PVC PIPING

PVC used in piping – suspension or mass

Pipe grade

K value	64-66
Volatile contents	< 0.
VCM	< 10 ppm
Bulk Density	33- 35 lb / cub. Ft
Compact density	38 –40
Mean particle size	135 microns

Organo-Tin stabilisers used

Pb based

Typical PVC pipe formulation

PVC	100
Tin stab	0.4
Paraffin lubricant	1- 1.3
Oxidised polyethylene	0.2 – 0.25
Cal stearate	0.4-0.8
TiO2	1- 1.5
Acrylic Processing aid	0 – 1.5
Calcium Carbonate	

Manufacturing process

Dry blends in high speed blenders
Twin screw extruders are used

Advantages:

1. Positively transport the plastic melt, little back flow, residence time is less dependant on back pressure
2. Energy for gelation is supplied by oil heating of screws

3. Superior homogenisation – due to shearing between flights and to the calendaring effect of one screw against the other

Functions of twin screw

- Take maximum amount of power per screw rpm
- Transport, melt meter material into di
- Mix the material by calendaring
- Homogenize and melt the material by shearing h
- Homogenize the materials by creating slight back flow in some zones
- Compress material before venting zone
- Vent
- Create frictional heat

Manufacture

Extruder
Head and hot die
Cooled sizing sleeve
Water tank
Puller
Saw cutting and chamfering
Dump table
Belling machines

Die

A good die should rake into account he following design parameter

1. Generate sufficient pressure build up for final gelation of compound in the extruder
2. Produce sufficient pressure to weld the material behind the spider
3. Percentage of swell in the die which is a result of pressure an formulation

Dimensions and specifications

Irrigation pipes – (Iron pipe size (IPS) and PIP (Plastic Irrigation Pipe sizes)

IPS	DIE		Min. wall thickness (“”)
SDR 64	ID	OD	Thickness
6	6.625	6.417	0.104
12	12.750	12.352	0.199

PIPE DESIGN

Wall thickness and standard dimension ration

SDR = OD /t (Av. OD divided by min wall thickness)

$2S/P = SDR - 1 = OD/t - 1$
$P = 2S/(SDR - 1) = 2S/(OD/t - 1)$

P = WORKING PRESSURE
S = hydrostatic design stress (HDS)

HDS = Extrapolated 100,000 hours hoops stress / safety factor (2)

For 4" SDR 26

OD = 4.5, t = 0.173 HDS = 2000 psi
$P = 2 * 2000/(4.5/0.173 - 1) = 160$ psi

Design stress

Plastic materials show creep
At longer times the creep effect is insignificant ie. (> 100, 000 hours)

Design basis for PVC pipe is extrapolated to 100,000 hours hoop stress
Plotting hoop stress values – obtained from tests that last up to 10,000 hour against time on logarithmic scale.

Hoop stress – by ASTM D 1598.

Expansion and contraction

Expands and contracts as the temperature changes.. Cofft. Of linear expansion is 0.00036"/OD/F

When pipe is free to move without restraint the stresses produced by expansion and contraction will not affect the performance of the pipe

Water Hammer

Liquid in motion has kinetic energy. When stooped or chanted, the energy must be dissipated. This creates pressure surges which are called water hammer.