



PE Compound Categorization for Potable Water Applications

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PE COMPOUND CATEGORIZATION FOR POTABLE WATER APPLICATIONS

In potable water applications, an oxidative environment can exist due to the continuous presence of disinfectant residuals in water. Accordingly, the PE pipe industry developed a testing methodology and criteria to categorize the performance of PE pipe compounds for potable water applications. This document is only intended to be used for categorization of PE compounds with respect to oxidative stability in this specific environment and is not directly applicable for any other purpose.

The categorization of PE pipe compounds can be used in conjunction with other industry documents which should provide design guidance for long-term service life under the expected service conditions. ASTM F2263-07 (2011) forms the basis of the qualification testing. PE compounds shall be evaluated for resistance to oxidative degradation by one of the following test methods:

- Method 1: Full ASTM F2263 testing
- Method 2: Single point validation testing.

Method 1: Full ASTM F2263 Testing

A PE compound can be evaluated using ASTM F2263 as the basis for evaluation. Testing shall be conducted on ¾" CTS tubing or smaller. Once testing to ASTM F2263 has been completed at multiple temperatures and stress levels, a regression analysis shall be performed in accordance with the requirements of ASTM F2263. Using the results of the regression analysis, calculate the time corresponding to 90°C and 360 psi. Compare the value obtained for time to the minimum required values from Table 1 to establish the category for the PE compound.

Table 1: PE Compound Categorization Requirements, Method 1

Categorization	Minimum calculated time, h
Category 1 (CC1)	8,100
Category 2 (CC2)	3,700
Category 3 (CC3)	1,350

Method 2: Single Point Validation (SPV) Testing

A single point test method for ensuring minimum performance levels of PE compounds for potable water applications is an alternative to full ASTM F2263 testing. The methodology uses the Jana Mode 3 Shift Functions in an approach analogous to the Popelar Shift Function¹ for the forecast of Stage II performance of PE pipe compounds. The theory behind the Jana Mode 3 Shift Functions can be found in Jana JP916².

Accelerated testing at a single temperature/stress condition is conducted in general accordance with ASTM F2263 with the following modifications:

1. Not less than six (6) test specimens shall be tested at 90°C and one stress chosen from Table 2.
2. Testing shall be conducted on 4" DR 11 IPS pipe meeting the dimensional requirements of ASTM D3035.³

3. The flow rate shall be established such that the average ORP of the test fluid exiting the test specimens remains above 825 mV.
4. The external test environment shall be either air or non-chlorinated water.
5. All failures shall be included, and non-failures may be included, in the calculation of the log average time except as provided by item 7.
6. If non-mode 3 failures occur such that the log average time is below the minimum requirement in Table 2, testing may be conducted at a lower stress from Table 2.
7. If one specimen fails due to defective test apparatus, sample preparation or other test procedure related anomaly, then log average testing time of the remaining five specimens shall be used for compound categorization. Data from not less than five specimens is required for compound categorization.
8. The compound shall be categorized according to Table 2 using log average time and the corresponding test stress.

Based on these modifications to ASTM F2263 and the application of the Jana Mode 3 Shift Functions, the minimum log average test times required for PE compound categorization are presented in Table 2. The required test times are presented at three different test stresses. Testing is only required at one stress level. The range of test stresses provides some flexibility to optimize the testing conditions based on the PE compound and an option to test at higher stresses to reduce testing time.

Table 2: PE Compound Categorization Requirements, Method 2

Categorization	Test Stress, psi		
	360	400	450
	Minimum Log Average Test Time, h		
Category 1 (CC1)	16,200	11,100	7,400
Category 2 (CC2)	7,400	5,100	3,400
Category 3 (CC3)	2,700	1,900	1,200

¹C. H. Popelar, *A Comparison of the Rate Process Method and the Bidirectional Shifting Method*, in *Thirteenth Plastic Fuel Gas Pipe Conference Symposium*. 1993. p. 151.

²Jana Technical Report, JP 916, *Jana Mode 3 Shift Functions- Alternate Test Methodology for Assessing PE Compound Performance in Potable Water Applications*, www.janalab.com, March 2012.

³ Testing of thinner walled pipe is also acceptable for compound categorization but will be treated as if the wall thickness had complied with the dimensional requirements of this section. An effect of pipe size has been observed in PE chlorine resistance testing with test times increasing with increasing pipe size.