HDPE PROFILE WALL PIPE

MANUFACTURING METHOD

HDPE Profile is a high density polyethylene pipe produced in nominal sizes from 18 inch through 120 inch with an integral rubber gasket bell and spigot joint.

The pipe is typically produced by extruding a flat strip of polyethylene onto a rotating mandrel in spiral fashion. Adjacent strips overlap and are pressure joined while the strip is still hot. A second profile extrusion is then wrapped on the pipe wall shell while the shell is still hot. The spigot groove and bell face are machined after the pipe section has cooled and is removed from the mandrel.

QUALITY CONTROL

Quality problems have included poor joint tolerances, resulting in rubber gasket joints that either won't go together, or that leak and have to be polyethylene welded in the field after joining.

If the shell of the pipe cools too much before the profile section is extruded and wrapped, poor bonding results. In a few instances, this has caused the ribs or profile portion to separate from the shell after installation.

STRUCTURAL ASPECTS

The initial stiffness of this type of pipe is low, particularly in the larger sizes. For example, the initial stiffness of a 48 inch Class 40 Spirolite pipe is about 5 psi, compared to 46 psi for a SDR 35 smooth wall PVC pipe. The long-term (50 year) stiffness of typical HDPE pipe is about one-sixth of the initial stiffness. By contrast, PVC long-term strength drops to one-third of the initial stiffness. Due to the low initial stiffness and long-term property changes, excessive deflection and flat spots sometimes occur. Such deflection may seriously impair buckling strength.

FIELD DEPENDENT FACTORS

Due to the very low stiffness, the product is very dependent on proper (high) compaction of the backfill materials. Pipe performance often depends on the backfill to provide 98 to 99 percent of the strength of the installation, while the pipe provides only one or two percent or less. This places most of the burden of performance in the field on the contractor's installation methods and adequacy of field inspection. Poor site conditions, such as weak native soils and groundwater, further aggravate the problem.

HYDRAULIC FACTORS

Hydraulic factors are good to excellent with smooth walls and few joints. Laboratory clean water "n" values of 0.010 have been observed. Similar values for concrete pipe are 0.010. Field (design) values for sanitary sewer or storm drain should be the same as concrete pipe, 0.013 and 0.012 respectively, due to the effect of fittings, structures, bends, build-up on the pipe walls and deposition.

CORROSION RESISTANCE

HDPE is resistant to attack by most acids. Small diameter HDPE has been used for 15 to 20 years in the U.S. for natural gas pressure service and water service with few failures.

HDPE is subject to environmental stress cracking at high stress levels in the presence of detergents. High stress levels may be induced during installation when the pipe is deformed into a square or other shapes which include flat spots.

Gasoline or other hydrocarbons will be absorbed by HDPE and the material will soften and lose strength.

FIRE RESISTANCE

Like most thermoplastics, HDPE is flammable and will burn if a fire develops from gasoline spills or other sources of ignition.

JOINTS

Due to the high creep rate of HDPE, gasket pressures cause the bell to expand and the spigot to contract, reducing gasket pressure to the point that root intrusion or leaks may result. A secondary effect is an irregular flow line or offset at each joint.

CONCERNS OF AGENCIES

Low stiffness, both initial and long-term, particularly in the larger sizes, and the resulting dependence on field installation factors is a major concern. Some agencies limit the maximum diameter they will allow, while others have specified a high strength classification pipe to assure somewhat higher stiffness.

SPECIFICATION SUGGESTIONS

- Specify a minimum pipe stiffness of 46 psi per ASTM 2412.
- Require flushing of the line with clean water followed by TV or visual inspection. Standing water more than 1/2 inch deep is cause for rejection.
- Specify maximum allowable deflection of 3% at least 30 days after completion of backfill. Replace pipe having deflection greater than 3%.

- Require deflection testing using a nine point mandrel.
- Require trench width minimum of three diameters where native trench wall soil strength is equal to, or greater than, backfill material strength and five diameters where native soil is weaker than backfill material. (This is a U.S. Bureau of Reclamation requirement for flexible pipe).