



Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Glycerin Solutions¹

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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:*²

D618 Practice for Conditioning Plastics for Testing

D4023 Terminology Relating to Humidity Measurements³

E104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions

2.2 *Other Documents:*

DIN50008 Constant Climates Over Aqueous Solutions⁴

Part 1: Saturated Salt and Glycerol Solutions

Part 2: Sulfuric Acid Solutions (1981)

3. Summary of Practice

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

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

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from *Deutsches Institut für Normung*, 4-10 Burggrabenstrasse Postfach 1107, D-1000 Berlin, Germany. Also available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036..

3.2 Practice E104 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 D618.

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