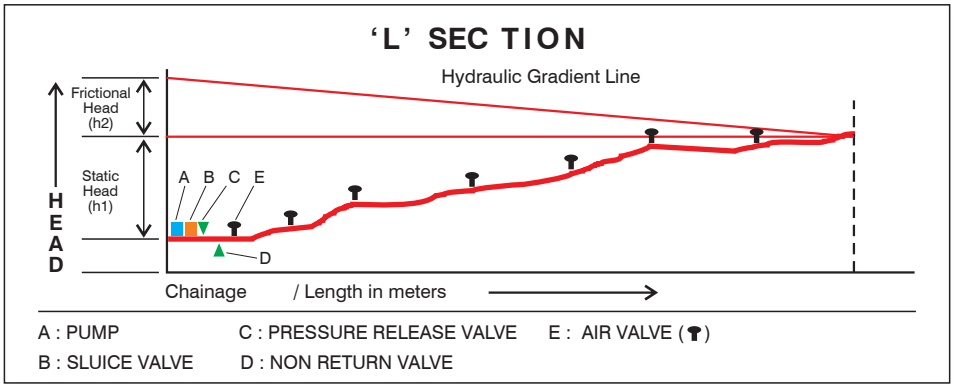
DESIGN ASPECTS OF A PVC-U PIPELINE*

BASIC PARAMETERS REQUIRED :



Discharge Required (Q) (lps) : This is the amount of water required for irrigating the fields & can be obtained by planning the crop pattern & frequency of irrigation.

Length of the Pipeline (L) (meters) : This is the total length of the pipe required from the source of water to the discharge point as shown in the 'L' section,

Static Head (h1) (meters) : This is the level difference between the lowest & the highest level of the pipeline as shown in the "L" section.

SELECTION OF PIPE DIAMETER :

For an optimum design, the velocity of the fluid passing through the pipe is taken as 1m/sec. Using the Flow chart available in Finolex Product Catalogue, select the pipe size at an intersection of velocity = 1m/sec & discharge Q in lps. For this pipe size also check the corresponding frictional losses (h2) from the flow chart. Alternatively the frictional losses can also be calculated by the Hazen Williams formula i.e. $V = 4.567 \times 10^{-3} \times C \times D^{0.63} \times S^{0.54}$ where

V - Velocity of the fluid flowing through the pipe.

C - Hazen Williams coeff for PVC = 150

D - Internal Diameter of the pipe.

S - Hydraulic Gradient.

SELECTION OF PRESSURE CLASS :

For selection of pressure class of a Pipeline, total head acting on the pipe at that particular point needs to be worked out as under :

Total Head (H) = h1 + h2 + 10% of (h1 + h2).

10% of (h1 + h2) is taken for losses in valves & fittings

Please note that the frictional losses calculated are in meters / km. & for total head this needs to be multiplied by the corresponding length.

On working out the total head, Pipe Pressure Class can be selected as below :

Total Head (Meters)	Pressure Class (kg / cm^2)
80 - 100	10
60 - 80	8
40 - 60	6
25 - 40	4
00 - 25	2.5

The principle, which is generally used, is that one kg/cm^2 is equal to 10 meters of water column.

PUMP SELECTION :

Pump can be selected by using the formula :

HP of pump = $Q \times H / 75 \times \eta$

where η = efficiency of the pump i.e. 65%.

On getting the Pump HP, Select the closest available model based on the manufacturers specification.

It is highly recommended to once again check the pressure class of the pipe by backward calculation upon selecting the pump.

WATER HAMMER :

Water hammer is a phenomenon caused due to change of velocity that arises due to various hydrodynamic effects. This gives rise to a series of pressure pulsation above and below the normal working pressure causing elastic deformation of both liquid and pipe.

The surge pressure is very heavy and can be several times the working pressure. Some automatic protection equipments are available to safe guard from the surge pressure. But considering the inherent property of PVC and the high modulus of elasticity, allowance for surge pressure can be very easily neglected for design calculations.

AIR VALVE SELECTION & INSTALLATION :

Pipe size and Pressure class selection is often found to be correct. But what is often neglected is the air valve installation and use.

Combination of air and water is very dangerous for PVC pipes. Air being compressible in nature, tends to accumulate in the pipeline, in case of non-functioning of air valves. This reacts by causing momentary change in localized velocity, which in turn generates high-localized pressure, which cannot be read on a conventional pressure gauge. To avoid this phenomenon, good quality air valves should be installed at all peak points in the pipeline with a distance of 300 to 400 meters between them.

Air valves are of two types : Single acting & double acting. As a general guideline, it is recommended that the size of the air valve be about 1/4th the diameter of pipe for the admission as well as release of air. (Refer manufacturers catalogue for installation and specification).

The function of an Air Valve is the same as that of a nose in a human body.

*** Note : It is recommended to use the services of a Design Engineer for designing pipeline.**

STORAGE AND TRENCH PREPARATION

HANDLING & STORAGE

The properties of PVC-U pipes differ from conventional metal pipes and it is important that these are taken into consideration to ensure satisfactory installation. PVC-U Pipes should be handled with due care to avoid damage to the surface and to the ends of the pipe. Dragging pipes along the ground should be strictly avoided.

PVC-U pipes should be loaded and unloaded by hand and use of skids/planks should be avoided. Lifting chains and hooks should be used carefully.

PVC-U pipes should be gently lowered onto the ground and stored on flat level ground free of sharp stones or objects. Stacking of pipes should be arranged as in Figure 'A'. Each layer of pipe must have the sockets protruding and alternate layers must have socket end and plain ends, to ensure that the pipes are supported throughout their whole length. Extra care must be taken to see that sockets of the bottom layer do not carry any load. This can be ensured by use of suitable wooden planks or blocks.

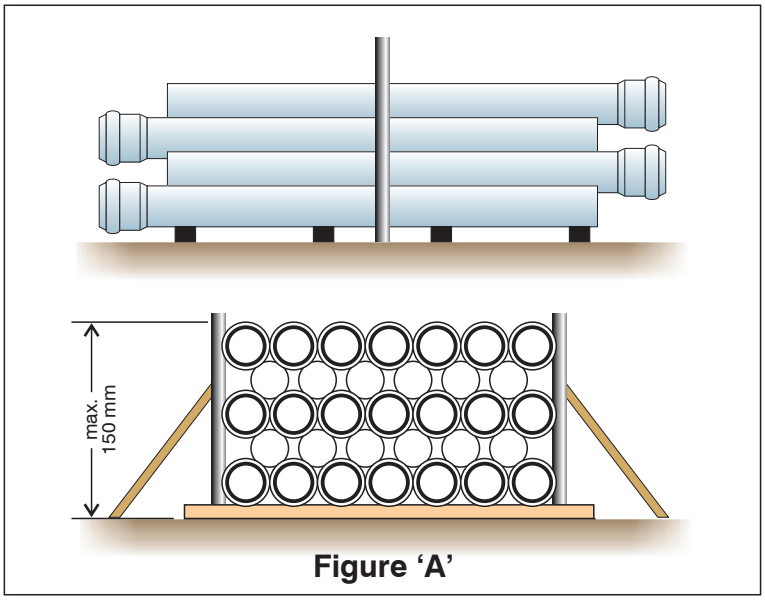


Figure 'A'

PVC-U Pipes should always be stored in shade and away from direct sunlight.

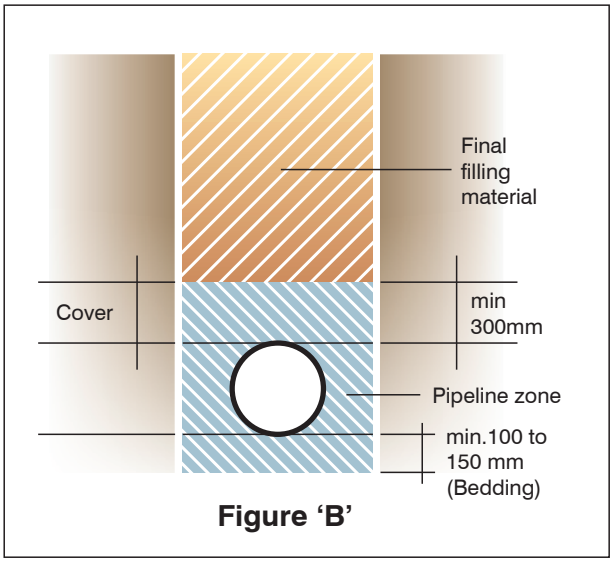


Figure 'B'

TRENCH PREPARATION

It is preferable that trenching should be done just ahead of the laying and joining of the pipeline. The width of the trench should be as narrow as possible, allowing enough room for joining, backfilling, etc. A trench width of 350 to 400 mm over the outside diameter of the pipe is found quite adequate.

Depth of the trench plays an important part in a good pipeline, and depends on the diameter of the pipe and also the minimum cover required. Ideally it should be 1 meter above the top of the pipe.

The trench should be provided with a proper bedding layer, which should be free of stones and other such objects. Proper and careful bedding of the pipeline will ensure a long service life for the entire system.

The various recommended dimensions for a good trench are shown in Figure 'B'.

REQUIREMENT OF PVC-U ADHESIVE FOR JOINTING

The following chart should be used as a guideline to determine your requirement :

Outside dia of pipe (mm)	20	25	32	40	50	63	75	90	110	140	160	200	225	250	280	315
Outside dia of pipe (inch)	½	¾	1	1¼	1½	2	2½	3	4	--	--	--	--	--	--	--
Approx. No. of Joints/kg. of Finolex Solvent Cement	350	300	250	200	150	125	103	79	54	36	27	15	12	09	07	05

For pipes of diameter 140 mm and above, the rubber ring 'Ringfit' system of jointing is recommended.