



Test for Cure State of Elastomers

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This procedure is used to evaluate the state of cure of elastomer materials by determining the equilibrium percent weight change in toluene. It is recommended that this procedure not be used with fluorocarbon based elastomers or any other materials which swell <25% upon exposure to toluene.

Note: This test procedure has limited utility in detecting under cured conditions in used elastomeric components which have seen significant heat exposure during use.

1.2 Applicability. Elastomeric materials.

1.3 Remarks. None.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D471

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. Material laboratory.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Analytical balance.

3.2.2 Covered glass container.

3.2.3 Vacuum oven.

3.2.4 Reagent-Grade toluene.

3.2.5 Stainless steel wire.

3.2.6 Glass beads.

3.2.7 Weighing bottles.

3.3 Test Vehicle/Test Piece. See 4.3.

3.4 Test Time. Reference the lab test procedures in Section 4 for timing details.

3.5 Test Required Information. See 5.3.

3.6 Personnel/Skills. Per laboratory accreditation requirements.

4 Procedure

4.1 Preparation.

4.1.1 Prepare five (5) volume change test specimens. If removing specimens from an elastomer component, care must be taken to ensure that only elastomeric portions of the component are taken. If the specimens are taken from a hose, take specimens from the cover stock, taking care not to include reinforcement fiber in the specimen. Mark the test specimens for identification with a punch.

Note: This test procedure has limited utility in detecting under cured conditions in used elastomeric components which have seen significant heat exposure during use.

4.1.2 Weigh each specimen, in grams, to four (4) decimal places. For each specimen, this weight determination will be called the "Original Weight".

4.1.3 String specimens on stainless steel wire, separated by glass beads according to ASTM D471. Place the specimens in a glass container and fill with reagent-grade toluene sufficient to cover the specimens with at least 3 cm to spare. Maintain the ambient temperature of the container to $23\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ during the test.

4.1.4 Keep specimens immersed in the toluene for seven (7) days, during which the toluene will be changed every day.

4.1.5 After seven (7) days of toluene immersion, begin measuring specimen weights every 72 h, changing the toluene immediately after a specimen weight determination has been made.

4.2 Conditions.

4.2.1 Environmental Conditions. See 4.3.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 To measure the weight of a specimen, quickly remove the specimens from the wire and place in fresh toluene. Weigh a weighing bottle, in grams, to four (4) decimal places. Remove the specimen from the toluene, blot it, and drop it into the weighing bottle and seal, all within 10 s to prevent any further weight loss due to evaporation. Weigh the bottle with the specimen inside and record the difference in weight. This difference in weight will be called the "Swollen Weight". Return the specimen to the fresh toluene. When all specimens have been weighed, rapidly restring on the wire as before and place into fresh toluene.

4.3.2 Continue determinations of the "Swollen Weight" at 72 h intervals until three (3) determinations have been made on each specimen. After three (3) determinations have been made, calculate the; Average Swollen Weight, Swollen Weight Variance, and Swollen Weight Coefficient of Variation for each specimen per the formula in Appendix A, Table A3. If each Swollen Weight Coefficient of Variation is <0.001 for each of the five (5) specimens, continue with 4.3.3. If any of the Swollen Weight Coefficient of Variation is >0.001 , continue making determinations of Swollen Weight at 72 h intervals as before. After each determination, recalculate the Average Swollen Weight, Swollen Weight Variance and Swollen Weight Coefficient of Variation using the last three (3) determinations of Swollen Weight of each specimen, until the Swollen Weight Coefficient of Variation is <0.001 for each specimen. When the Swollen Weight Coefficient of Variation is <0.001 , continue with 4.3.3.

4.3.3 After the Swollen Weight Coefficient of Variation calculated is <0.001 , average the last three (3) values recorded for Swollen Weight of each specimen. This will be that specimen's "Equilibrium Swollen Weight".

4.4 After recording the Equilibrium Swollen Weight, air-dry the specimens in a hood for 24 h, and then dry the specimens in a vacuum oven at $100\text{ }^{\circ}\text{C}$ to constant weight. Weigh the specimens every 24 h. This weight will be called the "Dry Weight". After three (3) determinations of the Dry Weight, calculate the Average Dry Weight, Dry Weight Variance, and Dry Weight Coefficient of Variation for each specimen per the formula in Appendix A, Table A3. If the Dry Weight Coefficient of Variation (COV) is <0.001 , continue with 5.1.

4.4.1 If the Dry Weight Coefficient of Variation for each specimen is greater >0.001 , continue drying the specimens in the vacuum oven at $100\text{ }^{\circ}\text{C}$ and weighing the specimens every 24 h. After each weight determination, use the last three (3) values determined for Dry Weight, to determine the Dry Weight Coefficient of Variation per the formula in Appendix A, Table A3. Continue until the Dry Weight Coefficient of Variation is <0.001 . When the Dry Weight Coefficient of Variation for each specimen is <0.001 , continue with 5.1.