



Preparation of Acid Rain Solution

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 standard covers the procedure for making the acid rain solution used in GMW14701, Resistance of Coatings to Chemical Etching and Distortion.

1.2 Applicability. Acid rain solution used in GMW14701.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ASTM D1193

2.2 GM Standards/Specifications.

GMW14701

2.3 Additional References. None.

3 Resources

3.1 Facilities.

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 Balance capable of measuring to 0.01 g.

3.2.2 Volumetric flasks, 300 ml and 1000 ml.

3.2.3 Ice bath.

3.2.4 Standardized pH meter.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. As required to make the acid rain solution.

3.5 Test Required Information. See 5.2.

3.6 Personnel/Skills. Test Technician capable of measuring and using required chemicals.

3.7 Materials.

3.7.1 Concentrated sulfuric acid, 95% to 98% concentration. All acids shall be reagent grade.

3.7.2 Concentrated nitric acid, 70% to 72% concentration. All acids shall be reagent grade.

3.7.3 Concentrated hydrochloric acid, 35% to 40% concentration. All acids shall be reagent grade.

3.7.4 Degassed, distilled, deionized water (ASTM D1193, Type IV).

3.8 Formulas.

3.8.1 The one (1) N acid stock solution should be 0.62 N Sulfuric Acid (H_2SO_4); 0.32 N Nitric Acid (HNO_3); 0.06 N Hydrochloric Acid (HCl). See Table 1 for acid characteristics.

Table 1: Acid Characteristics

Name	Molecular Weight (g/mole)	Equivalent Weight (g/equivalent)	Concentration Range Percent (%)
Sulfuric Acid	98	49	95 to 98
Nitric Acid	63	63	70 to 72
Hydrochloric Acid	36.5	36.5	35 to 40

3.8.2 Calculation of Weight of Concentrated Acid for Mixture (g):

$$\text{Acid Weight (g)} = \frac{\text{Equivalent Weight}}{\% \text{ Concentration}} \times \text{Normality of Acid in Acid Rain}$$

4 Procedure

4.1 Preparation of a One (1) N Acid Stock Solution.

4.1.1 To 300 mL of degassed, distilled, deionized water in a 1000 mL volumetric flask, slowly add the specified grams of sulfuric acid. In order to minimize heating, the volumetric flask should be surrounded by ice (ice bath). The flask should be swirled during the addition.

4.1.2 Allow the contents to cool.

4.1.3 Follow steps 4.1.1 and 4.1.2 for the nitric acid and hydrochloric acid.

4.1.4 Add the distilled water to within 50 mL of the mark. Remove the flask from the ice bath and allow the contents to return to room temperature. Dilute to volume. This makes a solution of approximately pH 0.

4.1.5 Obtain higher pH solutions by standard dilution of this stock solution. The final pH can be adjusted to exactly the desired value with either Two (2) N HCl or One (1) N Sodium Hydroxide (NaOH). Table 2 shows sample dilutions.

Table 2: Sample Dilutions

Starting pH	mL of Starting pH	Final Volume	Final pH
0	10	100	1
0	10	1000	2
2	10	100	3
2	10	1000	4
3	10	100	4

4.1.6 Verify that the pH is properly adjusted on a calibrated pH meter.

4.2 Conditions.

4.2.1 Environmental Conditions. Environment suitable for making acid rain solution.

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.