

PVC PIPE ASSOCIATION TECHNICAL BRIEF

PVC PRESSURE PIPE: NO “LOSS OF STRENGTH” WITH TIME

There is a misperception among some in the pipe world that PVC pressure pipe “degrades over time” or “loses strength with time.” This is a result of lack of understanding of the material’s “regression line” or “life line.”

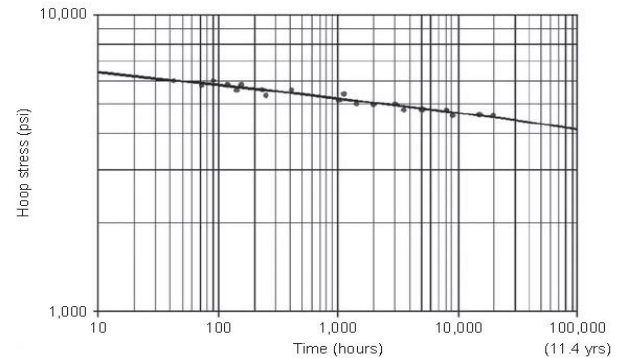
LIFE LINE

In the last few years there has been a move towards using “life line” rather than “regression line” as a title. “Life line” is certainly a better descriptor – it is more accurate and it avoids the negative connotations of the word “regression.”

REGRESSION LINE EXPLAINED

The regression line is developed by pressure testing pipe samples to failure. Testing is performed at different pressures that are designed to provide a specific set of failure times.

When these stress-versus-time points are plotted on traditional axes, the result is not particularly useful. However, when log-log axes are used, the result is a straight line that slopes downward as time increases – the so-called “regression line.”



Note that the line is a result of individual data points (the dots on the figure) – not from loss of strength of a pipe over time.

ASTM STANDARDS DEFINE STATISTICAL REQUIREMENTS FOR THE REGRESSION LINE

Development of the regression line is defined by ASTM standards. Testing for the stress-rupture data set is performed in accordance with ASTM D1598 “Standard Test Method for Time-to-Failure of Plastic Pipe under Constant Internal Pressure.” The test results are then analyzed per ASTM D2837 “Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Materials.” D2837 contains tight statistical requirements for the data – if these requirements are not met, the data set is not valid.

WHY THE DOWNWARD SLOPE?

Plastic materials (unlike traditional materials) have the ability to withstand higher short-term stresses than long-term stresses. For example, AWWA C900 DR18 pipe has a long-term rating (pressure class) of 235 psi, but a much higher short-term rating of 376 psi.

It is this property that gives the regression line its downward slope as time increases – not any loss of strength with time.

KEY TAKE-AWAYS

- The life-line is developed by testing individual pipe samples until failure.
- The line’s downward slope indicates different lifetimes for different internal pressures – shorter for high pressure, longer for low pressure.
- There is no loss of strength with time.
- For additional information, see section 5.3 of Uni-Bell’s *Handbook of PVC Pipe*.

References: ASTM D1598; ASTM D2837; *Handbook of PVC Pipe*, Uni-Bell