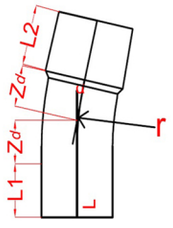
Long Radius Bend 30 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	68	31	36	203
56.5	198	76	34	40	226
63	221	84	38	44	249
75	263	100	44	50	294
90	315	120	51	59	350
96.5	337	128	54	63	373
110	385	147	61	71	426
160	560	214	86	100	614
200	700	268	106	123	765



Long Radius Bend 22 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	54	31	36	175
56.5	198	61	34	40	196
63	221	68	38	44	217
75	263	81	44	50	256
90	315	97	51	59	304
96.5	337	104	54	63	325
110	385	119	61	71	370
160	560	173	86	100	532
200	700	216	106	123	661

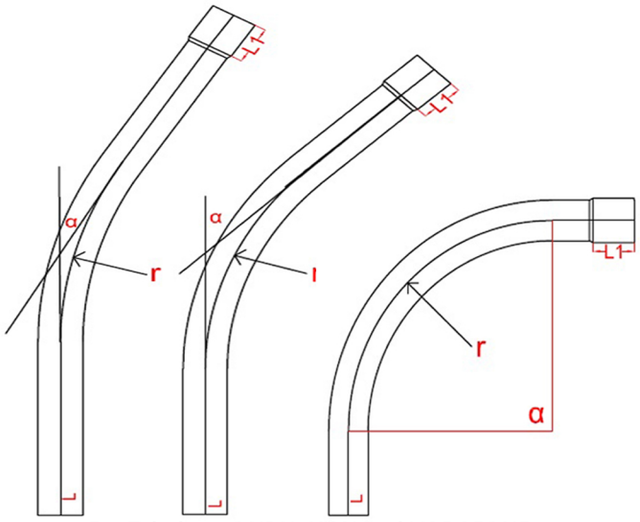


Long Radius Bend 11 Degree

OD	Radius (r)	Zd	L	L1	L2
	Minimum	Minimum	Minimum	Minimum	Minimum
50	175	38	31	36	143
56.5	198	42	34	40	158
63	221	46	38	44	173
75	263	55	44	50	204
90	315	66	51	59	242
96.5	337	71	54	63	259
110	385	81	61	71	294
160	560	118	86	100	422
200	700	147	106	123	523

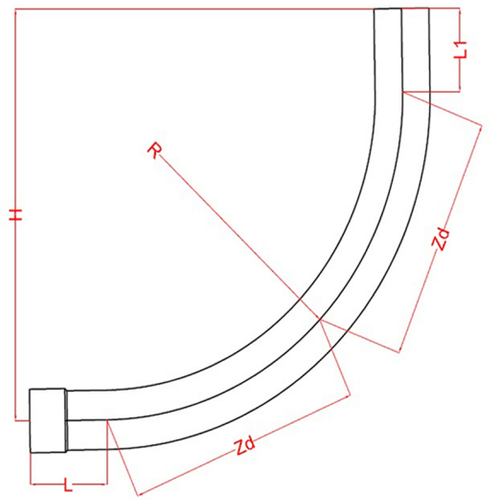
uPVC Electrical Duct and Conduits Accessories

Specifications



For Teleduct, QNBN, UGN and VODAFONE

Trade Name	Size (OD) (mm)	Angle (Degree)	Radius (r) Min. (mm)	L1 Min (mm)	L Min. (mm)
56A	56.5	30	500	70	1070
56A	56.5	45	375	70	970
56A	56.5	90	250	70	870
54D	96.5	30	1000	100	1500
54D	96.5	45	700	100	1450
54D	96.5	90	500	100	1400



Street Lighting Pole LR Bend

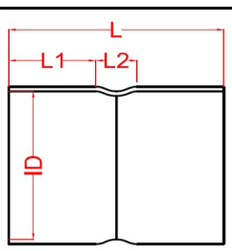
OD	Radius (r) Minimum	Zd Minimum	L Minimum	L1 Minimum	L2 Minimum	H
110	600	689	61	71	1510	764

LR Bend NEMA TC3 EPC 40 & 80

OD (inch)	Radius (Inches) 90°	45°	30°	22°
2	9.5	-	-	-
2	24	24	24	24
2	36	36	36	36
3	13	-	-	-
3	24	24	24	24
3	36	36	36	36
4	16	-	-	-
4	24	24	24	24
4	36	36	36	36
4	48	-	-	-
6	30	-	-	-
6	36	36	36	36
6	48	48	48	48

Duct End Cap

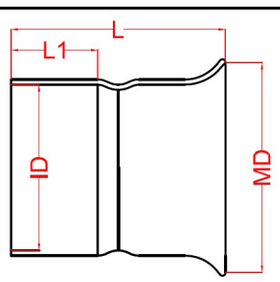
For Duct OD	ID	H Min
50	50	20
56.5	56.5	20
63	63	20
75	75	20
90	90	25
96.5	96.5	25
110	110	25
160	160	30
200	200	30
250	250	30



Coupler / Double Socket

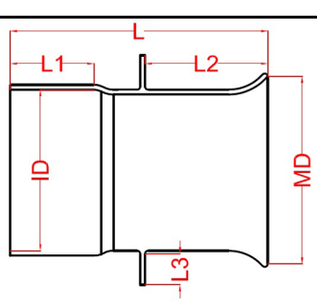
For Duct OD	ID	MD Min	L1 Min	L2 Min
50	50	80	35	180
56.5	56.5	86.5	38	180
63	63	93	42	180
75	75	105	48	200
90	90	120	55	200
96.5	96.5	126.5	58	200
110	110	144	65	200
160	160	210	90	200
200	200	250	110	250
250	250	135	41	311

L2 is customizable by requirements



Bellmouth

For Duct OD	ID	L1 Min	L Min	L2 Min
50	50	35	11	81
56.5	56.5	38	11	88
63	63	42	12	95
75	75	48	14	109
90	90	55	17	127
96.5	96.5	58	17	134
110	110	65	20	150
160	160	90	27	207
200	200	110	33	253
250	250	135	41	311



Bellmouth with Puddle Flange

For Duct OD	ID	MD Min	L1 Min	L2 Min	L3 Min
50	50	80	35	180	90
56.5	56.5	86.5	38	180	90
63	63	93	42	180	90
75	75	105	48	200	100
90	90	120	55	200	100
96.5	96.5	126.5	58	250	125
110	110	144	65	250	125
160	160	210	90	250	125
200	200	250	110	300	150
250	250	310	135	350	175

L2 & L3 are customizable by requirements

Qplast

Polyethylene (PE) Warning Tapes - Non Detectable Specifications

Qatar National Plastic Factory manufactures high-quality warning tapes with the brand name "Qplast", when installed correctly warning tapes identify pipes and cables so that workers can locate them during future excavations. This practice improves safety in the workplace and helps to minimize the risk of costly mistakes. We manufacture low density polyethylene tapes and can produce high density polyethylene tapes on special request . Our tapes are long lasting, easy to apply and on efficient way to safeguard the well-being of the workforce and general public. Plastic underground warning tapes are usually installed at a specified distance directly above the service line. This makes it easier for utilities to be located and identified.

Advantages of Qplast Warning Tapes

- Manufactured from prime grade virgin low density polyethylene (LDPE)
- Highly resistant to alkalies and acidic soil
- Custom manufacturing options (width, length, thickness, warning message, colour etc.)
- Completely lead free pigments and plastics used in manufacturing
- Long life span of protection

Typical Properties	Unit	Value
Density	gm/cm³	0.910-0.930
Melt flow index 190°C (5kg)	gm/10min	< 2.5
Vicat Softening Point	° C	110
Working temperature	° C	0-55
Tensile strength @break MD (machine direction)	N/mm²	≥ 12.5
Tensile strength @break TD (transverse direction)	N/mm²	≥ 10.5
Elongation at break MD	%	≥ 350
Acidic and alkaline resistance	Ph	Resistant from 2.5 to 11

Our warning tapes are rot-proof, thus will not undergo for biodegradation or chemical decomposition.

Water Mains (Kahramaa Water Dept.)
Size: 15cm x 500mtr - 200 microns
Colour: Blue (RAL 5005)

Drainage System (Ashghal Drainage)
Size: 15cm x 500mtr - 200 microns
Colour: Reddish (RAL 3020)

Surface Water (Ashghal Drainage)
Size: 15cm x 500mtr - 200 microns
Colour: Grey (RAL 7040)

Treated Sewage Effluent (Ashghal Drainage)
Size: 15cm x 500mtr - 200 microns
Colour: Green (RAL 6029)

LV/MV Network (Kahramaa Electrical Dept.)
Size: 15cm x 1000mtr - 100 microns
Colour: Yellow (RAL 1023)

LV/MV Network (Kahramaa Electrical Dept.)
Size: 40cm x 1000mtr - 100 microns
Colour: Yellow (RAL 1023)

Street Lighting Cables (Ashghal)
Size: 40cm x 1000mtr - 100 microns
Colour: Yellow (RAL 1023)

Unified Government Network (UGN)
Size: 6 inches (15.4cm) x 305mtr - 180 microns
Colour: Yellow (RAL 1023)

MOI-SSD (Security System Department)
Size: 35cm x 500mtr - 150 microns
Colour: Yellow (RAL 1023)

Ooredoo Qatar
Size: 6 inches (153.4mm) x 1000 feet - 180 microns
Colour: Orange (RAL 2004)

QAF (Qatar Armed Forces)
Size: 15cm x 500mtr - 200 microns
Colour: Orange (RAL 2004)

Vodafone Qatar
Size: 20cm x 500mtr - 150 microns
Colour: Orange (RAL 2004)

Above mentioned images are for reference only. Design are subject to change. QNPF manufactures all warning tapes to custom design.

Qplast

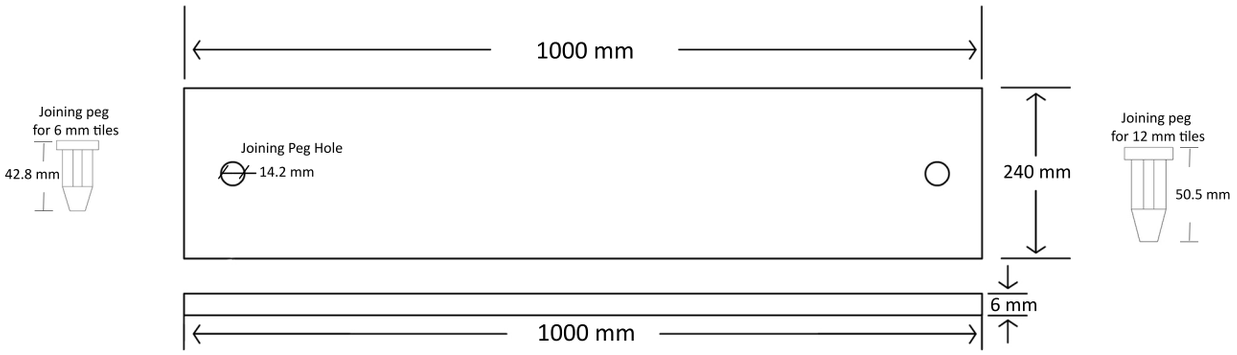
Polyethylene (PE) Tiles for Cable Protection — Specifications

Heavy duty warning tiles perform the same function as warning tapes and can use similar designs (see page 1). Tiles provide additional security; visibility, strength, non-degradation and difficulty to ignore during excavations. Our tiles are manufactured from recycled polyethylene. Qatar National Plastic cable protection tiles are widely used to protect buried high voltage and medium voltage cables, fibre optic cables, instrument cables and other utilities. Each tile is supplied with a peg to pin the tiles. Qplast tiles offer a much higher level of protection than alternative systems.

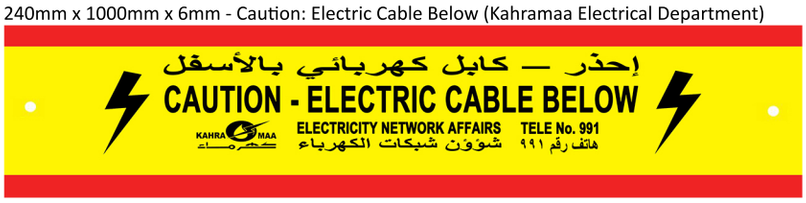
Width mm	Length mm	Thickness mm
240	1000	6
240	1000	8
240	1000	12
300	1000	8
300	1000	12
450	1000	12

Typical Properties	Unit	Value
Density	gm/cm³	0.91-0.96
Vicat Softening Point	° C	110
Working Temperature	° C	0-55
Tensile strength @break	N/mm²	8-15
Acidic and alkaline resistance	Ph	Resistant from 2.5 to 11

Our tiles are rot-proof, thus will not undergo for biodegradation or chemical decomposition.

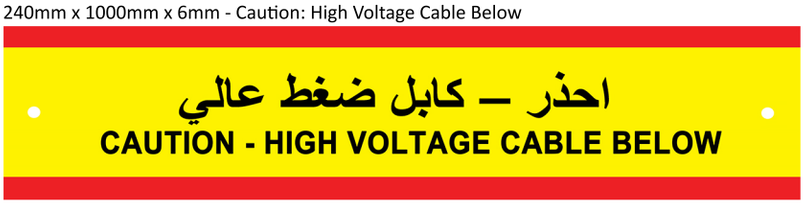


240mm x 1000mm x 6mm - Caution: Electric Cable Below (Kahramaa Electrical Department)



240mm x 1000mm x 6mm - Caution: CCTV Cable Below

240mm x 1000mm x 6mm - Caution: High Voltage Cable Below



300mm x 1000mm x 8mm - Caution: Instrument Cable Below

300mm x 1000mm x 8mm - Caution: Fibre Optic Cable Below

Above mentioned images are for reference only. Design are subject to change. QNPF manufactures all cable tiles to custom design.

Qplast

Polyethylene (PE) Sleeves for D.I. Pipes Specifications

Ductile Iron pipes and fittings require corrosion protection, particularly when installed in aggressive soils. Polyethylene (PE) encasing or Sleeving is the easiest, most economical and most effective method of ensuring such protection. It provides a non-bonded film preventing direct contact of the pipe with the surrounding soil. This reduces the electrolyte available to support any corrosion activity leaving only the moisture that might be present in the thin annular space between the pipe and polyethylene sleeve.

In effect, although some moisture with the corrosive characteristics of the surrounding soil may become entrapped inside the sleeve, the available dissolved oxygen supply beneath the wrap is soon reduced and the oxidation process stops long before any real damage occurs. Trapped water soon enters a state of stagnant equilibrium where a uniform environment exists around the pipe.

To be effective, only the best quality sleevings should be used. For this reason, Qatar National Plastic Factory PE sleeves are manufactured with virgin LDPE as main ingredient and incorporate UV stabilizer and colorants.

Typical Properties	Unit	Value
Density	gm/cm³	0.910-0.930
Melt flow index 190°C (5kg)	gm/10min	< 2.5
Vicat softening point	° C	110
Working temperature	° C	0-55
Tensile strength @break MD (machine direction)	N/mm²	≥ 13.5
Tensile strength @break TD (transverse direction)	N/mm²	≥ 11.5
Elongation at break MD and TD	%.	400-600
Acidic and alkaline resistance	Ph	Resistant from 2.5 to 11

Our PE Sleeves are rot-proof, thus will not undergo for biodegradation or chemical decomposition.

Potable Water Network DI Pipes

Standard: ISO 8180
Thickness: 225±25 microns
Colour: Blue RAL 5005
UV protection: Enabled

Nominal Ø of D.I. Pipe (mm)	Lay flat width (mm)	Length (m)
80	280	200
100	320	200
150	435	200
200	540	200
300	755	200
400	980	200
450	1090	200
500	1215	100
600	1440	100
700	1610	100
800	1825	100
900	2025	100
1000	2255	100
1200	2500	100
1400	2800	100
1600	3100	100

Above sizes specified by KAHRAMAA water department.

Drainage Network DI Pipes

Standard: BS 6076
Thickness: 200-250 microns
Colour: Black RAL 9004
UV protection: Enabled

Lay flat width of tubular polyethylene film			
Nominal internal diameter of pipe (mm)	For use with pipeline incorporating push-in flexible joints (mm)	For use with pipeline incorporating mechanical flexible joints (mm)	Length (m)
80	350	-	200
100	350	450	200
150	450	550	200
200	550	650	200
250	650	700	200
300	700	800	200
350	800	-	200
400	1100	1100	200
450	1100	1100	200
500	1350	1350	100
600	1350	1350	100
700	1750	-	100
800	1750	-	100
900	2000	-	100
1000	2000	-	100
1100	2500	-	100
1200	2500	-	100

Above sizes comply with QCS Section 8 Part 3, 3.7.5 requirements for sleeves for drainage networks.

Installation

Method A: Cut polyethylene sleeve to a length approximately 600mm longer than the pipe length. Slip the tube around the pipe, move it to provide 300mm overlap on each adjacent pipe section and bunch it lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole in bedding must be made at the joints to facilitate installation of the polyethylene sleeve. After assembling the pipe joint, make the overlap of the polyethylene sleeve. Pull the bunched polyethylene sleeve from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Then slip the end of the polyethylene sleeve from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipe as to make a snug but not tight fit along the barrel of the pipe, securing the fold at quarter points by means of adhesive tapes. Refer Figure SL-01 for installation and Figure SL-02 for securing the fold as quarter point.

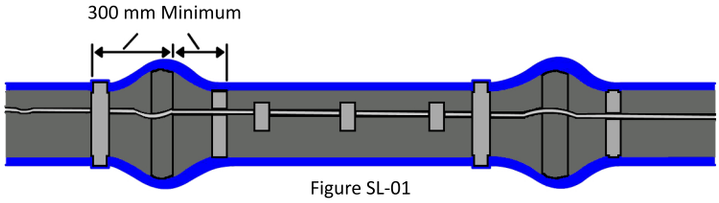


Figure SL-01

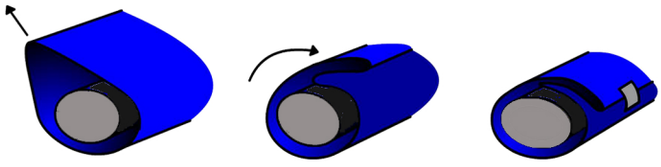


Figure SL-02

Qplast

continuation of PE Sleeve installation

Method B (Recommended for bolted joints): Cut polyethylene sleeve to a length approximately 300mm shorter than that of the pipe length. Slip the sleeve around the pipe and move it to provide 150 mm of bare pipe at each end. Take up the slack width at the top of the pipe to make a snug but not tight fit along the barrel of the pipe, securing the fold at quarter points with adhesive tapes. Before making up a joint, slip a 900mm length of polyethylene sleeve over the end of the preceding pipe section, bunch it lengthwise. Alternatively, place a 900mm length of polyethylene sleeve in the trench under the joint to be made. After completing the joint, pull the 900mm length of polyethylene sleeve over or around the joint, overlapping the polyethylene sleeve previously installed on each adjacent section of the pipe by at least 300mm and make each end snug and apply adhesive tape. A shallow bell hole in the trench is necessary and this help polyethylene sleeve to joint pipe socket area. Refer SL-03 for installation.

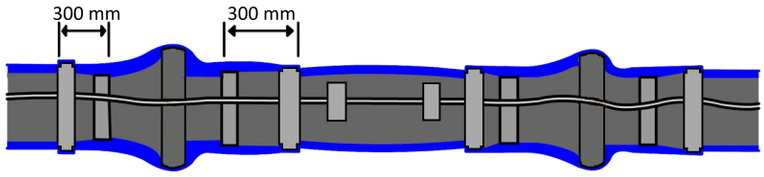


Figure : SL-03

For installation in wet areas: method A and B, a circumferential adhesive tape wrap should be used more frequently every 600mm length of pipe. Cuts, tears, punctures or any other damages shall be repaired with a piece polyethylene sleeve or adhesive tape before filling the trench.

LDPE Construction Sheet

Low Density Polyethylene (LDPE) Films are manufactured using virgin low density polyethylene raw material (film grade). We manufacture these sheets under strict quality control and in accordance to British standards BS 2782 and BS 3012. Generally the sheets are transparent, However, we also produce coloured or tinted sheets as per the client's requirements. LDPE sheets have a wide range of applications as water vapour barriers in construction of roads, multi-storey buildings, farms and for the covering for goods.

Open Width	Thickness			
(m)	Micron	Millimeter	Mill	Gauge
2 to 10	25	0.025	1	100
2 to 10	50	0.050	2	200
2 to 8	100	0.100	4	400
2 to 8	125	0.125	5	500
2 to 8	150	0.150	6	600
2 to 8	200	0.20	8	800
2 to 8	250	0.25	10	1000
2 to 6	300	0.30	12	1200
2 to 6	400	0.40	16	1600
2 to 3	500	0.50	20	2000

Length of roll is available from 6mtr to 100mtr

Typical Properties	Unit	Value
Density	gm/cm³	0.91-0.93
Vicat softening Point	° C	110
Working temperature	° C	0-55
Tensile strength @yield	N/mm²	10-20
Elongation	%	500-650

LDPE Green House Films

These films are manufactured virgin low density polyethylene (LDPE) as the main ingredient; also 3% to 5% UV-stabilizer is incorporated to ensure the stability of film if expose to sunlight. The films are manufactured either in light green colour or customised colour. Films are also used to protect crops from sunlight in agricultural farms.

Open Width &	Thickness	
Length (m)	Micron	Gauge
5.5x14	100	400
5.5x14	200	800
5.5x45	200	800
5.5x14	250	1000
5.5x14	300	1200

LDPE Agricultural Mulch Films

Our Agricultural Mulch films are manufactured using virgin LDPE. These films are available in black and transparent with UV protection as standard. These films are used in agricultural projects as a deterrent against sunlight. Mulch films are used to modify soil temperature, limit weed growth, prevent moisture loss, and improve crop yield as well as precocity.

Open Width &	Thickness	
Length (m)	Micron	Gauge
2X100	100	400
4X100	100	400
2X100	200	800
4X100	200	800
4X100	250	1000

Width and length are customizable.

Qplast