

Life Expectancy for Plastics Pipes

INTRODUCTION

Based on the use of 50-year stress regression data, it has been incorrectly assumed that plastics pipe systems have a life expectancy of 50 years. In reality, such systems can reasonably be expected to last 100 years or more.

PE and PVC pipes and fittings were introduced into Australia during the 1950's, mainly for water supply and irrigation, but also for fuel gas and industrial applications. The first Australian Standard for PE pressure pipes was ASK119-1962 and the first for PVC pressure pipes was ASK138-1963.

The creep rupture characteristics of these materials necessitated a new method for selection of design stress, compared with other materials in use at the time - AC, CI, GWI, etc. The method adopted was that already in use in Europe - using the creep rupture (stress regression) curve, select a time and establish the associated burst stress. Apply a design factor to the burst stress to give the design stress.

The time chosen was 50 years, already adopted in Europe, and is still in use today in AS/NZS, ISO, and CEN Standards. The use of this particular time interval has led to the misunderstanding that it represents the pipe life.

Similarly, the use of 50-year modulus values for use in ring deflection calculations for non-pressure pipes has also led to misunderstanding regarding life.

The following extract from WSA01-2004, Polyethylene Pipeline Code, explains why prediction of system life should not be based on the arbitrarily chosen time value.

PRESSURE

Selection of allowable stress is based on long term pressure testing in the laboratory and regression analysis applied to the data obtained. The 50-year point is arbitrarily chosen for this basis, as for all thermoplastics pipes. A factor is applied to the 50-year point in order to provide the design stress.

It shall not be taken that either:

(a) the pipes weaken with time; or (b) the predicted life is 50 years.

System life is dependent on many factors. If the design stress were used in relation to the regression curve, predicted pipe life would be indefinite, not 50 years. As with other materials, the life is dependent on manufacture, transport, handling, installation, operation, protection from third party damage and other external factors.

Provided that PE pipeline system components are appraised and supplied to nominated industry standards under third-party product certification systems, and provided pipelines are designed and constructed correctly, then the likelihood of failure is minimised. For correctly manufactured and installed systems, the actual life cannot be predicted, but can logically be expected to be well in excess of 100 years before major rehabilitation is required.

If a system life is to be assigned beyond 100 years, it has to be based on the likelihood of failure arising from the above factors, not the pipe regression curve. Pipe strength has been shown not to decrease with time-in fact, it increases slightly. "Instantaneous " burst pressure after a period in service will be at least equal to that of new pipe.

NON-PRESSURE

The life of non-pressure PE pipelines will be dependent on performance under four main conditions:

- (a) Soil mechanics and pipe mechanics stability.
- (b) Pipe material strength
- (c) Chemical and biological stability.
- (d) Functional stability.

The life of thermoplastic non-pressure pipeline systems has been extensively studied and reported. For example, the report titled *Plastics Pipes-How Long Can They Last*, by Prof Lars-Eric Janson of VBB Sweco Consulting Group reaffirmed a 1987 report concluding that the answer to the above question was "at least 100 years".

The latest report, produced in 1996, states that "...it has been clearly found that nothing has emerged, which contradicts the statement made in 1987." It also states that the report refers mainly to buried gravity sewer pipes, but the conclusions can in most cases be applied for pressure applications. The aim of the work was to verify the claim of "at least 100 years".

The summary states that "...one can thus conclude that everything is pointing to at least 100 years practical service life for today's buried sewer pipes made of high-quality virgin PVC-U and PE resins, on condition that the pipes are used in accordance with the prevalent national standard installation instructions."

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