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AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Glycerin Solutions[1]

This standard is issued under the fixed designation D 5032; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes a method for obtaining constant relative humidity ranging from 30 to 98 % at temperatures ranging from 0 to 70°C in relatively small containers by means of an aqueous glycerin solution.

1.2 This practice is applicable for closed systems such as environmental conditioning containers.

1.3 This practice is not recommended for the generation of continuous (flowing) streams of constant humidity unless precautionary criteria are followed to ensure source stability.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 4023 Terminology Relating to Humidity Measurements[3]

E 104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions[3]

2.2 *Other Documents:*

DIN50008 "Konstantklimate uber wasserigen Losungen" (Constant Climates Over Aqueous Solutions)

Part 1: Saturated Salt and Glycerol Solutions

Part 2: Sulfuric Acid Solutions (1981)[4]

3. Summary of Practice

3.1 Controlled relative humidity environments are generated using mixtures of glycerin and water.

3.2 Practice E 104 contains methods for maintaining constant relative humidity environments using aqueous saturated salt solutions or various strength sulfuric acid-water systems.

4. Significance and Use

4.1 Controlled relative humidity environments are important for conditioning materials for shelf-life studies or for investigating the change in physical or dielectric properties after exposure.

4.2 The use of aqueous-glycerin solutions reduces the possibility of contamination of the materials or corrosion of electrode systems which would be more likely to result from saturated salt or acid water solutions.

4.3 Applicable material specifications should state the exposure conditions, including time, temperature and relative humidity, that a material should be subjected to before subsequent testing. Typical conditions are given in Practice D 618.

5. Apparatus

5.1 *Container*, airtight, of a material not acted upon by copper sulfate (or with the glycerin solution contained in a tray made of a material not acted upon by copper sulfate).

5.2 *Refractometer*, covering the range of 1.33 to 1.47 (sodium) with an accuracy of 0.0003.

6. Glycerin Solution

6.1 Use a good industrial grade of glycerin ("high gravity" and "dynamite" grades are satisfactory) in distilled water. Calculate the concentration in terms of the refractive index, (R), at 25°C for the desired relative humidity at any temperature between 0 and 70°C as follows:

$$R = \left(\sqrt{(100 + A)^2 + A^2 - (H + A)^2} - A\right)\frac{1}{715.3} + 1.3333 \quad (1)$$

where:

T = temperature of the solution, °C,
A = $25.60 - 0.1950T + 0.0008T^2$, and
H = relative humidity, percent.

6.1.1 This will give the desired relative humidity with an accuracy of ±0.2 % at a constant temperature of 25°C. At other constant temperatures, the error, if any, may increase with the deviation of the temperature from 25°C. The relative humidity values at 0, 25, 50 and 70°C for a number of refractive index values are given in Table 1. Obtain the refractive index for intermediate values of relative humidity and temperature by plotting curves from the values in the table or by calculating from the above formula.

[1] This practice is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

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[2] *Annual Book of ASTM Standards*, Vols 08.01 and 10.01.

[3] *Annual Book of ASTM Standards*, Vol 11.03.

[4] Available from *Deutsches Institut fur Normung*, 4-10 *Burggrenzenstrasse Postfach* 1107, D-1000 Berlin, Federal Republic of Germany. Also available from American National Standards Institute, Publication Office, 1430 Broadway, New York, NY 10018.