

PLASTIC PIPE - GENERAL

The plastic pipe products typically encountered for sewer and storm drain applications fall into 2 basic categories:

Thermoplastic - a plastic that repeatedly can be softened by heating, and hardened by cooling through a temperature range characteristic of the plastic, and that in the softened shape can be shaped into articles by molding or extrusion.

Thermosetting - a plastic that, after having been cured by heat or other means, is changed into a substantially infusible or insoluble product (i.e. non-reversible).

Thermoplastic pipe products are mainly poly vinyl chloride (PVC), polyethylene (PE), or acrylonitrile butadiene styrene (ABS).

The majority of sanitary sewers are PVC, while the majority of plastic culverts and storm drains are PE. ABS is occasionally used for sanitary sewers only.

PVC pipes are either white or colored depending upon the manufacturer. A typical color code for different applications are: blue for potable water and green for sanitary purposes. PE pipes are almost always black in color.

Polyethylene resins can be classified as low density PE (LDPE), medium density PE (MDPE), or high density PE (HDPE). Polyethylene pipes are always specified as high density polyethylene (HDPE).

Currently, most PVC pipes have a Pipe Stiffness (PS) of 46 psi or greater, while nearly all HDPE pipes have a Pipe Stiffness less than 46 psi (some as low as 2 psi).

The cross-section profile of these products vary from a uniform smooth (straight) solid wall section to a profile wall (solid, but having external projecting ribs) to various configurations of hollow wall construction from a uniform smooth (straight) interior and exterior to a uniform smooth interior and a profiled exterior.

The profile wall vs the smooth solid wall has been developed to economize on material cost, recognizing the ability of a given amount of material to carry load (resist bending) increases as a function of the distance that material is from its center of gravity (moment of inertia).

The short (initial) and long-term physical properties of plastics vary over a broad range.

For pipe products, the following values are from AASHTO Design Manual, Section 18, "Soil-Thermoplastic Pipe Interaction Systems":

Material	Initial		50 Year	
	Tensile Strength psi	Modulus Elasticity psi	Tensile Strength psi	Modulus Elasticity psi
Polyethylene - Smooth Wall	3,000 ¹	110,000	1,440 ¹	22,000
Polyethylene - Corrugated	3,000 ²	110,000	900 ²	22,000
Polyethylene - Ribbed	3,000 ³	80,000	1,125 ³	20,000
Poly Vinyl Chloride	7,000	400,000	3,700	140,000
Thermosetting	7,000 ⁴ 33,000 ⁴	1,400,000 ⁴ 2,400,000 ⁴	est. 80% of Initial	

1. Based on Hydrostatic Design Basis (HDB) resins rated at 1,600 psi.
2. Based on Hydrostatic Design Basis (HDB) resins rated at 1,000 psi.
3. Based on Hydrostatic Design Basis (HDB) resins rated at 1,250 psi.
4. Typical compressive strength is 14,000 psi. The physical properties can be varied to fit the application as a function of resin, glass and fill combinations.

Note that polyethylene long term values are approximately 80% less than initial values, and PVC long term values are approximately 65% less than initial values as determined by ASTM D 2837.