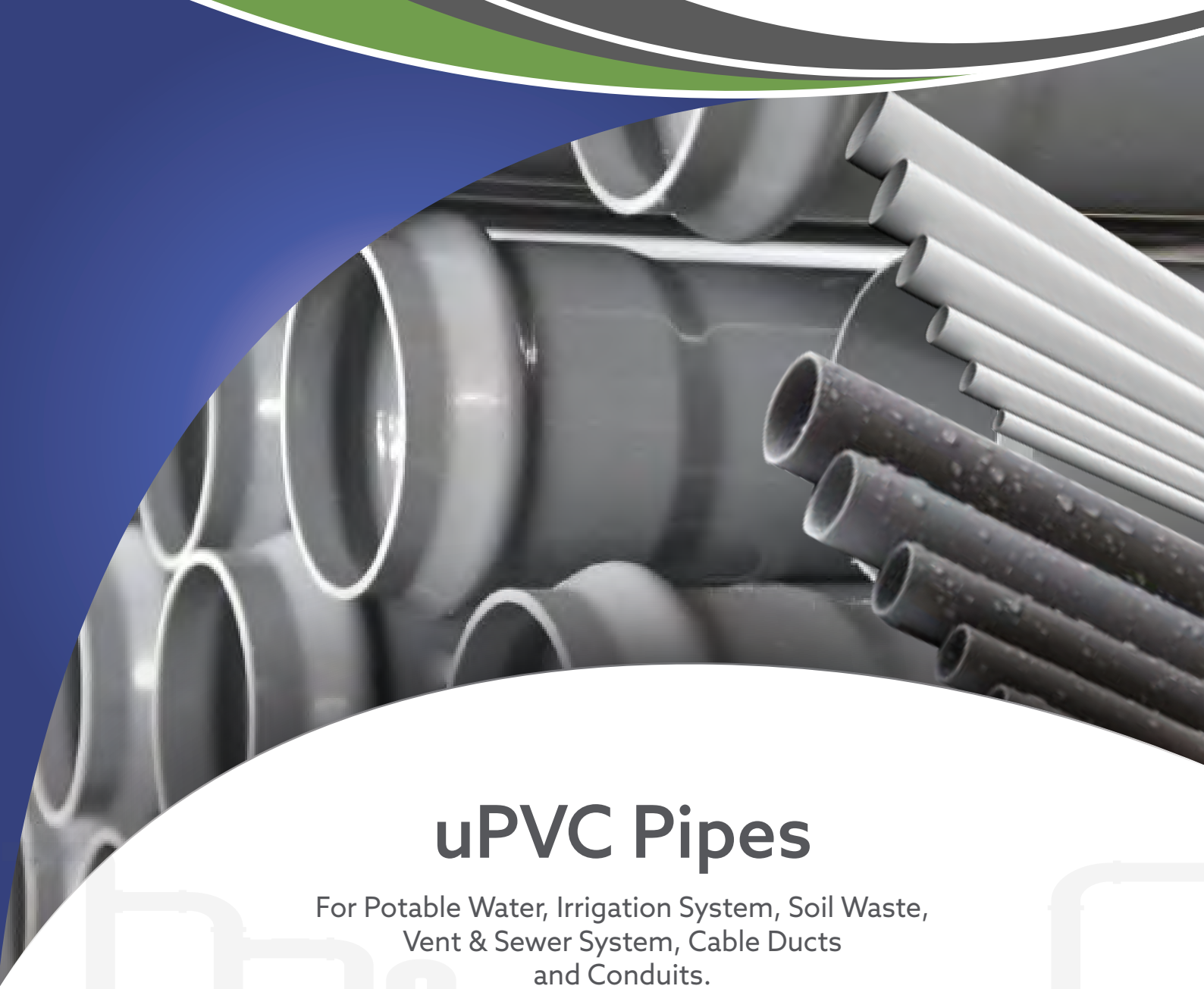
ALPLAST



# uPVC Pipes

For Potable Water, Irrigation System, Soil Waste,
Vent & Sewer System, Cable Ducts
and Conduits.

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## NAL for Manufacturing CO.LTD. (NALPLAST) in brief

The factory is one of the most advanced factories in the kingdom of Saudi Arabia and the gulf region It is an important resource for the national industry in this field. It contributes directly to the needs of the local market of this important commodity. Its products have achieved great success and have received excellent kingdom and gulf countries in addition to some Arab countries.

## Factory Products

NALPLAST offers a wide range of plastic products, the most important of which are uPVC, cPVC pipes and fittings sized 16 mm to 400 mm used in drinking water and sewerage networks and cPVC pipes used in hot water pipes using modern technology and modern machines produced accordance with Saudi and international specifications. The factory also produces polyethylene pipes (HDPE) used in drinking water, agricultural installations and dictates used in electrical installations.The factory also produces the same material as Serves in the fibre optic of telecoms operators. It also produce thermal pipes manufactured from PPR according to Saudi and international specifications.

All products are manufactured by the leading national company SABIC and some international companies specialized in this field.

To complete the production lines and find a comprehensive and integrated plant, a modern manufacturing line to produce fittings has recently been launched. We believe that after the inauguration of the Fittings factory, we will complete the construction of a comprehensive and integrated national plant that will undoubtedly be a tangible and powerful addition to the national industry not only in its field, but also in addition to the quality of the national industry in general.

# Some Applications of NALPLAST uPVC Pipes

## Water Networks:

NALPLAST uPVC pipes will NEVER interfere or interact with the water or whatever liquid flowing inside. As for the drinking water, it will never change its taste, color or give it a weird smell.

## Irrigation system:

uPVC pipe is suitable for numerous watering applications, including irrigation (reticulation), water supply, recycled water.

## Sewage & drainage systems:

uPVC Pipes are the ideal substitute for cast-iron Because of its special features such as chemical resistance and corrosion resistance, it is strong and long lasting, and easy to install. In addition, it has high flow rates and a wide range of applications such as sanitary water drainage, waste and ventilation.

## Industrial:

NALPLAST uPVC pipes make it the best choice to use every where even in industrial factories because they are easy to install and fix, light weight, high chemical resistance makes it more convenient than old traditional steel pipes systems.

## Electrical & Telecommunication Cables Protection:

NALPLAST uPVC pipes are suitable to use as conduits for electrical or communication cables.

# uPVC Pipe Features and Benefits

While PVC are very different materials, they share numerous advantages common to plastic piping systems. Advantages include Ease of installation, Corrosion resistance, Low friction loss, Low cost, and Long life.

## Flow Capacity

Extremely smooth pipe bore, precision joints, and lack of internal projections encourage flow capacity over the total life of the system flaatter grades may be possible using PVC-U systems comparedwith alternative pipe materials.

## Easy & Low Installation Cost

uPVC systems are light in weight ( Approximately one half the weight of aluminium and one-sixth the weight of steel) reducing transportation handling and installation cost.They have smooth,seamless interior walls. No special tools are required for cutting.These materials can be installed using the solvent cement joining technique or the rubber joint push fit type.

## Flammability and Fire Resistance

uPVC piping systems are self- extinguishing and will not support combustion.The ASTM E 84 test protocol is used to determine the flame and smoke rating for various materials. uPVC will not pass the ASTM E-84 25/50 flame spared/smoke developed test and is not acceptable for use in plenum areas. For plenum applications, follow prevailing code requirements.

## Strength

uPVC products are highly resilient, tough and durable with high tensile and high impact strength.

## Non-Conductivity

uPVC is a non-conductor of electricity, and is therefore not subject to galvanic or electrolytic action.

## Low Friction Loss

The smooth interior surfaces of uPVC assure low friction loss and high flow rate. Additionally, since uPVC pipe resist rusting, pitting, scaling and corrosion, the high flow rate can be maintained for the life of the piping system.

## Chemical Resistance

NALPLAST uPVC pipes are one of the best products that resist to a wide range of chemicals, this is what makes uPVC one of the best products used in the industrial piping systems, a proven history of over 50 years is witnessed in many applications that makes uPVC the chosen product when aggressive fluids are carried in the piping systems.

# Quality Control Department

Our company applies a strict quality control system through an independent quality control department to ensure quality at all levels. The quality control department works round the clock to synchronize with shift system of the plant and reports to the top management of the company to insure ascendency free.

## Raw Material Quality Control

All types of raw material from our supplier are subject to input quality control test. Before production, samples of raw material are tested to confirm its compatibility with specification matches our production requirements reporting system from other departments.

## Process Quality Control

To assure quality of the Products during production process and finish product, Quality Control department ensures that material used in the manufacturing process are in strict compliance with the end users' requirement and the end product is in conformity with the applicable international standards.

## High Quality and Performance Standards

The quality and performance of pipes and fittings are assured by a wide array of tough standards, control tests and independent certifications NALPLAST pipes maintain the quality of the products as per the revised and the latest standard ISO 9001/ which also is in line with the international standards on product quality.

## Extensive Quality Control

NALPLAST pipe undergoes numerous quality control tests, including regular measurements of critical dimensions, tests for extrusion quality, pipe flattening, burst pressure, impact resistance, joint integrity, and hydrostatic soundness, melt flow rate, Internal Hydrostatic Pressure Resistance (ICPR), longitudinal reversion (heat reversion), tensile strength. This ensures optimum quality, reliability and long-term strength.

## Laboratory Testing

To ensure quality of pipes, the following tests are regularly conducted in our laboratory as per SASO, ISO, EN and ASTM Standards.

# Quality Control & Testing Lab

NALPLAST is a high quality product that must adhere to strict quality control procedures implemented. The following are some of the testing equipment:

## Impact Strength

This test applies pressure to a pipe sample, to measure the how much it can absorb.

## Flattening & Stiffness

This test is used to calculate how much pressure can the pipe hold before deforming, this test is important for the buried pipes installation.

## Bulk Density

This test deals with the level of how much the materials in the pipe sample are compact and to measure its density.

## Density & Specific Gravity

This test uses certain levels of gravity to identify the properties of the making process of the pipes.

## Vicat Softening Temperature

This test measures the temperature when the pipe sample softens under.

## Hydrostatic Strength

This tests is done to measure the strength of the pipe sample, it applies internal pressure on the sample, for both short and long term.

## Tensile Strength, Elongation and Elasticity

This test measures how strong the pipe sample is, before it can be pulled apart to check the elongation. Alongside this test, the same testing equipment check the stiffness of the pipe sample.

## Longitudinal Reversion or Effects of Heating

This test exposes the pipe sample to heat, to see at which temperature the sample begins to deform, or start cracking. And to measure how much heat the pipe sample can take.

## Methylene Chloride Test

This test identifies the homogeneity of raw material mix.

## Manufacturing Standards:

NALPLAST uPVC pipes are manufactured in comply with:

• NEW Saudi Arabian standards (SASO-ISO-1452-2).

• Saudi Arabian standards (SASO 14 and 15 for potable water) ISO (international organization for standardization) 161/1 is associated with the German standard DIN 8061/8062.

• BS EN 1401 -1.

• BS EN 1329-1.

• British Standard BS 3505 / 3506.

• ASTM standards: PVC Pipes according to ASTM D-1785 for SCH40 & SCH80, ASTM D-2665 and D-2241 for SDR, and F-441for cPVC.

• NEMA standards TC-2, TC-6, TC-8 and TC-3/TC-9.

• Saudi Arabian standard (SSA 255, 254) for electrical conduits based on BS 6099 part1.

## Range of Production:

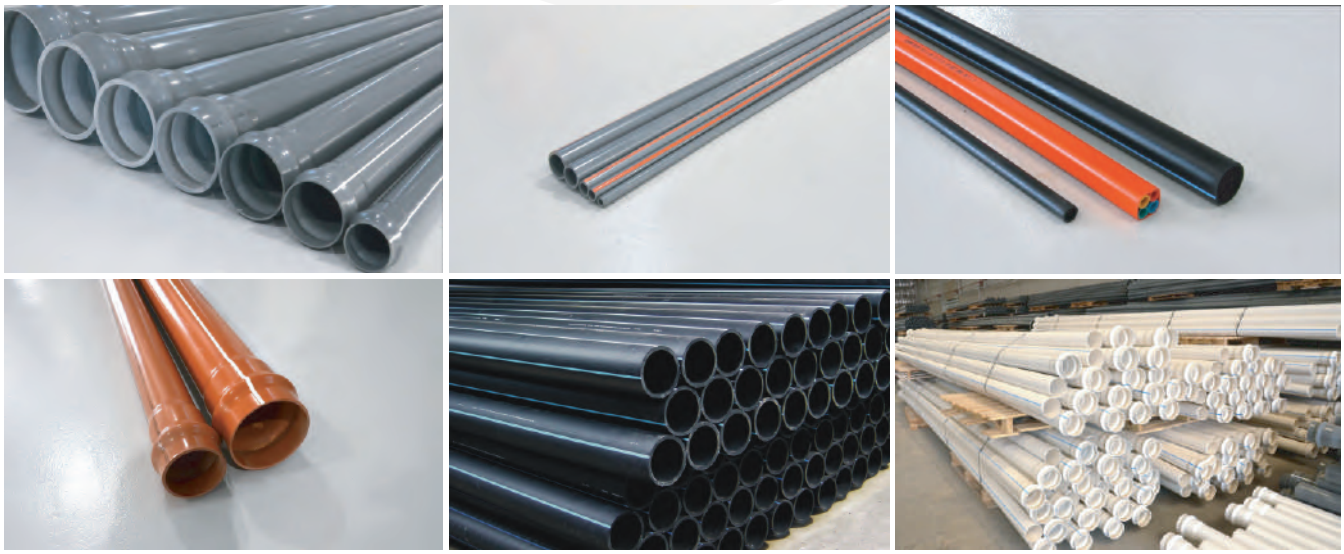
NALPLAST uPVC pipes are manufactured in metric sizes starting from 16 mm up to 400 mm outer diameter, varying in classes of pressure resistance and dimensions, (details will be shown later in the catalogue).

As per SASO/EN standards, NALPLAST uPVC pipes are available in solvent joint socket, for sizes up to 63 mm as for bigger sizes they are available in both solvent and rubber joint type.

NALPLAST ASTM pipes are manufactured in sizes ranging from 1/2" to 8", all pipes are manufactured in plain socket, (socketed pipes are available on special orders). Both PVC and cPVC pipes are produced in accordance with ASTM Standards and comply with the relevant specification to each type of material.

## Marking:

NALPLAST pipes are marked during the production process in according with the relevant standards and the facility name produced from.



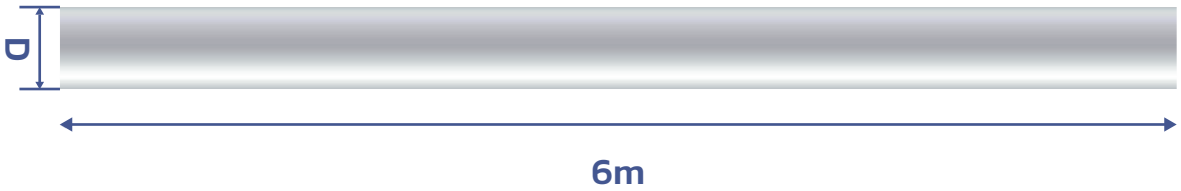
# NALPLAST uPVC Pipes According to (SASO-ISO-1452-2) .

## Table No. 1 :

| Nominal Outside diameter | Nominal (minimum) Wall Thickness Pipe Series S | | | | | | |
|---|---|---|---|---|---|---|---|
| | S 20 (SDR 41) | 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) |
| | Nominal pressure PN based on service (design) coefficient C=2,5 | | | | | | |
| | | PN 6 | PN 8 | PN 10 | PN 12,5 | PN 16 | PN 20 |
| 16 | | - | - | - | - | - | 1.5 |
| 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 | | 1.6 | 2.0 | 2.4 | 3.0 | 3.7 | 4.6 |
| 63 | | 2.0 | 2.5 | 3.0 | 3.8 | 4.7 | 5.8 |
| 75 | | 2.3 | 2.9 | 3.6 | 4.5 | 5.6 | 6.8 |
| 90 | | 2.8 | 3.5 | 4.3 | 5.4 | 6.7 | 8.2 |
| | Nominal pressure PN based on service (design) coefficient C=2,0 | | | | | | |
| | PN 6 | PN 8 | PN 10 | PN 12.5 | PN 16 | PN 20 | PN 25 |
| 110 | 2.7 | 3.4 | 4.2 | 5.3 | 6.6 | 8.1 | 10.0 |
| 125 | 3.1 | 3.9 | 4.8 | 6.0 | 7.4 | 9.2 | 11.4 |
| 140 | 3.5 | 4.3 | 5.4 | 6.7 | 8.3 | 10.3 | 12.7 |
| 160 | 4.0 | 4.9 | 6.2 | 7.7 | 9.5 | 11.8 | 14.6 |
| 180 | 4.4 | 5.5 | 6.9 | 8.6 | 10.7 | 13.3 | 16.4 |
| 200 | 4.9 | 6.2 | 7.7 | 9.6 | 11.9 | 14.7 | 18.2 |
| 225 | 5.5 | 6.9 | 8.6 | 10.8 | 13.4 | 16.6 | - |
| 250 | 6.2 | 7.7 | 9.6 | 11.9 | 14.8 | 18.4 | - |
| 280 | 6.9 | 8.6 | 10.7 | 13.4 | 16.6 | 20.6 | - |
| 315 | 7.7 | 9.7 | 12.1 | 15.0 | 18.7 | 23.2 | - |
| 355 | 8.7 | 10.9 | 13.6 | 16.9 | 21.1 | 26.1 | - |
| 400 | 9.8 | 12.3 | 15.3 | 19.1 | 23.7 | 29.4 | - |
| 450 | 11.0 | 13.8 | 17.2 | 21.5 | 26.7 | 33.1 | - |
| 500 | 12.3 | 15.3 | 19.1 | 23.9 | 29.7 | 36.8 | - |
| 560 | 13.7 | 17.2 | 21.4 | 26.7 | - | - | - |
| 630 | 15.4 | 19.3 | 24.1 | 30.0 | - | - | - |
| 710 | 17.4 | 21.8 | 27.2 | - | - | - | - |

**Note:** To apply a design coefficient of 2.5 (insted of 2.0) for pipes with nominal diameters above 90mm, the next higher.

Length : 6 meters (Other lengths are available on request).
Colour : Grey (Other Colour are available on request).
Socket Type : Rubber joint (R/J) type supplied from sizes 63 mm up to 710 mm.
Solvent Cement (P/S) type supplied from sizes 20 mm up to 315 mm.



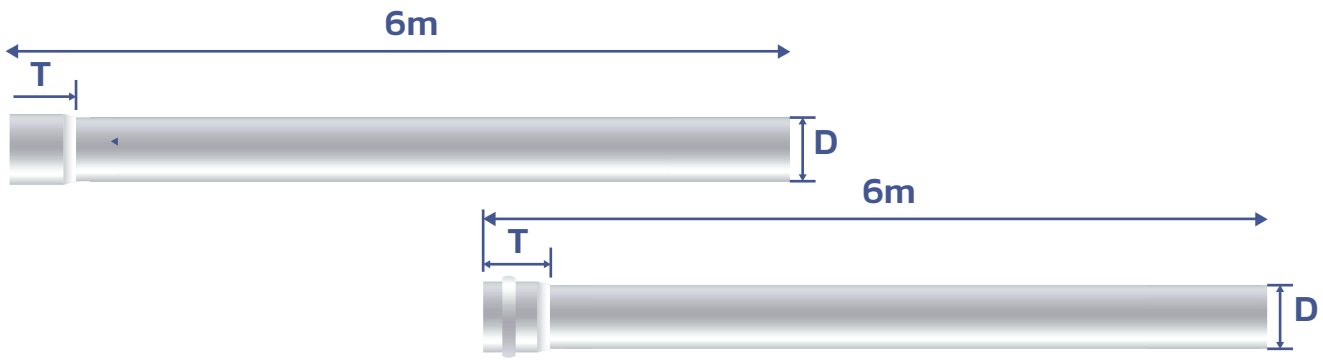
# uPVC Pipes According to (SASO 14&15/1998,ISO 161/1 and DIN 8061/62)

NALPLAST uPVC pipes comply to SASO 14 and 15/1998, ISO 161/1 and DIN 8061/62 standards, both are nominal outer diameters and wall thickness.

## Table No. 2 :

| Nominal Outside Diameter (mm) | Socket Depth for R/J mm(t) | Socket Depth for S/J mm(t) | CLASS 1 2 Bar | | CLASS 2 4 Bar | | CLASS 3 6 Bar | | CLASS 4 10 Bar | | CLASS 5 16 Bar | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Nom.wtkg/m | Nom. thick. of the wall mm | Nom.wtkg/m | Nom. thick. of the wallmm | Nom.wtkg/m | Nom. thick. of the wallmm | Nom.wtkg/m | Nom. thick. of the wallmm | Nom.wtkg/m | Nom. thick. of the wallmm |
| 16 | | | | | | | | | | | 0.09 | 1.2 |
| 20 | | 20 | | | | | | | | | 0.137 | 1.5 |
| 25 | | 25 | | | | | | | 0.174 | 1.5 | 0.212 | 1.9 |
| 32 | | 32 | | | | | | | 0.264 | 1.8 | 0.342 | 2.4 |
| 40 | | 40 | | | | | 0.334 | 1.8 | 0.35 | 1.9 | 0.525 | 3 |
| 50 | | 50 | | | | | 0.422 | 1.8 | 0.552 | 2.4 | 0.809 | 3.7 |
| 63 | 117 | 63 | | | | | 0.562 | 1.9 | 0.854 | 3 | 1.289 | 4.7 |
| 75 | 119 | 70 | | | 0.642 | 1.8 | 0.782 | 2.2 | 1.22 | 3.6 | 1.82 | 5.6 |
| 90 | 124 | 79 | | | 0.774 | 1.8 | 1.13 | 2.7 | 1.75 | 4.3 | 2.61 | 6.7 |
| 110 | 129 | 91 | 0.95 | 1.8 | 1.16 | 2.2 | 1.64 | 3.2 | 2.61 | 5.3 | 3.9 | 8.2 |
| 125 | 132 | 100 | 1.08 | 1.8 | 1.48 | 2.5 | 2.13 | 3.7 | 3.34 | 6 | 5.01 | 9.3 |
| 140 | 135 | 109 | 1.21 | 1.8 | 1.84 | 2.8 | 2.65 | 4.1 | 4.1 | 6.7 | 6.27 | 10.4 |
| 160 | 142 | 121 | 1.39 | 1.8 | 2.41 | 3.2 | 3.44 | 4.7 | 5.47 | 7.7 | 8.17 | 11.9 |
| 200 | 150 | 145 | 1.74 | 1.8 | 3.7 | 4 | 5.37 | 5.9 | 8.51 | 9.6 | 12.8 | 14.9 |
| 225 | 162 | 160 | 1.96 | 1.8 | 4.7 | 4.5 | 6.76 | 6.6 | 10.8 | 10.8 | 16.1 | 16.7 |
| 250 | 162 | 175 | 2.4 | 2 | 5.65 | 4.9 | 8.31 | 7.3 | 13.2 | 11.9 | 19.9 | 18.6 |
| 280 | 170 | 193 | 3.11 | 2.3 | 7.11 | 5.5 | 10.4 | 8.2 | 16.6 | 13.4 | 24.9 | 20.8 |
| 315 | 180 | 214 | 3.78 | 2.5 | 9.02 | 6.2 | 13.1 | 9.2 | 20.9 | 15 | 31.5 | 23.4 |
| 355 | 189 | | 4.87 | 2.9 | 11.4 | 7 | 16.7 | 10.4 | 26.5 | 16.9 | 39.9 | 26.3 |
| 400 | 200 | | 6.1 | 3.2 | 14.5 | 7.9 | 21.1 | 11.7 | 33.7 | 19.1 | 50.8 | 29.7 |
| 450 | 213 | | 7.65 | 3.6 | 18.3 | 8.9 | 26.8 | 13.2 | 42.7 | 21.5 | - | - |
| 500 | 253 | | 9.37 | 4 | 22.4 | 9.8 | 32.9 | 14.6 | 52.6 | 23.9 | - | - |

**Note:** SASO14 &15 is a withdrawn standard replaced by SASO-ISO 1452 -2 and produced on request only for an indefinite period of time.



# For non-pressure underground and above ground drainage uPVC plastic piping systems

## Table No. 3:

**BS EN 1401 - 1** uPVC Pipes for underground drainage:
Underground drainage, sewer and storm water pipes are available under BS EN 1401 (Orange Brown) as follows:

| BS EN 1401-1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nominal Size | Outside Diameter | | Wall Thickness | | | | | |
| | | | SdR 51 | | SdR 41 | | SdR 34 | |
| (mm) | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum |
| 110 | 110 | 110.3 | - | - | 3.2 | 3.8 | 3.2 | 3.8 |
| 125 | 125 | 125.3 | - | - | 3.2 | 3.8 | 3.7 | 4.3 |
| 160 | 160 | 160.4 | 3.2 | 3.8 | 4 | 4.6 | 4.7 | 5.4 |
| 200 | 200 | 200.5 | 3.9 | 4.5 | 4.9 | 5.6 | 5.9 | 6.7 |
| 250 | 250 | 250.5 | 4.9 | 5.6 | 6.2 | 7.1 | 7.3 | 8.3 |
| 315 | 315 | 315.6 | 6.2 | 7.1 | 7.7 | 8.7 | 9.2 | 10.4 |

**Application Information:**

- The standard length of pipes is 6 meters or as required.
- Pipe color is Orange Brown or as required.
- Pipes with solvent cement or Ring seal socket end.

## Table No. 4:

**BS EN 1329** are manufactured in sizes from 32mm to 315mm for soil and waste discharge piping systems, the dimensional specifications under this standard are as follows (in metric sizes):

| BS EN 1329-1 | | | | |
|---|---|---|---|---|
| Nominal Size(Outside Diameter) | | | | |
| | B | | BD | |
| (mm) | Minimum | Maximum | Minimum | Maximum |
| 32 | 3 | 3.5 | | |
| 40 | 3 | 3.5 | | |
| 50 | 3 | 3.5 | | |
| 63 | 3 | 3.5 | | |
| 75 | 3 | 3.5 | 3 | 3.5 |
| 90 | 3 | 3.5 | 3 | 3.5 |
| 110 | 3.2 | 3.8 | 3.2 | 3.8 |
| 125 | 3.2 | 3.8 | 3.2 | 3.8 |
| 160 | 3.2 | 3.8 | 4 | 4.6 |
| 200 | 3.9 | 4.5 | 4.9 | 5.6 |
| 250 | 4.9 | 5.6 | 6.2 | 7.1 |
| 315 | 6.2 | 7.1 | 7.7 | 8.7 |

Class B: For Non pressure water networks (Above Ground only – Inside or Outside buildings).
Class BD: For Non pressure water networks (Above & Under Ground – Inside or Outside buildings).

**Application Information:**

- The standard length of pipes is 6 meters or as required.
- Pipe color is Grey or as required.
- Pipes with solvent cement or Ring seal socket end.
- Solvent Cement (S/J) Type Supplied from Size: 32 mm up to 315 mm.

# uPVC Pipes According to British Standard BS 3505 / 3506

## Table No. 5:

| Nominal Size (mm) | Outer Dia. (mm) | CLASS B 6 Bar | | CLASS C 9 Bar | | CLASS D 12 Bar | | CLASS E 15 Bar | |
|---|---|---|---|---|---|---|---|---|---|
| | | Thickness mm (min) | Thickness mm (max) | Thickness mm (min) | Thickness (max) | Thickness mm (min) | Thickness (max) | Thickness mm mm (min) | Thickness mm (max) |
| ½″ | 21.2 - 21.5 | | | | | | | 1.7 | 2.1 |
| ¾″ | 26.6 - 26.9 | | | | | | | 1.9 | 2.5 |
| 1″ | 33.4 - 33.7 | | | | | | | 2.2 | 2.7 |
| 1¼″ | 42.1 - 42.4 | | | | | 2.2 | 2.7 | 2.7 | 3.2 |
| 1½″ | 48.1 - 48.4 | | | | | 2.5 | 3 | 3.1 | 3.7 |
| 2″ | 60.2 - 60.5 | | | 2.5 | 3 | 3.1 | 3.7 | 3.9 | 4.5 |
| 3″ | 88.7 - 89.1 | 2.9 | 3.4 | 3.5 | 4.1 | 4.6 | 5.3 | 5.7 | 6.6 |
| 4″ | 114.1 - 114.5 | 3.4 | 4 | 4.5 | 5.2 | 6 | 6.9 | 7.3 | 8.4 |
| 6″ | 168.0 - 168.5 | 4.5 | 5.2 | 6.6 | 7.6 | 8.8 | 10.2 | 10.8 | 12.5 |
| 8″ | 218.8 - 219.4 | 5.3 | 6.1 | 7.8 | 9 | 10.3 | 11.9 | 12.6 | 14.5 |

Pressure ratings for working pressures at 20°C
Class B 6.0 bar
Class C 9.0 bar
Class D 12.0 bar
Class E 15.0 bar

# Perforated and Slotted pipes

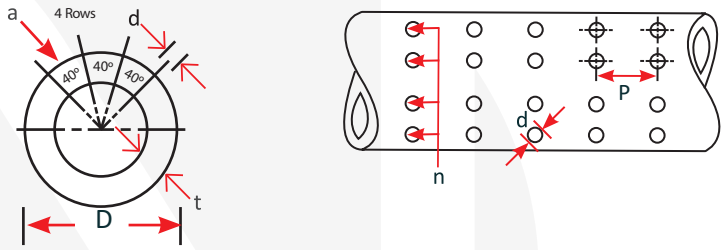
## a)Perforated uPVC pipes

Perforated uPVC pipes are manufactured upon request depending on the size and class of the pipes below figures given a general configuration which may vary for each client requirements.

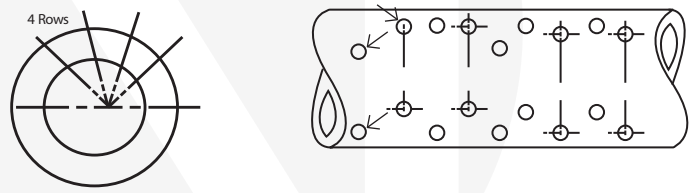
## Table No. 6 :

| Parameters | | Limits of variation |
|---|---|---|
| Outside diameter | D | 32mm to 630mm in standard sizes. |
| Wall thickness | t | In accordance with the wall thickness of pipe selected. |
| Longitudinal pitch of holes | P | 50 mm to 200mm depending on size and wall thickness of pipe. |
| Hole diameter | d | 6 mm to 13 mm depending on size and wall thickness of pipe. |
| Number of rows | n | 1 to 4. |
| Angular pitch of holes | a | 40 degrees tor 3 or 4 rows.<br>40, 80 or 120 degrees for 2 rows. |

### Straight Rows




### Staggered Rows

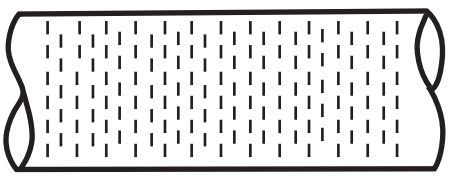



## b)Slotted uPVC pipes

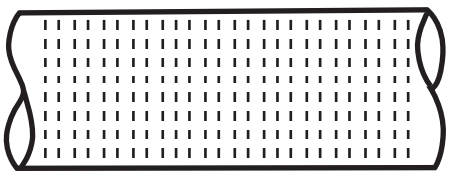
Slotted pipes are produced according to RDA requirements and for use in lowering under-ground water table.

## Table No. 7 :

| Parameters | Limits of variation |
|---|---|
| Slot Length | Dep end to the size. |
| Slot Width | 1 ,1½, 2 and 3 mm. |
| Number of Row | 4,6 & 8 (but according to the size) . |
| Angular Pitch | To be recommended by NALPLAST. |



Staggered Slots



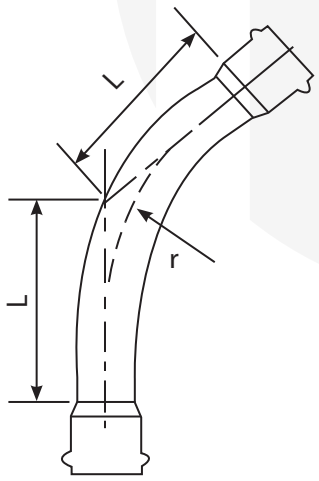
Straight Slots

# uPVC Fabricated Fittings

## a) uPVC Long Radius Bends

## Table No. 8:

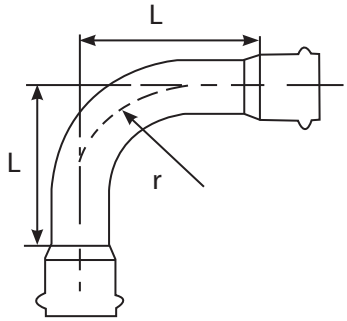
| Pipe Size (mm) | Radius (r) mm | L(mm) | | | |
|---|---|---|---|---|---|
| | | 11. ¼° | 22. ½° | 45° | 90° |
| 63 | 221 | 165 | 187 | 235 | 364 |
| 75 | 263 | 177 | 204 | 260 | 414 |
| 90 | 315 | 192 | 224 | 292 | 476 |
| 110 | 385 | 212 | 251 | 334 | 559 |
| 125 | 438 | 227 | 271 | 365 | 622 |
| 140 | 490 | 243 | 292 | 397 | 684 |
| 160 | 729 | 303 | 373 | 524 | 934 |
| 225 | 788 | 329 | 408 | 578 | 1039 |
| 250 | 852 | 350 | 435 | 595 | 1240 |
| 280 | 980 | 385 | 483 | 694 | 1268 |
| 315 | 1103 | 420 | 531 | 768 | 1414 |
| 355 | 1243 | 860 | 1110 | 1200 | 1840 |
| 400 | 1400 | 910 | 1160 | 1300 | 1940 |
| 450 | 1575 | 960 | 1210 | 1400 | 2090 |
| 500 | 1750 | 1110 | 1410 | 1500 | 2190 |




Notes:
- Dimensions stated on table are indicative, detailed specification for design purposes should be obtained from our technical Departmet.

- Bends for size 63 mm and above are available either with P/S or R/S.

- Single Socket or Double Socket to be specialized.

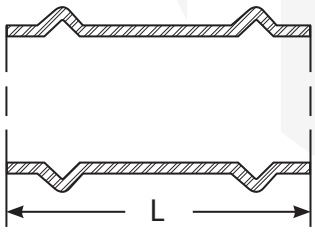


## b) uPVC Couplings

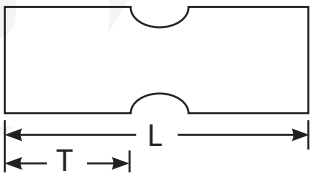
### Table No. 9 :

| Pipe O.D (mm) | R/J Coupling | | P/S Coupling | |
|---|---|---|---|---|
| | L(mm) | T(mm) | L(mm) | T(mm) |
| 20 | | | 58 | 27 |
| 25 | | | 66 | 30 |
| 32 | | | 74 | 34 |
| 40 | | | 94 | 39 |
| 50 | | | 96 | 45 |
| 63 | 240 | 100 | 126 | 53 |
| 75 | 250 | 103 | 140 | 60 |
| 90 | 270 | 111 | 160 | 69 |
| 110 | 290 | 116 | 185 | 81 |
| 140 | 330 | 125 | 230 | 99 |
| 160 | 350 | 135 | 250 | 111 |
| 200 | 375 | 144 | 300 | 135 |
| 225 | 430 | 154 | 360 | 150 |
| 250 | 445 | 162 | 380 | 165 |
| 280 | 495 | 172 | 425 | 183 |
| 315 | 545 | 185 | 478 | 204 |
| 355 | 588 | 194 | 520 | 224 |
| 400 | 612 | 205 | 570 | 246 |

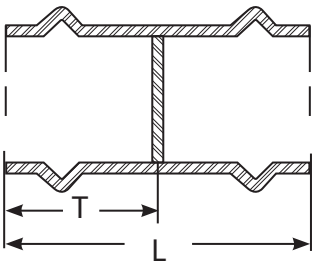
### a) Repair Coupling R/J




### c) Coupling with Register P/S




### b) Register Coupling R/J




### d) Coupling without Register P/S


Note:Dimensions stated on table are indicative, detailed specification for design purposes should be obtained from our technical Department.

# Fittings

**ELBOW UPVC DWV**

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| E1PVC-50 | 50 mm | 92.5 | 61 | 28.00 | 90° | 0.111 |
| E1PVC-75 | 75 mm | 130 | 88 | 41.00 | 87.5° | 0.254 |
| E1PVC-110 | 110 mm | 178 | 126 | 51.00 | 87.5° | 0.655 |
| E1PVC-160 | 160 mm | 252 | 180 | 71.00 | 87.5° | 1.465 |

# Fittings

### ELBOW WITH DOOR UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| E2DPVC-75 | 75 mm | 130 | 88 | 41.00 | 87.5° | 0.300 |
| E2DPVC-110 | 110 mm | 178 | 126 | 51.00 | 87.5° | 0.723 |
| E2DPVC-160 | 160 mm | 252 | 180 | 71.00 | 87.5° | 1.550 |

### ELBOW UPVC DWV 45°

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| E3PVC-50 | 50 mm | 98.7 | 61 | 28.00 | 45° | 0.088 |
| E3PVC-75 | 75 mm | 136.8 | 88 | 41.00 | 45° | 0.200 |
| E3PVC-110 | 110 mm | 181 | 126 | 51.00 | 45° | 0.500 |
| E3PVC-160 | 160 mm | 260 | 180 | 71.00 | 45° | 1.122 |

### SOCKET UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| S1PVC-50 | 50 mm | 60 | 61 | 28.00 | N/A | 0.060 |
| S1PVC-75 | 75 mm | 87 | 88 | 41.00 | N/A | 0.142 |
| S1PVC-110 | 110 mm | 108 | 126 | 51.00 | N/A | 0.332 |
| S1PVC-160 | 160 mm | 150 | 180 | 71.00 | N/A | 0.758 |

### REDUCER SOCKET UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| R1PVC-11050 | 110/50 mm | 105 | 110.1 | 28.00 | N/A | 0.191 |
| R1PVC-11075 | 110/75 mm | 117 | 110.1 | 41.00 | N/A | 0.223 |
| R1PVC-160110 | 160/110 mm | 175 | 160.3 | 51.00 | N/A | 0.570 |

### ACCESS PLUG

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| S2DPVC-50 | 50 mm | 55 | 50.1 | N/A | N/A | 0.057 |
| S2DPVC-75 | 75 mm | 72 | 75.1 | N/A | N/A | 0.136 |
| S2DPVC-110 | 110 mm | 87 | 110.1 | N/A | N/A | 0.290 |
| S2DPVC-160 | 160 mm | 120 | 160.3 | N/A | N/A | 0.509 |

### TEE UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| T1PVC-50 | 50 mm | 127 | 61 | 28.00 | 87.5° | 0.161 |
| T1PVC-75 | 75 mm | 189 | 88 | 41.00 | 87.5° | 0.400 |
| T1PVC-110 | 110 mm | 248 | 126 | 51.00 | 87.5° | 0.958 |
| T1PVC-160 | 160 mm | 346 | 180 | 71.00 | 87.5° | 2.162 |

## TEE REDUCER UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| TR1PVC-160110160 | 110/160 mm | 288 | 180 | 71.00 | 87.5° | 1.611 |
| TR1PVC-11050 | 110 x 50 | 165 | 125 | 185 | 87.5 | |
| TR1PVC-11075 | 110 x 75 | 190 | 125 | 220 | 87.5 | |

## TEE WITH DOOR UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| T2DPVC-75 | 75 mm | 189 | 88 | 41.00 | 87.5° | 0.455 |
| T2DPVC-110 | 110 mm | 248 | 126 | 51.00 | 87.5° | 1.066 |
| T2DPVC-160 | 160 mm | 346 | 180 | 71.00 | 87.5° | 2.267 |

## TEE CROSS UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| TXPVC-110 | 110 mm | 248 | 126 | 51.00 | 87.5° | 1.200 |

## Y UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| Y1PVC-50 | 50 mm | 138 | 61 | 28.00 | 45° | 0.175 |
| Y1PVC-75 | 75 mm | 203 | 88 | 41.00 | 45° | 0.436 |
| Y1PVC-110 | 110 mm | 279 | 126 | 51.00 | 45° | 1.182 |
| Y1PVC-160 | 160 mm | 320 | 180 | 71.00 | 45° | 2.530 |

## Y REDUCER UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| YR1PVC-160110 | 160/110mm | 320 | 180 | 71.00 | 45° | 1.813 |
| YR1PVC-11050 | 110 x 50 | 185 | 125 | 190 | 45 | |
| YR1PVC-11075 | 110 x 75 | 220 | 125 | 225 | 45 | |

## 45° DOUBLE 'Y' BRANCH

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| YT1PVC-110 | 110 mm | 310 | 126 | 51.00 | 45° | 1.560 |

# Fittings

## MULTI BRANCH UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| MBPVC-11050 | 110/50 mm | 186 | 189.5 | 28.00 | N/A | 0.670 |

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| MBPVC-1105075 | 110/50/75 mm | 208 | 194.75 | 28/41. | N/A | 0.741 |

## FLOOR TRAP MULTI BRANCH

| Art-No. | Dimensions mm | | | | |
|---|---|---|---|---|---|
| | D | H | W | L | A° |
| MB-PV2-200110110 | 200 x 110 x 110 | 190 | 300 | 300 | N/A |

## P- TRAP UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| PTPVC-110 | 110 mm | 256 | 152 | 51.00 | N/A | 0.842 |

## SYPHON UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| SYPVC-110 | 110 mm | 320 | 152 | 51.00 | N/A | 1.338 |
| SYPVC-50 | 50 | 150 | 65 | 170 | N/A | |

## SYPHON ( P-TRAP ) WITH DOOR

| Art-No. | Dimensions mm | | | | |
|---|---|---|---|---|---|
| | D | H | W | L | A° |
| SY2D-PV2-110 | 110 | 250 | 125 | 325 | N/A |

## END PLUG UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| C1PVC-50 | 50 mm | 38.5 | 56.5 | 35 | N/A | 0.031 |
| C1PVC-110 | 110 mm | 55 | 124 | 50 | N/A | 0.161 |

## PIPE CAP UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| C2PVC-50 | 50 mm | 26.5 | 56.5 | 22.1 | N/A | 0.030 |
| C2PVC-75 | 75 mm | 38.5 | 83.5 | 33.6 | N/A | 0.085 |
| C2PVC-110 | 110 mm | 47.3 | 120.56 | 41.8 | N/A | 0.150 |
| C2PVC-160 | 160 mm | 63.9 | 172.8 | 56 | N/A | 0.350 |

## VENTILATION CAP UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| VPVC-75 | 75 mm | 100 | 88 | 41 | N/A | 0.121 |
| VPVC-110 | 110 mm | 110 | 126 | 51 | N/A | 0.246 |
| VPVC-160 | 160 mm | 150 | 180 | 71 | N/A | 0.621 |

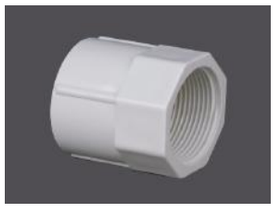
## EXPANSION COUPLER WITH DOOR UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| EXDPVC-110 | 110 mm | 145 | 138.5 | 61 | N/A | 0.526 |

## TRANSITION FEMALE ELBOW UPVC DWV

| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| EFPVC-5011/2 | 50 mm x 1.1/2" | 92.5 | 61 | 28 | 90° | 0.110 |

## TRANSITION FEMALE SOCKET UPVC DWV



| Art-No. | Dimensions mm | | | | | KG/PCS |
|---|---|---|---|---|---|---|
| | D | H | W | L | A° | |
| SFPVC-5011/2 | 50 mm x 1.1/2" | 58 | 62.5 | 28 | N/A | 0.070 |

# Rubber Orange Fitting

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Swept Elbow 87.5° | E1-PV5-50 | 50 | 120 |
| | E1-PV5-75 | 75 | 42 |
| | E1-PV5-82 | 82 | 42 |
| | E1-PV5-110 | 110 | 25 |
| | E1-PV5-160 | 160 | 8 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Elbow 87.5° with door Swept | E2D-PV5-75 | 75 | 30 |
| | E2D-PV5-82 | 82 | 30 |
| | E2D-PV5-110 | 110 | 20 |
| | E2D-PV5-160 | 160 | 10 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Elbow 45° | E3-PV5-50 | 50 | 140 |
| | E3-PV5-75 | 75 | 60 |
| | E3-PV5-82 | 82 | 60 |
| | E3-PV5-110 | 110 | 40 |
| | E3-PV5-160 | 160 | 10 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Tee 87.5° Swept | T1-PV5-50 | 50 | 50 |
| | T1-PV5-75 | 75 | 24 |
| | T1-PV5-82 | 82 | 24 |
| | T1-PV5-110 | 110 | 14 |
| | T1-PV5-160 | 160 | 5 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Swept Tee 87.5° with door | T2D-PV5-75 | 75 | 22 |
| | T2D-PV5-82 | 82 | 22 |
| | T2D-PV5-110 | 110 | 14 |
| | T2D-PV5-160 | 160 | 4 |

# Rubber Orange Fitting

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Swept Reducer Tee | TR1-PV5-11050 | 110 x 50 | 20 |
| | TR1-PV5-11075 | 110 x 75 | 20 |
| | TR1-PV5-11082 | 110 x 82 | 20 |
| | TR1-PV5-160110 | 160 x 110 | 10 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Floor Trap Multi Branch | FT2-PV5-1107550 | 110 x 75 x 50 | 24 |
| | FT2-PV5-1108256 | 110 x 82 x 56 | 24 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Reducer Socket | R1-PV5-7550 | 110 x 56 | 88 |
| | R1-PV5-8256 | 82 x 56 | 88 |
| | R1-PV5-11050 | 110 x 50 | 88 |
| | R1-PV5-11075 | 110 x 75 | 88 |
| | R1-PV5-11082 | 110 x 82 | 70 |
| | R1-PV5-160110 | 160 x 110 | 21 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Socket | S1-PV5-50 | 50 | 200 |
| | S1-PV5-75 | 75 | 72 |
| | S1-PV5-82 | 82 | 72 |
| | S1-PV5-110 | 110 | 60 |
| | S1-PV5-160 | 160 | 10 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Syphon P trap | ST2-PV5-110 | 110 | 6 |
| Syphon S trap | SS2-PV5-110 | 110 | 6 |

# Rubber Orange Fitting

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Y ( Tee 45° ) | Y1-PV5-50 | 50 | 50 |
| | Y1-PV5-75 | 75 | 24 |
| | Y1-PV5-82 | 82 | 24 |
| | Y1-PV5-110 | 110 | 14 |
| | Y1-PV5-160 | 160 | 4 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Reducer Y ( Tee 45° ) | YR1-PV5-11050 | 110 x 50 | 8 |
| | YR1-PV5-11075 | 110 x 75 | 8 |
| | YR1-PV5-11082 | 110 x 82 | 16 |
| | YR1-PV5-160110 | 160 x 110 | 8 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| 45° Double 'Y' Branch | YT1-PV5-110 | 110 x110 x 110 | 9 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Cross Tee | TX-PV5-110 | 110 x110 x 110 | 12 |

| Fitting Item description | Item Code | Size | Std.Qty/ Carton |
|---|---|---|---|
| Access Plug | IS2-PV3-110 | 110 | 6 |

# Temperature Pressure Relationship

Since uPVC is a thermoplastic material, pressure ratings must be reduced as higher temperatures are encountered. Table 10 shows the percentage of the pressure rating recommended for various working temperatures over 20° C with a fluctuation not exceeding 5° C. uPVC pipes should not be used for pressure duties if the operational temperature exceeds 60° C. As with all pipe lines, special precautions must be taken when there is a possibility of water hammer or surge pressure. Incorporating surge tanks or pressure release valves in the system will obviate this problem.

## Table No. 10 :

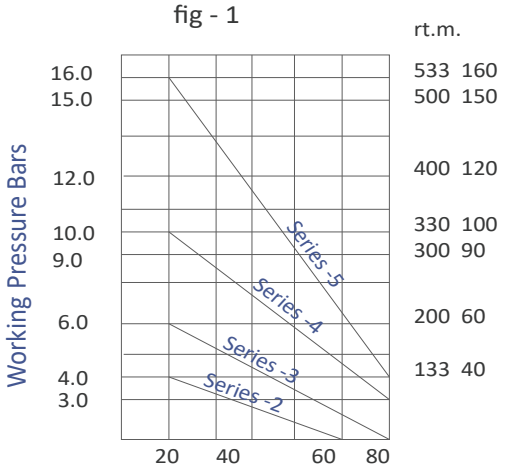
| | C | F | Percentage of Working Pressure |
|---|---|---|---|
| Temp | 20 | 68 | 100 |
| | 30 | 86 | 90 |
| | 35 | 95 | 80 |
| | 40 | 104 | 70 |
| | 45 | 113 | 60 |
| | 50 | 122 | 45 |
| | 55 | 131 | 30 |
| | 60 | 140 | 15 |

Pressure Temp. Relationship
Ambient Variable Internal Temp 20 °C

Pressure Temp. Relationship
Internal Variable Ambient Temp 20 °C

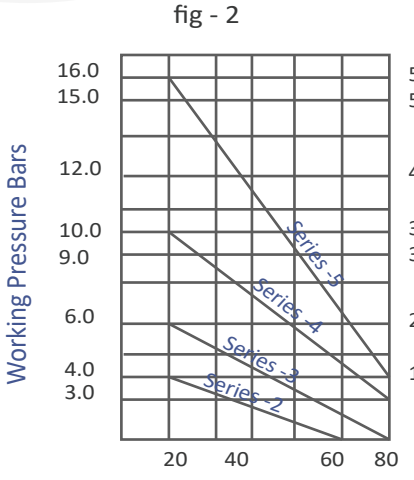
Water Head

fig - 1




Water Head

fig - 2




AMBIENT TEMPERATURE OF 40°C a required working pressure of 6.0 bars use a 10 bae rated pipe.

## Table No. 11 : Pipe Properties

| Properties | | |
|---|---|---|
| **Mechanical** | **unit** | **values** |
| Tensile Strength Ultimate | kgf/cm2 | 492 min |
| | MPa | 48.0 min |
| Modulus of Elasticity in Tension | kgf/cm | 28123 min |
| | MPa | 2758 min |
| Compressive Strength | kgf/cm2 | 638 min |
| | MPa | 62.0 min |
| Flexural Strength | kgf/cm2 | 1020 |
| Izod Impact Strength | MPa | 100.0 min |
| | j/m of notch | 34.7 min |
| Hardness | Durometer"D" | >70t3 |
| | Rockwell"R" | 110-120 |
| **Electrical** | **unit** | **values** |
| Dielectric Strength | Volts/Mil | 1100 |
| Dielectric Constant | 60cps @ 30 °C | 4 |
| Specific Volume Resistivty | Ohm/cm | $>101^4$ |
| Power Factor | at 10 cycles | 3 |
| **Thermal** | **unit** | **values** |
| Coefficient Of Thermal Linear Expansi on | mm/m °k | 5.6 |
| Thermal Conductivity | Wm/°k/m2 | 0.18 |
| Specific Heat | cal / °C | 0.23 |
| | kcal /kg °C | 0.23 |
| Vicat Softening Tamperature | °C | >80 |
| Deflection Tamperature | °C | >70 min |
| Elongation at Break | % | >40 min |
| **General** | **unit** | **values** |
| Specific Gravity | | 1.42 |
| Water Absorption | mg / cm2 | <4 |
| Cell Designation | ASTM1784 | 1245-B |
| Flame Spread E-84 | | <25 |
| Poison's Ratio @73 °F | | 0.35- 0.38 |
| Smoke Density | | 500 |
| Friction Coefficient | Factor"C" | 150 |

## Chemical Resistance of NALPLAST uPVC Pipes

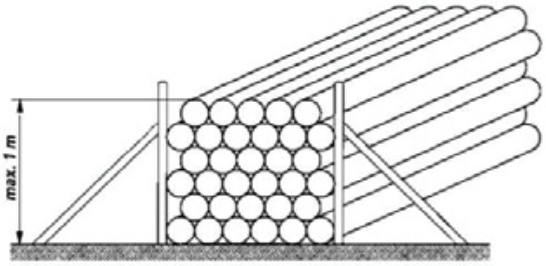
The polyvinyl chloride (uPVC) material is one of the best petro-chemical products that has shown over 50 years a high percentage and excellent resistance to a wide range of chemicals. The following table, will indicate the uPVC material resistance at two different temperatures of the liquids carried in the system. The uPVC compatibility resistance to the chemicals are indicated as a reference but does not mean a full adherence to the actual operating circumstances since it has to take into consideration the multiple effect conformity by the system design that should be granted prior to any design and usage.

# Table No. 12 : Chemical Resistance

| product | Conc. % | Temp 20℃ | Temp 60℃ | product | Conc. % | Temp 20℃ | Temp 60℃ |
|---|---|---|---|---|---|---|---|
| ACETIC ACID | 60 | S | L | HYDROFLUORIC ACID | 60 | L | NS |
| ACETIC ACID MONOCHLORIDE | SOL. | S | L | HYDROGEN | 100 | S | S |
| ACETIC ALDEHYDE | 100 | NS | - | HYDROGEN DIOXIDE | 30 | S | S |
| ACETIC ANHYDRIDE | 100 | NS | NS | HYDROGEN SULPHITE | 100 | S | S |
| ACETONE | 100 | NS | NS | IRON CHLORIDE | SOL.SAT. | S | S |
| ADIPIC ACID | SOL.SAT. | S | L | LACTIC ACID | 10 | S | L |
| ALLYLALCOHOL | 90 | L | S | LACTIC ACID | 10~90 | L | NS |
| ALUMINUM CHLORIDE | SOL.SAT. | S | S | LEAD ACETATE | SOL.SAT. | S | S |
| ALUMINUM SULPHATE | SOL.SAT. | S | S | LEAD TETRAETHYL | 100 | S | - |
| AMMONUA(AQUEOUS) | 100 | L | NS | MAGNESIUM CHLORIDE | SOL.SAT. | S | S |
| AMMONIA(GAS) | 100 | S | S | MAGNESIUM SULPHIDE | SOL.SAT. | S | S |
| AMMONIA(SOLUTION) | SOL.DIL. | S | L | MALEIC ACID | SOL.SAT. | S | L |
| AMMONIUM CHLORIDE | SOL.SAT. | S | S | METHYL ALCOHOL | 100 | S | L |
| AMMONIUM FLUORIDE | 20 | S | L | METHYL METHACRYLATE | 100 | NS | NS |
| AMMONIUM NITRATE | SOL.SAT. | S | S | METHYLENE CHLORIDE | 100 | NS | NS |
| AMMONIUM SULPHATE | SOL.SAT. | S | S | MILK | | S | S |
| AMYL ACETATE | 100 | NS | NS | NIKEL SULPHIDE | SOL.SAT. | S | S |
| AMYL ALCOHOL | 100 | S | L | NICOTINIC ACID | CONC. | S | S |
| ANILINE | 100 | NS | NS | NITRIC ACID | >46 | S | L |
| ANILINE | SOL.SAT. | NS | NS | NITRIC ACID | 46~98 | NS | NS |
| ANILINE HYDROCHILORIDE | SOL.SAT. | NS | NS | OILS | | S | S |
| ANTMONY CHLORIDE | 90 | S | S | OLEIC ACID | 100 | S | S |
| ARSENIC ACID | SOL.DIL. | S | - | OLEUM | 10% OF SO3 | NS | NS |
| BEER | | S | S | OXALIC ACID | SOL.DIL. | S | L |
| BENZALDEHYDE | 0.1 | NS | NS | OXALIC ACID | SOL.SAT. | S | S |
| BENZEN | 100 | NS | NS | oxigen | 100 | S | S |
| BENZOIC ACID | SOL.SAT. | L | NS | ozone | 100 | NS | NS |
| BORAX | SOL.SAT | S | L | Perchloric Acid | 10 | S | L |
| BORIC ACID | SOL.DIL. | S | L | Perchloric Acid | 70 | L | NS |
| BROMINE (LIQUID) | 100 | NS | NS | Petrol | 80/20 | NS | NS |
| BROMINE ACID | 10 | S | - | Phenol | 90 | NS | NS |
| BUTADIENE | 100 | S | S | Phosphine | 100 | S | S |
| BUTANE | 100 | S | - | Phosphor Trichloride | 100 | NS | - |
| BUTYL ACETATE | 100 | NS | NS | Phosphoric Acid | 30 | S | L |
| BUTYL PHENOL | 100 | NS | NS | picric Acid | SOL.SAT. | S | S |
| BUTYLENE | 100 | S | L | potassium Bichromate | 40 | S | S |
| BUTYRIC ACID | 20 | S | L | potassium Bromide | SOL.SAT. | S | S |
| BUTYRIC ACID | 98 | NS | NS | potassium Chloride | SOL.SAT. | S | S |
| CALCIUM CHLORIDE | SOL.SAT | S | S | potassium Chromate | 40 | S | S |
| CALCIUM NITRATE | 50 | S | S | potassium Cyanide | SOL. | S | S |
| CARBON DIOXIDE | 100 | S | S | potassium Ferricyanide | SOL.SAT. | S | S |
| CARBON SULPHIDE | 100 | NS | NS | potassium Ferrocynaide | SOL.SAT. | S | S |
| CARBON TETRACHLORIDE | 100 | NS | NS | potassium Hydroxide | SOL. | S | S |
| CETYL ACID | 100 | S | S | potassium Nitrate | SOL.SAT. | S | S |
| CHLORINE (DRY GAS) | 100 | L | NS | potassium Permangnate | 20 | S | S |
| CHLORINE (LIQUID) | SOL.SAT. | L | NS | potassium Persulfate | SOL.SAT. | S | L |
| CHLOROSULPHONIC ACID | 100 | L | NS | Propane (gas liquid) | 100 | S | - |
| CHROMIC ACID | 1~50 | S | L | Pyridin | 100 | NS | - |
| CITRIC ACID | SOL.SAT. | S | S | Sea Water | | S | L |
| COPPER CHLORIDE | SOL.SAT. | S | S | Silver Nitrate | SOL.SAT. | S | L |
| COPPER FLURIDE | 2 | S | S | Soap | SOL. | S | L |
| CREOSOL | SOL.SAT. | - | NS | Sodium Benzoate | 35 | S | L |
| CRESOL ACID | SOL.SAT. | NS | NS | Sodium Bisulphite | SOL.SAT. | S | S |
| CROTONIC ALDEHYDE | 100 | NS | NS | Sodium Chlorate | SOL.SAT. | S | S |
| CYCLOHEXANOL | 100 | NS | NS | Sodium ferricyanide | SOL.SAT. | S | S |
| CYCLOHEXANONE | 100 | NS | NS | Sodium Hydroxide | SOI. | S | L |
| DEVELOPING BATH | | S | S | Sodium Hypochlorite | 100(30%CL.) | S | L |
| DEXTRINE | SOL.SAT. | S | L | Sodium Solphite | SOL.SAT. | S | L |
| DICHLOROETHYLENE | 100 | NS | NS | Sugar | SOL.SAT. | S | S |
| DIGLYCOLIC ACID | 18 | S | L | Sulphur Acid | SOL. | S | S |
| DIMETHYLANNINE | 30 | S | - | Sulphur Anhydride | 100(liquid) | L | NS |
| ETHYL ACETATE | 100 | NS | NS | Sulphur Anhydride | 100(dry) | L | NS |
| ETHYL ACRYLATE | 100 | NS | NS | Sulphuric Acid | 40 ~90 | S | L |
| ETHYL ALCOHOL | 95 | S | L | Sulphuric Acid | 96 | L | NS |
| ETHYL ETHER | 100 | NS | L | Tannic Acid | SOL. | S | S |
| ETHYLNE GLYCOL | CONC. | L | L | Tartaric Acid | SOL. | S | S |
| FLUOSILICIC ACID | 32 | S | S | Tin Chloride | SOL.SAT. | S | S |
| FORMALDEHYDE | SOL. | S | S | Toluene | 100 | NS | NS |
| FORMALDEHYDE | 40 | S | S | Trichoroethylene | 100 | NS | NS |
| FORMIC ACID | 1~50 | S | L | TRIMETHYL PROPANE | <10 | S | L |
| FURFURFAL ALCOHOL | 100 | NS | NS | UREA | 10 | S | L |
| GLUCOUSE | SOL.SAT. | S | L | URINE | | S | L |
| GLYCERIN | 100 | S | S | VINAGRE | | S | S |
| GLYCOCLIC ACID | 30 | S | S | VINYL ACETATE | 100 | NS | NS |
| GOLDEN SYRUP | SOL. | S | L | WINE | | S | S |
| HYDRAZINE BENZENE | 100 | NS | NS | XYLENE | 100 | NS | NS |
| HYDROZINE BENZENE CLORIC | 97 | NS | NS | YEAST | SOL. | S | L |
| HYDROBROMIC ACID | 50 | S | L | ZINC CHLORIDE | SOL.SAT. | S | S |
| HYDROCHLORIC ACID | >30 | S | S | | | | |

# Handling and Storage of uPVC Pipe

## To store uPVC pipes safely, consider the following:




1- All storage areas should be flat and kept free from stones and sharp-edged objects.

2- Pipes are to be stored in such a way to prevent any contamination of the insides.

3- End closure caps should be removed just before installation.

4- Storage zones and stack heights are to be chosen which avoid possible damage or permanent deformation.

5- Large diameter pipes with low wall-thicknesses are to be provided with stiffener rings.

6- Single point or longitudinal contact support for any pipe is to be avoided.

7- Non-pelleted pipes should be stacked in heights not exceeding 1 meter. This is not applicable for pipes which are stacked on pallets providing their full weight is supported by the frame of the pallet. In principle, coiled pipes are to be either laid flat or placed in a suitable protective framework for storage.

8- Fastening bands should not be removed until shortly before installation.

9- If pipes are correctly stacked on pallets and secured against lateral movement, stacking heights may be increased by 50 percent.

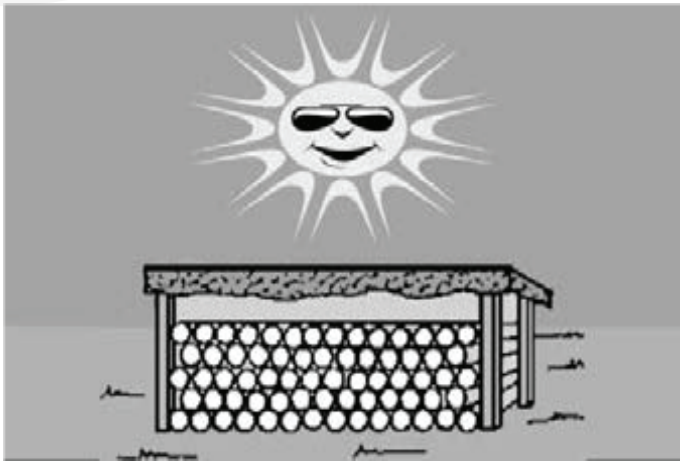
10- The location where pipe and piping components are stored must provide as much protection as possible.

11- Pipes should not be allowed to come into contact with fuels, solvents, oil, greases, paints (silicones) or heat sources during storage.

12- Dragging pipes and coils over the ground must be avoided at all times.

## Effect of Weather

If pipes are stored in the open area (for example, on construction sites) they must be covered with suitable coloured or plain black sheeting to protect them from the effects of weather (e.g. UV radiation). Further more, a one sided exposure to direct sunshine can ultimately lead to deformation of the pipe.



## Transportation of uPVC pipes:

Vehicles for transporting pipes should be selected in such a way so that the pipes can lay completely flat on the bed of the vehicle without any over-hang.

1- All pipes are to be supported so that they cannot bend or become deformed.

2- The area of the truck where the pipes are laid should be covered with either protective sheeting or cardboard (including all side supports) in order to prevent any possible damage from protruding rivets or nails etc.

3- Pipes should be protected from possible damage during transport and not dragged over the bed of the truck or across open ground prior to installation.

4- Pipes and fittings should always be loaded and unloaded with extreme care. Special support frames are to be employed when using cranes for loading or unloading from vehicles.

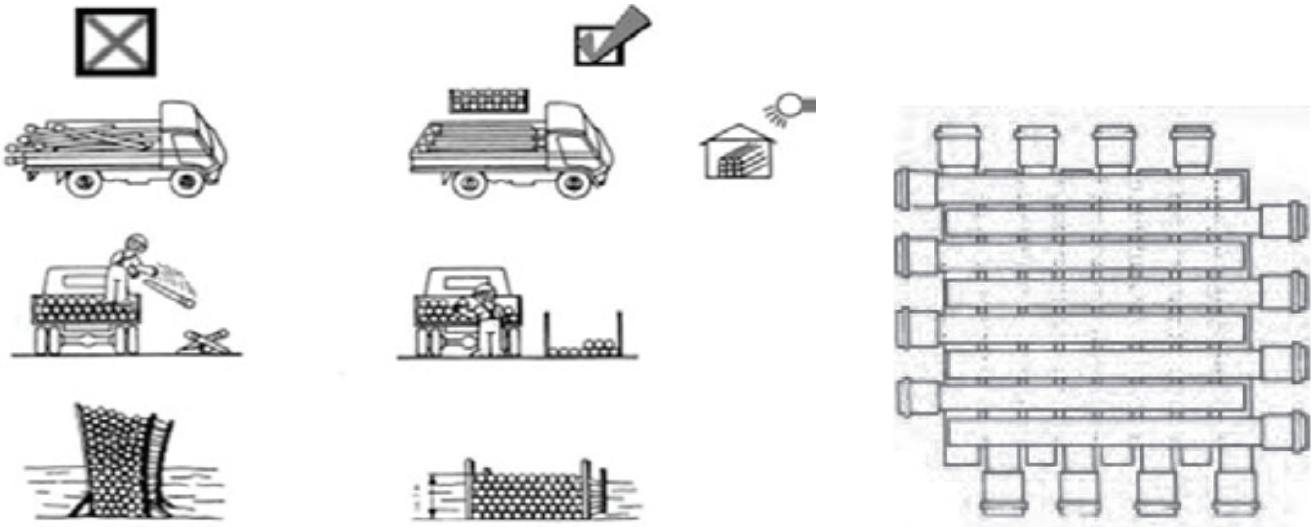
5- Throwing pipes onto the ground from the bed of the transport truck must be prevented at all times.

6- Sudden shock impacts are to be avoided under all circumstances.

7- Pipes are to be transported and stored in such a way so that they do not become contaminated by earth, mud, sand, stones, water, oils, chemicals, solvents, other liquids and the effects of weather etc.

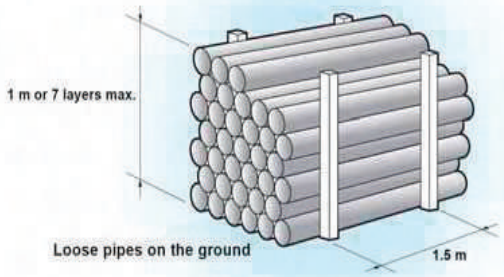
## Handling and Storage Methods

The person receiving the pipe must look for any transportation damage cause by over-tightened tie down straps, improper treatment, or a shift in the load. Pipe received in a closed trailer must be inspected as the trailer is opened. take extra time to ensure that the pipe has not been damaged by other materials having been stacked on top of it, load shift, or rough handling. Visually examine the pipe ends for any cracks, splits, gouges, or other forms of damage. Additionally, the pipe should be inspected for severe deformation which could later cause joining problems. The entire inside diameter of lager diameter pipe (4" and above) must be checked for any internal splits or cracks which could have been caused by loading or transit.



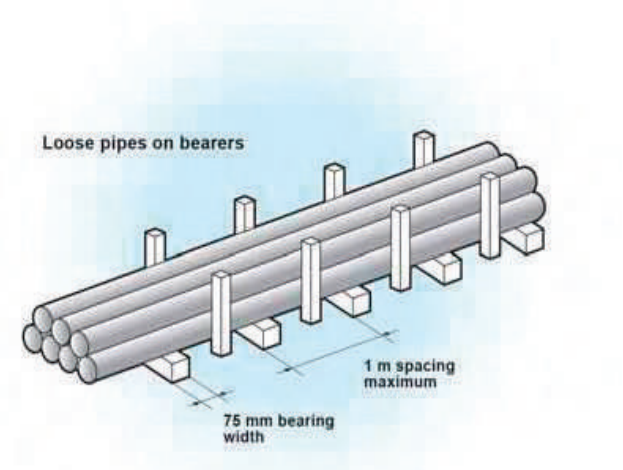
## Pipe Storage

Pipes should be stored under shade or inside a closed warehouse. When this is not possible, the pipe should be stored on level ground which is dry and free from sharp objects. If different schedules of pipe are stacked together, the pipe with the thickest walls should be on the bottom. If the pipe is packed in pallets, the pallets should be sacked with the pallet wooden frames on top of each other's rather than having them placed on the pipes. This will prevent damage to or bowing underlying pipes. If the pipe is stored in racks it should be continuously supported along its length. If this is not possible, the spacing of the supports should not exceed their feet (3").The pipe should be protected from the sun and be in an area with proper ventilation. This will reduce the effects of ultraviolet rays and help prevent heat deflection impact.




## Stacking

Pipes should be given adequate support at all times. They should not be stacked in large piles, especially under warm temperature conditions. As the bottom pipes may distort, thus giving rise to difficulty in pipe alignment and jointing. Socket and spigot pipe joints should be stacked in large layers with sockets placed at alternate ends of the stack and imparting of a permanent set to the pipes. For the long-term storage, pipe racks should preferably provide continuous support but, if this is not possible, timber supports of at least 75 mm (3 in) Bearing width, at spacing not greater than 1 m (3.2 ft.) centres should be placed beneath the pipes and, if the stacks are rectangular, at twice this spacing at the different classes of pipe are kept in the same racks then the thickest classes must always be at the bottom.



# Site Work Instructions

## a) Above Ground Installation :

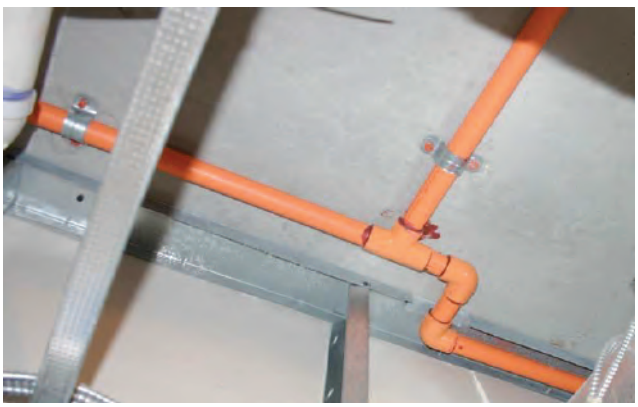
1- Above -ground installations should be fully supported, firmly enough to avoid strain on all joints but flexible enough to allow for a certain amount of thermal expansion in a pipeline. All flanged joints should be supported on both sides. Rubber ring joints should be anchored against end trust. Pipelines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

2- uPVC pipelines must be protected from direct sunlight and external heat. Ring Seal Joints should not be used on above ground installations unless all the joints are anchored against end thrust.

3- Plastic pipelines need to be supported at specific intervals. These intervals will depend on the specific gravity of the material being conveyed, the temperatures of the liquid and the environment and the pipe wall thickness and type of plastic used. Some deflection may be allowed between brackets and at changes of direction. The average deflection between centers should be up to a maximum of 25 mm.

4- Where plastic pipelines incorporate metal valves or other heavy fittings it is essential to support the valve directly rather than allow their weight to be carried by the plastic pipe.

5- For light duty and small pipe sizes, plastic pipe support brackets are suitable. Matching formed metal pipe supports should be used with cork or P.E. liner for fixed points.



## b) Under Ground Installation :

1- Cleanliness is of prime importance and pipes specially spigot ends should be supported clear of the ground to prevent dirt being smeared on with the lubricant. Placing the pipes on blocks also reduces friction and consequently facilitates the making of the joint.These blocks must be removed before backfilling, and every care must be taken to ensure that the pipe is not bedded on submerged rock.

2- The pipeline should be tested initially after a few joints (certainly not more than 500 meters) to ensure that they have been made correctly, and subsequently at convenient intervals, preferably not exceeding 1000meters.

3- All changes of direction must be anchored. Concrete thrust blocks are suitable, but the unit should only be hunched, and a flexible membrane interposed between the concrete and the unit, to protect it against damage by abrasion.

4- Before testing, the line must be backfilled leaving the joints exposed. If the joints must be covered, it is useful to mark their position.

5- The trench should not be opened to far in advance of pipe laying and should be backfilled as soon as possible. The width of the trench at the crown of the pipe should be as narrow as practicable but not less than the outside diameter of the pipe plus 300 mm to allow proper compaction of the side fill, 225 mm above the crown of the pipe, the trench may be any convenient width. The inherent flexibility of uPVC drainage pipe can be used to advantage but care must be taken to ensure that the bed of the trench will support the pipeline adequately so as to prevent localized loss of gradient or bridging. Projections must be removed to avoid point loading of the pipe.

# Trenching:

The trench bottom should be as level as possible, so that the barrel of the pipe is fully supported.
The trench bottom should have sandy or loamy soil, free from rocks and stones to ensure continuous supporter the pipe.

Wet Conditions

In wet ground, sloppy working conditions can be alleviated by first placing a layer of hard granular material, or by dewatering the area in and around the trench. If patches of ground are so wet that there is a risk of subsidence and possible damage to sections of the pipeline, these areas should be consolidated by the addition of suitable fill material.

Trench Installation

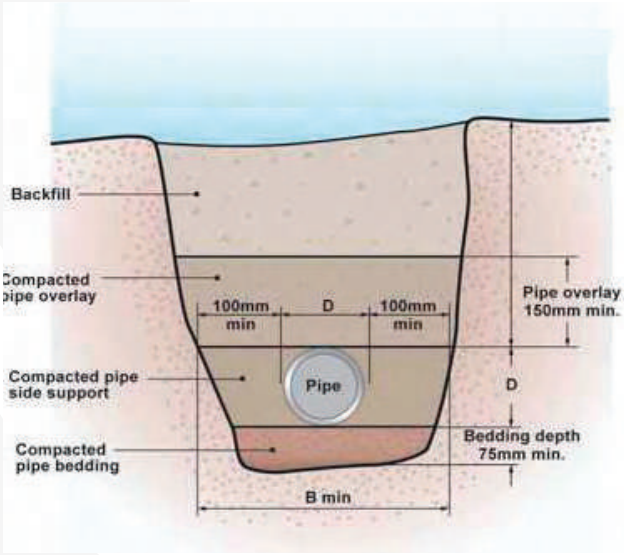
The trench should be excavated deeply enough to allow for the specified grade, the required depth of bedding, and the minimum cover over the pipe.

# Bedding and Side Filling:

-Some soils, as excavated from the trench such as free drainage coarse sand, gravel, loam and soil of a Friable nature may be suitable for use as side fill material, but they must be capable of being compacted sufficiently to provide adequate support for the pipe.

-Soils such as hard chalk which break up when wet, and clay should not be used immediately around the pipe for bedding, side fill or backfill, unless a rotary type excavator has been used.

-Granular material is very satisfactory as it requires little compaction once placed.



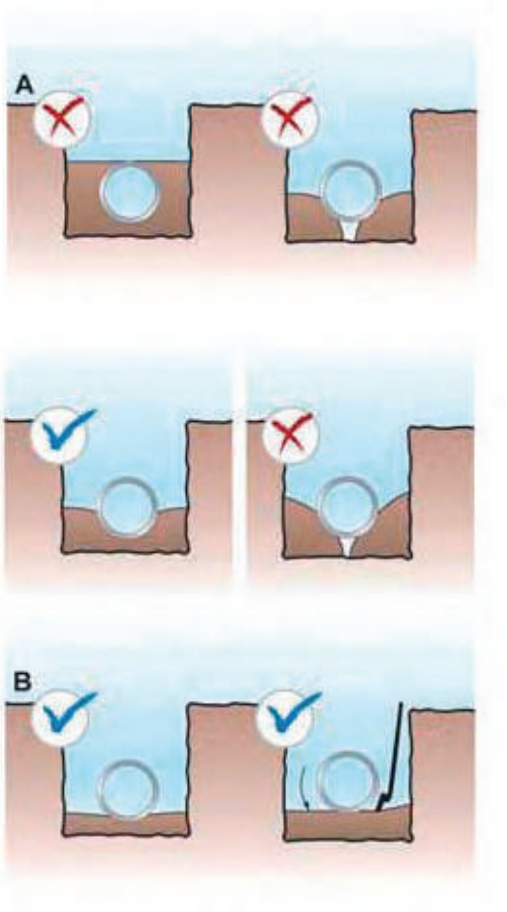

- With flexible pipes, it is very important that the side backfill is firmly compacted between the sides of the pipe and the soil sides in the trench. Any trench sheets must be partially retracted to allow this. Before backfilling, any levelling stakes or temporary fills should be removed. The bedding at the bottom of the pipe cylinder must be at least one-third of the diameter, and at least 100 mm thick. In all soft or wet conditions, or where the bottom of the trench is highly irregular, this thickness should be increased as necessary to give a suitable bed.

- The bedding should be thoroughly compacted in layers not more than 150 mm thick to give a uniform bed, true to gradient, on which the pipe may be laid. Pipes should be laid directly on this bedding. Bricks or other hard materials must not be placed under the pipes for temporary support. Further bedding material should be placed around the pipe and be thoroughly compacted in 75 mm layers by careful tamping up to the crown of the pipe, eliminating all cavities under the two lower quadrants of the pipe. The same material should then be placed over the crown of the pipe tor not less than 2/3 of the diameter, with a minimum height of 100 mm and a maximum of 300 mm and be thoroughly compacted. The process of Filling and tamping should proceed equally on either side of the pipe, so as to maintain an equal pressure on both sides.

## Backfilling:

The initial backfill should be placed by hand-shovel in layers not exceeding 100 mm deep.
Each layer should be well tamped round and under the pipeline. In this way air pockets are eliminated from beneath the pipe.

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




A) Too much soil is present and the tamping bar cannot compact it properly leaving a void underneath the pipe.

B) Shows the correct fill of a 100 mm layer of soil which can be compacted to form a firm bed for the pipe.

C) Pipe joints should be temporarily left exposed when placing the initial backfill, to enable pressure tests to be carried out after testing the line, backfilling and final filling may be completed.

## Minimum and Maximum Depths:

Under roads and verges or in open area ( uPVC pipes may be buried with a maximum cover depth of 6.1 meters. However, a minimum cover depth of 1.2 meters should be allowed when pipes are installed under roads). Tests have shown that traffic loads (wheel loads) do not affect pipes with this amount of cover depth provided they are properly installed and back-filled. At depths less than 1.2 meters, special consideration should be given to all the engineering factors involved, such as class of road, its construction and the position of other services. Under these circumstances, concrete may be used as a protecting raft above the pipeline, provided a cushion of fill is laid between the pipe crown and the raft.

In open area, where top loading is unlikely to occur, pipes may be laid with a minimum cover depth of 0.45 meters without any protection. At depths less than 0.45 meters, elsewhere than under roads, concrete slabs on a cushion of fill materials above the pipe should be used as a protection against picks, gardening implements.

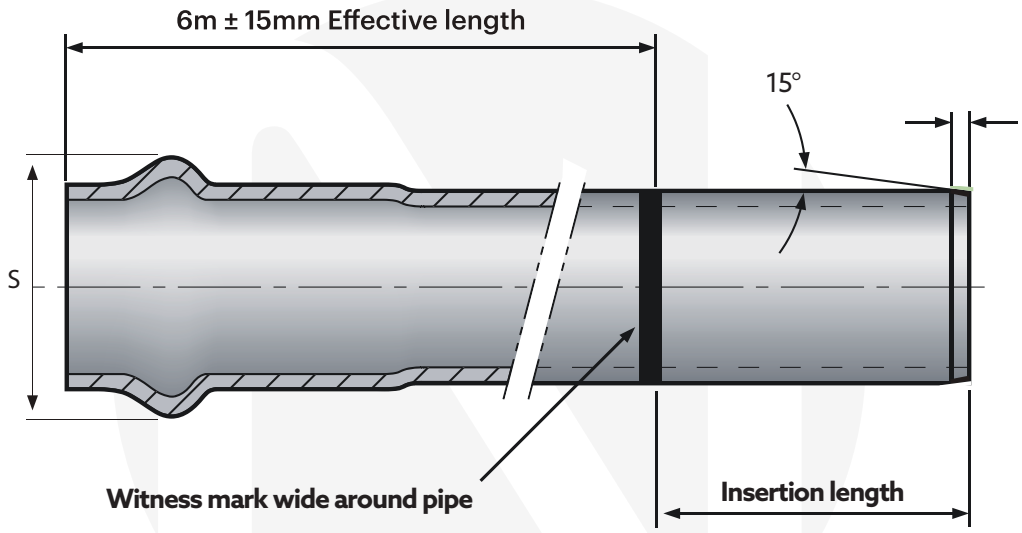
# Pipe Cutting and Chamfering

uPVC pipes may be easily cut on site using a fine-toothed handsaw or power driven circular masonry blade.

Pipe should be cut square. A simple method of cutting pipes square is to wrap paper around the pipe with no overlap of the edges. Mark line around pipe (use soft pencil, crayon or felt pen).

Remove any burrs, sharp edges and pipe shavings using a file or reaming tool. Failure to correctly deburr may prevent full pipe penetration and/or cause the detrimental accumulation of solvent cement at the back of the joint.

Ends cut should be chamfered at an angle of approximately 15° to about 1 /3 of the wall thickness with a coarse file, Surform tool or chamfering tool.




## Jointing Methods:

NALPLAST uPVC pipes and fittings may be joined using rubber ring joints or solvent cement joints.

## A) Solvent Cement Joints

## To achieve strong leak free joints, should:

1. Select the correct solvent cement and cleaner primer for the application.

2.Cleaner primer and solvent cement must be used together to achieve permanent leak-free joints.

3. Select the correct pipe and fitting.

4. Follow the recommended jointing steps shown below.

## Solvent Cement Welding Procedure:

1. Ensure the pipe and socket are clean and dry. Moisture contamination may lead to future joint failure.

2. Cleaner primer fluid must be used to clean and prime all surfaces, it is important to the jointing process.

3. Apply cleaner primer to the pipe and socket with a lint-free cloth (natural fibres) dampen the joint with priming fluid.

4. Apply solvent cement without delay after cleaning, using a flat clean brush. Apply an even unbroken layer brushing axially to the pipe end and socket mouth with a heavier layer on the pipe.

5. Apply a second full even coat to the pipe if required. Excessive solvent cement on the outer can easily be wiped away after assembly.

6. Ensure the entire surface is covered and are with cement before assembly. As solvents evaporate faster from the exposed pipe than from the socket. (a dry patch not lubricated by wet solvent, may prevent full insertion).

7. Immediately insert the pipe into the socket up to the entry mark, align pipe and socket. Hold in position for a few seconds, then wipe off excess cement (do not twist).

## After Jointing:

Do not move the joint for at least 10 - 15 minutes, allow 4 hours if the jointed pipe lengths are to be laid in a trench.

Do not fill the pipe with water for at least one hour after making the last joint. Allow the cement to fully cure before attempting any site hydrostatic testing. Joint curing normally takes at least 24 hours at 20° C. Allow up to 48 hours cure time if the temperature is less than 20° C.

## B) Seal (Rubber) Ring Joints

1. Ensure the inside of all pipes and fittings are completely free of dirt, sand, grease, and water before joint assembly begins.

2. Thoroughly wipe out, dry and clean the empty pipe socket .

3. Be sure the pipe spigot is correctly chamfered and has a clearly visible witness mark at the correct insertion depth.

4. Insert pipe into the socket without rubber ring place and mark pipe when it is fully inserted. Place seal in groove of socket ensuring that seal is correct way round.

5. Ensure that the rubber ring is dry and clean. Be sure there is no lubricant in the empty socket. With the fingers, form a heart shaped fold in the seal to reduce the ring diameter then place it in the ring groove. Install with the flap facing into the socket. Smooth firmly round the seal until it seats positively in the ring groove.

6. Apply jointing lubricant to the spigot, fully covering the circumference up to the witness mark, including the pipe chamfer and also to the inner flap of the rubber ring. Be sure there is no lubricant between the rubber ring outer surface and the rubber ring housing to prevent displacement of the rubber seal during joint assembly.

7. Be sure the pipe spigot and socket are axially aligned with one another. If joint deflection is required, do not deflect until after joint assembly is completed, Push the pipe firmly into the socket up to the insertion mark previously made. If an expansion gap is required the pipe is then pulled back by the desired amount.

## Hydraulic Test:

The purpose of testing a non-pressure pipeline is to ensure that the line has been correctly laid to line and grade and careful checking and adequate supervision will ensure that sewer lines are laid to line and grade.

Pipeline to be tested should be backfilled leaving all couplings and fittings exposed for inspection during testing. In solvent weld uPVC jointed non-pressure pipelines, at least 24 hours should have elapsed since the last joint was made before testing commissioning.

## Test Procedure:

Fill the pipeline to be tested, with water to a height of not less than 1 meter above the pipeline level at the highest point of the test section and not more than 3 meters at the lowest point of the test section. Maintain the pressure without leakage for at least 15 minutes. Locate the source of any leaks and repair any defects. Then retest the pipeline.

## Table No. 13:

**The following amount of lubricant is recommended to apply 100 joints.**

| Pipe outer nominal diameter DN | OD diameter(mm) | Adhesive(kg) | Primer(kg) |
|---|---|---|---|
| 25 | 25 | ≈0.8 | ≈0.5 |
| 32 | 40 | ≈1.1 | ≈0.7 |
| 40 | 50 | ≈1.6 | ≈0.9 |
| 50 | 63 | ≈1.7 | ≈1.7 |
| 60 | 75 | ≈2.2 | ≈1.3 |
| 80 | 90 | ≈4 | ≈1.4 |
| 100 | 110 | ≈8 | ≈1.7 |
| 125 | 125/140 | ≈13 | ≈2.1 |
| 150 | 160 | ≈19 | ≈2.5 |
| 200 | 200/225 | ≈26 | ≈4.5 |
| 250 | 280 | ≈38 | ≈6.5 |
| 300 | 315 | ≈52 | ≈10.2 |
| 400 | 400 | ≈62 | ≈12.9 |
| 450 | 450 | ≈69.75 | ≈14.4 |
| 500 | 500 | ≈77.5 | ≈16 |

## Water Hammer

Water Hammer is a term used to described the sudden increase in pressure created by quickly stopping, staring, or changing the direction of the flow of fluid in piping system, Typical action which cause water hammer are:

1. Quick closing a valve.
2. Quick opening a valve.
3. Starting pumps with an empty discharge line.
4. A high speed wall of liquid ( such as starting a pump) suddenly charges direction ( such as going through a90* elbow ).
5. Moving entrapped air through the system.

The pressure increase generated must be added to the fluid pressure already existing in the piping system to determine the total pressure the system must withstand.

CAUTION ! If water Hammer is not accounted for the sudden pressure surge could enough to burst the pipe or break the fitting or valve.

## Taking the following measures will help prevent problem

1. Keep fluid velocities under 5 feet per second.
2. Use actuated valves with controlled opening and clothing speeds.
3. Instruct operator of the manual valve on the proper opening and clothing speeds.
4.When starting a pump, partially close the valve in the discharge line of minimize the volume of liquid accelerating through the system. Fully open the valve after the line is completely filled.
5. Use check valve in the pipe line near the pump to keep the line full.
6. Use air relief valves to control the amount of air that is admitted or exhausted throughout the piping system.
7. Design the piping system so that the total pressure (operating plus water hammer surge) does not exceed the pressure rating of the lowest rated component in the system.

## How to use the Nomograph on the following page

1. Liquid velocity ( feet /seconds ), piping length ( feet ) and valve closing time (seconds ) must be known.
2. Place a straight edge on the liquid velocity in the pipe (line A) and the pipe line length ( line D ).
3. Mark intersection of the straight edge with pivot line ( line C ).
4. Place straight edge on mark just placed on pivot line (line C) and on valve closing for valve being used (line A ).
5. The intersection of the straight edge with the pressure increase line ( line B ) is the liquid momentum surge pressure (water hammer ).

# Friction loss:

Friction loss through PVC pipe is normally obtained by using the Hazen-Williams equation shown below for water:

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85 / d^4.8655)

where:
hf = head loss in feet in feet of water
L= length of pipe in feet
C = friction coefficient
gpm = gallons per minute (USA gallons not imperial gallons)
d = inside diameter of the pipe in inches

# Friction Loss Through Fittings

The friction loss through fittings is considered to be equivalent to the loss through a certain number of linear feet of pipe of the same diameter as the fittings. To determine the loss through a piping system, add together the number of "equivalent feet" Calculated for the fittings in system.The chart below shows approximate friction losses, in equivalent feet, for variety of Schedule 40 & 80 PVC fittings of different sizes.

## Table No. 14 : Approximate Friction Loss For PVC Fittings In Equivalent Feet of Straight Pipe

| Fitting | ½" | ¾" | 1" | 1¼" | 1½" | 2" | 2½" | 3" | 4" | 6" | 8" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tee(Run) | 1.0 | 1.4 | 1.7 | 2.3 | 2.7 | 4.3 | 5.1 | 6.2 | 8.3 | 12.5 | 16.5 |
| Tee(Branch) | 4.0 | 5.0 | 6.0 | 7.3 | 8.4 | 12.0 | 15.0 | 16.4 | 22.0 | 32.7 | 49.0 |
| 90° Elbow | 1.5 | 2.0 | 2.5 | 3.8 | 4.0 | 5.7 | 6.9 | 7.9 | 12.0 | 18.0 | 22.0 |
| 45° Elbow | .08 | 1.1 | 1.4 | 1.8 | 2.1 | 2.6 | 3.1 | 4.0 | 5.1 | 8.0 | 10.6 |
| Male/Female Adapter | 1.0 | 1.5 | 2.0 | 2.75 | 3.5 | 4.5 | 5.5 | 6.5 | 9.0 | 14.0 | ---- |

The table on page shows friction heads in feet and friction losses in psi for schedule 40 pipe. It also shows the gallons per minute (GPM) and velocities (in feet per second) for various pipe sizes.

# Combined External Load

## Table No. 15 :

| DEPTH | | EARTH LOAD | Wheel Load | Combined Load |
|---|---|---|---|---|
| cm | ft | Kg/vm2 | Kg/vm2 | Kg/vm2 |
| 30 | 1 | 0.0493 | 1.226 | 1.2753 |
| 60 | 2 | 0.0905 | 0.546 | 0.63365 |
| 90 | 3 | 0.1248 | 0.313 | 0.3478 |
| 120 | 4 | 0.1533 | 0.204 | 0.3573 |
| 150 | 5 | 0.1771 | 0.144 | 0.3211 |
| 180 | 6 | 0.1969 | 0.107 | 0.3039 |
| 210 | 7 | 0.2135 | 0.083 | 0.2965 |
| 240 | 8 | 0.2272 | 0.066 | 0.2932 |

The load of backfill acting upon a burried pipe is calculated formula of Master Anderon.

PE = Cd,VB
-2ktan?H/B

CD = I-e B
2ktan?

K = 1-sin?
1+sin?

Where PE = static earth load,kg/cm

V = specific weight of backfill
In kg/cm
(Normal Soil =0.0018kg/cm

H = depth of cover ,in cm

? = angle of repose of soil ,n deg.

B = width of trench,in cm.

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

Pt = 2w1(1+I)
(a+2H)(c+b+2H)

where

Pt = Wheel load, in kg/cm

I = impact coefficient (normally 0.3).

Wt = load per wheel ,in kg.

a = length of wheel in contact whith ground, in cm.

b = width of wheel in contact whith ground, in cm.

C = distance between wheels of two parallel trucks in cm.

H = depth of cover ,in cm

NALPLAST

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