

Rainstore3 - Issues Related to Resin “Creep”

For eight months prior to beginning construction of our first Rainstore3 injection mold, we worked closely with Stress Engineering to create the optimum structural design characteristics of the Rainstore3 form, including long term integrity and performance of the selected resins. For the best structural performance, chemical resistance, and lowest production (resulting in lowest market prices), we selected polyolefin resin materials – High Impact Copolymer Polypropylene and High Density Polyethylene.

Our major competitors in the stormwater storage market – steel and aluminum pipe and concrete pipe, have begun to notice our entry into the market and are raising the same “boogeymen” they raised when plastic pipe entered their realm – “Creep”. Creep is defined simply as: to slip or gradually shift position, or to change shape permanently from prolonged stress or exposure to high temperatures. All structural materials are subject to creep – some just react more slowly, or more gradually.

In the world of plastics, creep can be explained as a “relaxation” of the molecules when placed under stress, resulting in a loss of strength over time. The rate of such loss is variable depending upon the original shape, thickness, and nature of load applied. In the world of pipe, competitive pipe makers wanted to suggest that loads applied from the surface of soils above the pipe would eventually collapse plastic pipe by crushing the top. In actuality, most plastic storage pipe is thick-walled and corrugated (as is steel and aluminum pipe for the same reasons), and loads are applied against the pipe walls from more directions than just the top. As creep would apply to all of the resin molecules over time, and stress is applied from most all directions, the change of shape would be spread over the entire pipe surface – eliminating the likelihood of a single point of potential failure.

The rings of Rainstore3 receive loads much differently than pipe (any material), as loads are transferred longitudinally through the walls of the ring instead of against the perimeter edge of the pipe circumference. This is a tremendous structural advantage for Rainstore3.

In the case of the Rainstore3 product design, creep was designed into the part resulting in an optimal wall thickness of each ring where stacking layers nest into and bear against another layer’s surface, forming columns. Each ring has four tabs on the bottom of each ring that enters the top side of the layer below, extending about 1/2 inch inside the lower layer. These tabs act to prevent lateral movement of one layer relative to adjacent layers. Where the two (top and bottom) wall surfaces meet, the top layer rests directly upon the lower layer, resulting in a continuous “column” of rings to receive, bear and transfer loads from the surface of the chamber.

As long term creep occurs (expected over at least a fifty year period), it would take place uniformly through the entire structure – including the ring walls, tabs, and even the cross-bars between rings. The overall structure height may shrink 1 to 3% (depending upon continuous loads applied), but load bearing capacity will not be adversely affected.

A visit to the following websites may provide additional information to those with specific questions related to this subject::

< <http://www.cppa-info.org/abouthdpe.html>>

< <http://www.era.co.uk/techserv/pubs/p990323r.htm>>

The following statement is from the Corrugated Plastic Pipe Association website:

Will Corrugated Polyethylene Pipe Last?

High density polyethylene is one of the most chemically inert of all plastics, and therefore is extremely chemical and corrosion resistant. This gives corrugated polyethylene pipe a significant long-term strength advantage over concrete and metal pipe.

A study at California State University, Sacramento, proved that even though corrugated polyethylene had a significantly thinner wall than concrete, it was more abrasion resistant. And, corrugated polyethylene pipe lasted 45 percent longer than concrete under more aggressive conditions.

Polyethylene has demonstrated, through testing and actual application, that it will meet or exceed life service requirements for storm water drainage applications. A service life of 70+ years is projected in areas where corrugated polyethylene is specified.

Summary

Pipe is structurally weaker (in horizontal plane applications with loads applied to the wall circumference) than the Rainstore3 design. Long-term creep factors have been incorporated into the product design, and are less critical in structural performance due to the nature of our design than with pipe.

Please let us know if you have any further questions. Thank you.