

SAE Inc. Standard No. 102

Freeze-Thaw Withstand of Latex-Based Products

ABSTRACT

This test method is used to evaluate the freeze-thaw withstand of SAE's latex-based products when exposed to varying water and salt-water exposure. The largest factors in freeze-thaw behavior of a material are the freeze-thaw rate and exposure to water. Samples were subjected to 90 freeze-thaw cycles, which equates to 30 years of exposure to an extreme environment.

1. INTRODUCTION

- 1.1 This test method was developed using "Masonry: Research, Application, and Problems" a publication by John Conway and John Grogan which compiled papers from the fourth masonry symposium held in December of 1983.
- 1.2 One of the papers in the publication, "Durability of Brick Masonry: A Review of the Literature" by Clayford Grimm stated that a realistic freeze-thaw test method includes subjecting samples to 90 freeze-thaw cycles, which equates to 30 years of exposure to an extreme environment.
- 1.3 Grimm also suggests in his paper that three freeze-thaw cycles is the equivalent of one year of natural weathering.
- 1.4 This test method evaluates the freeze-thaw withstand of latex-based products with varying water and salt-water exposure.
- 1.5 The largest factors in freeze-thaw behavior include freeze-thaw rate and exposure to water.

2. EQUIPMENT REQUIRED

- 2.1 Electronic balance accurate to 1 g
- 2.2 Band saw
- 2.3 Multimeter
- 2.4 Infrared thermometer
- 2.5 Freezer

3. SAMPLE PREPARATION

- 3.1 Prepare the latex-based product for testing (i.e., ConduDisc, ConduFlow, etc.) and pour into a 4"x8" grey test cylinder coated with a thin layer of petroleum jelly, which will act as a mold release agent.
- 3.2 After one week remove the test sample from the cylinder and wipe the surface of the sample with mineral spirits to remove any excess petroleum jelly, which will inhibit the cure.
- 3.3 Allow the sample to cure for an additional three weeks, four weeks total.
- 3.4 Using the band saw trim both ends of the test sample so that the surface is smooth and flat.
- 3.5 Then use the band saw to cut the cylinders into sections approximately 1" thick.
- 3.6 Next, cut the sections along their diameter, resulting in half-disc samples approximately 2" in diameter and 1" thick.
- 3.7 Label the samples accordingly.

4. TEST SETUP

- 4.1 Initial measurements
 - 4.1.1 Weigh each half-disc sample using an electronic balance accurate to +/- 1 g.
 - 4.1.2 Record the temperature of each sample using a laser temperature gun.
 - 4.1.3 Using a multimeter set to the 200 Ω setting measure of resistance of each sample.
 - 4.1.4 Record any notes about the initial conditions/appearance of each sample.
- 4.2 For each material to be tested
 - 4.2.1 Two samples are to remain dry throughout the experiment
 - 4.2.2 Two samples are to be "wet", soaked in water once thawed and removed from the water prior to each freeze cycle
 - 4.2.3 Two samples are to be completely submerged in freshwater
 - 4.2.4 Two samples are to be completely submerged in saltwater

5. PROCEDURE

- 5.1 After the initial measurements of the individual samples are recorded the "wet" samples are placed into a plastic container and enough freshwater is added to completely cover the samples.
- 5.2 The samples to be submerged in freshwater are placed into a plastic container and enough freshwater is added to completely cover the samples. The mass of the system (container, water and samples) is recorded.

- 5.3 The samples to be submerged in saltwater are placed into a plastic container and enough saltwater (a solution of 3% sodium chloride by mass) is added to completely cover the samples. The mass of the system (container, water and samples) is recorded.
- 5.4 The samples are left to soak for 6-7 hours then the “wet” samples are removed from their container and the surface of each sample is dried.
- 5.5 All of the samples are placed into the freezer for approximately 16 hours (overnight).
- 5.6 In the morning the samples are removed from the freezer and the mass, temperature and resistance of the dry and “wet” samples are recorded. The mass and temperature of the system for the submerged samples is recorded. Record notes about any physical or electrical changes to any of the samples
- 5.7 All of the samples are allowed to thaw for approximately 24 hours.
- 5.8 After the 24 hour thaw the mass, temperature and resistance of the dry and “wet” samples are recorded. The wet samples are placed into their respective containers of fresh water. For the submerged samples the mass of the system is recorded, then each sample is removed from the container, the surface is dried, and the mass, temperature and resistance is recorded then each sample is placed back into their respective container. Record notes about any physical or electrical changes to any of the samples.
- 5.9 After 6-7 hours the “wet” samples are removed from the containers, and all of the samples are placed back into the freezer.
- 5.10 The above is considered one cycle (one freeze period and one thaw period).
- 5.11 Testing continues until 90 cycles, roughly equivalent to 30 years in-situ, have been completed.
- 5.12 If the samples experience physical or electrical failure prior to reaching 90 cycles, then the test will be stopped when this occurs.
- 5.13 A report will be written to analyze the trends seen in the product during the 90 freeze-thaw cycles.

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