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 performance under the expected service conditions. ASTM F2263[1] is the standard test method that forms the basis of the qualification testing and Section 6.8 of ASTM D3350[2] is the standard specification that defines the oxidative resistance classification (e.g., CC0, CC1, CC2, CC3). PE compounds shall be evaluated for resistance to oxidative degradation by the following test method:

Single Point Validation (SPV) Testing

The methodology uses the Jana Mode 3 Shift Functions in an approach analogous to the Popelar Shift Function[3] 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 JP916[4].

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 1.
2. Testing shall be conducted on 4” DR 11 IPS pipe meeting the dimensional requirements of ASTM D3035.
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 1, testing may be conducted at a lower stress from Table 1.
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 1using 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 1. 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 1: PE Compound Categorization Requirements

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

[1] *ASTM F2263, Standard Test Method for Evaluating the Oxidative Resistance of Polyethylene (PE) Pipe to Chlorinated Water, West Conshohocken, PA*

[2] *ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials, West Conshohocken, PA*

[3] C. 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.

[4] Jana 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.