



Rate Process Method for Projecting Performance of Polyethylene Piping Components TN-16/2008

Foreword

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The purpose of this technical note is to provide general information on use of an industry-accepted method (Rate Process Method) to evaluate performance of polyethylene pipe and fittings.

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RATE PROCESS METHOD FOR PROJECTING PERFORMANCE OF POLYETHYLENE PIPING COMPONENTS

1.0 Introduction

The PPI Hydrostatic Stress Board (HSB) conducted an extensive evaluation of various methods for forecasting the effective long-term performance of polyethylene (PE) thermoplastic piping materials. Basically, these methods require elevated temperature sustained pressure testing of pipe where the type of failure is of the slit or brittle-like mode. Details of this evaluation and conclusions are contained in reference 1.

As a result of this study, HSB determined that the three-coefficient rate process method (RPM) equation provided the best correlation between calculated long-term performance projections and known field performance of several PE piping materials. It also had the best probability for extrapolation of data based on the statistical “lack of fit” test.

The Rate Process Method (RPM), which was developed out of this study, was incorporated in two ASTM standards. ASTM D 2837 (2) added a “validation” requirement for PE piping materials, and ASTM D 2513 (3) added a validation requirement for the pipe producer. Since some high performance PE materials do not exhibit SCG (slit or brittle-like failure) under elevated temperature testing, the RPM method can not be applied to these materials for the established validation methods. The ASTM standard test method for determining chlorine resistance of PEX tubing, ASTM F 2023 (4), uses the Rate Process Method for its projected performance calculations.

Provided that the RPM method is applied to materials that demonstrate SCG (slit or brittle-like failure) resin and pipe producers, as well as end-users, may apply RPM calculations to make relative judgments on specific materials and/or piping products. One example has been to use the RPM to estimate projected life of SCG-susceptible PE pipe exhumed from buried service. Projections from the Rate Process Method for this exhumed PE gas pipe were shown to have very good correlation with actual field failures from three gas companies (5). These projections are based on the primary load, which is the internal pressure. RPM can also be used to determine the effects of secondary loads such as indentation (rock impingement), bending, deflection or squeeze-off.

Another example is projected performance of polyethylene fittings as discussed in references 6 and 7. Because fittings have different geometries, different failure modes may be observed at different test conditions. The three RPM coefficients from each fitting will be different; again, this is due to their different geometries.