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**Glassware - Test Method for Freezing Resistance of Glass
Containers**

玻璃仪器 玻璃容器耐冷冻性试验方法

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Table of Contents

Foreword	3
1 Scope	4
2 Normative References	4
3 Terms and Definitions	4
4 Principle	4
5 Reagents or Materials	5
6 Instruments and Equipment	5
7 Samples	6
8 Test Procedures	6
9 Test Report	7

Glassware - Test Method for Freezing Resistance of Glass Containers

1 Scope

This document describes the test method for the freezing resistance of glass containers.

This document is applicable to the test of the freezing resistance of glass containers in the glassware field.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 6682 Water for Analytical Laboratory Use - Specification and Test Methods

GB/T 35599 Laboratory Glass and Glassware Outward Defect Terms

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 temperature uniformity

Temperature uniformity refers to the maximum value of the temperature difference between the central point of the water bath kettle (or water bath) and the operating space of the cryogenic test equipment and any other point in the operating space.

3.2 temperature fluctuations

Temperature fluctuations refer to the temperature variation of any point in the water bath kettle (or water bath) and the operating space of the cryogenic test equipment within a certain period of time.

4 Principle

Place the sample in a low-temperature environment and maintain for a certain period of time. Then, take the sample out and place it in an environment at room temperature or a certain

NOTE: the total volume of test samples refers to the sum of the volumes of all samples when each sample is regarded as a solid body.

6.2 Cryogenic Test Equipment

The cryogenic test equipment shall comply with the following requirements:

- Temperature adjustment: the temperature of the freezing chamber can be adjusted to $-50\text{ }^{\circ}\text{C}$ or at least $5\text{ }^{\circ}\text{C}$ lower than the test temperature;
- The temperature accuracy shall not be lower than $0.1\text{ }^{\circ}\text{C}$, and the temperature uniformity shall not exceed $\pm 2\text{ }^{\circ}\text{C}$;
- The temperature fluctuations shall satisfy that the temperature fluctuations at any point in the operating space of the cryogenic test equipment are within $\pm 2\text{ }^{\circ}\text{C}$.

7 Samples

7.1 The surface of the test samples shall be free from obvious glass defects and dirt, and without other debris.

7.2 The outer surface of the samples shall be dry.

8 Test Procedures

8.1 Sample Preparation

8.1.1 Conduct the inspection in accordance with the stipulations of GB/T 35599. Select samples without obvious glass defects as the test samples. When inspecting the appearance of the samples, gloves shall be worn to avoid touching the samples directly with hands.

8.1.2 Remove the dirt or other debris on the samples, and let them stand at room temperature for more than 30 min.

8.2 Gradient Freezing Method

8.2.1 Inject $1/3 \sim 1/2$ nominal volume of the test water (5.2) into each sample; the outer surface of the samples shall maintain dry. Put the samples containing the test water into the sample box (5.1), and maintain the samples upright and separated from each other to avoid mutual collision.

8.2.2 Put the samples, together with the sample box, into the freezing chamber of the cryogenic test equipment (6.2), and start cooling. Firstly, lower the temperature of the freezing chamber to $-20\text{ }^{\circ}\text{C}$, control the temperature of the freezing chamber within $-20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, and maintain for 2 h. Then, continue to cool, adjust the temperature of the freezing chamber to the test temperature, control the temperature fluctuations within $\pm 2\text{ }^{\circ}\text{C}$, and maintain for 22 h or the specified time.

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