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**General Requirements for Polyethylene Terephthalate (PET)
Bottle for Drinks**

聚对苯二甲酸乙二醇酯（PET）饮品瓶通用技术要求

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General Requirements for Polyethylene Terephthalate (PET) Bottle for Drinks

1 Scope

This Document specifies the terms and definitions, product classification, requirements, test methods, inspection rules and marking, packaging, transportation and storage of polyethylene terephthalate (PET) bottle for drinks.

This Document applies to the bottle for drinks taking polyethylene terephthalate as the main raw materials through injection molding, stretching and blow molding, etc.

This Document does not address safety requirements related to food contact materials.

2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

GB/T 2828.1-2012 Sampling Procedures for Inspection by Attribute - Part1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-Lot Inspection

GB/T 2918 Plastics - Standard Atmospheres for Conditioning and Testing

GB/T 16288 Marking of Plastics Products

3 Terms and Definitions

For the purposes of this Document, the following terms and definitions apply.

3.1 Bottle for drinks

The bottle that is used for filling liquid dairy products, packaged drinking water, fruit and vegetable juices and their beverages, protein beverages, carbonated beverages, special-purpose beverages, flavored beverages, tea (type) beverages, coffee (type) beverages, vegetable beverages, and other beverages, etc.

3.2 Fill point

A point at a certain distance from the surface of the bottle mouth to the design liquid level.

3.3 Hot filling bottle

The bottle for drinks whose filling temperature is greater than or equal to 65°C.

3.4 Cold filling bottle

The bottle for drinks whose filling temperature is less than 65°C.

3.5 Carbonated bottle for drinks

The bottle for drinks whose internal pressure is greater than or equal to 0.243MPa after filling at (23 ± 2) °C.

3.6 Non-carbonated bottle for drinks

The bottle for drinks whose internal pressure is less than 0.243MPa after filling at (23 ± 2) °C.

4 Product Classification

4.1 According to the filling process, it is divided into cold filling bottle and hot filling bottle.

4.2 According to product characteristics, it is divided into carbonated bottle for drinks and non-carbonated bottle for drinks.

4.3 According to the sealing method, it is divided into cap-sealed bottle for drink and bottle for drinks sealed by other methods.

5 Requirements

The appearance shall comply with the provisions of Table 1. The schematic diagram of each part can refer to Figure 1.

Take 6 sample bottles; and place them in the environment of $(23 \pm 2) ^\circ\text{C}$ for more than 2h. Inject the bottle with carbonated water solution with a temperature of $(23 \pm 2) ^\circ\text{C}$ and a carbon dioxide content of $(0.80 \pm 0.02) \%$ (mass fraction) (equivalent to 4.0 ± 0.1 times the volume, see Appendix B for the preparation method) to the fill point. Quickly sealed with a cap, and place horizontally at $(23 \pm 2) ^\circ\text{C}$ for 4 h to observe whether there is liquid leakage from the bottle mouth.

Only the capped bottle for drinks are required; and the bottle for drinks sealed by other methods is not required.

6.5.1.2 Non-carbonated bottle for drinks

Hot filling bottle: Take 6 sample bottles; place them in an environment of $(23 \pm 2) ^\circ\text{C}$ for more than 2h; and pour water with a temperature of (design filling temperature of drinks $\pm 1 ^\circ\text{C}$) into the bottles to the fill point; and then quickly use cap to seal the bottle; place it horizontally for 30s and vertically for 120s; then put it in a water tank to cool it to room temperature; and place it horizontally at $(23 \pm 2) ^\circ\text{C}$ for 4h to observe whether there is liquid leakage from the bottle mouth.

Cold filling bottle: Take 6 sample bottles; place them in an environment of $(23 \pm 2) ^\circ\text{C}$ for more than 2h; pour water at a temperature of $(23 \pm 2) ^\circ\text{C}$ into the bottles to the fill point; and then quickly seal them with bottle caps. Place it horizontally for 4h at $(23 \pm 2) ^\circ\text{C}$; and observe whether there is liquid leakage from the bottle mouth.

Only the capped bottle for drinks is required; and the bottle for drinks sealed by other methods is not required.

6.5.2 Vertical load pressure

6.5.2.1 Vertical load pressure of empty bottle (carbonated bottle for drinks)

Take 6 empty bottles (unused); place them at $(23 \pm 2) ^\circ\text{C}$ for more than 2h; place them vertically on the pressure testing machine; and apply vertical pressure to the sample bottles at a constant speed of 100mm/min; and record the maximum load within the deformation range of 5% of the bottle height, accurate to 1N; calculate the arithmetic mean of the measurement results.

6.5.2.2 Vertical load pressure after filling (non-carbonated bottle for drinks)

Take 6 bottles for drinks (commercially available or filled under normal conditions) filled with beverages and sealed with caps; place them vertically on the pressure testing machine; and apply vertical pressure to the sample bottles at a constant speed of 50mm/min. Record the maximum load within the deformation range of 5% of the bottle height, accurate to 1N; and calculate the arithmetic mean of the measurement results.

6.5.3 Falling performance

6.5.3.1 Carbonated bottle for drinks

Take 6 sample bottles and inject into the bottles the carbonated water solution at a temperature of $(23 \pm 2)^\circ\text{C}$ and a carbon dioxide content of $(0.80 \pm 0.02)\%$ (mass fraction) (equivalent to 4.0 ± 0.1 times the volume, see Appendix B for the preparation method) to the fill point; and quickly cover with cap. In which 3 samples are placed in an environment of $(4 \pm 1)^\circ\text{C}$ for 24h; and the other 3 samples are placed in an environment of $(23 \pm 2)^\circ\text{C}$ for 24h. Then put the sample bottle at a height of 1.2m; make the bottle perpendicular to the ground; and freely fall to the concrete floor with the bottom of the bottle facing downwards; check the cracking situation of the bottle and whether the bottle can stand stably.

6.5.3.2 Non-carbonated bottle for drinks

Hot filling bottle: Take 6 sample bottles; pour water at a temperature of (the design filling temperature of the beverage $\pm 1^\circ\text{C}$) into the bottle to the fill point; then quickly seal it with the bottle cap; put it horizontally for 30s, vertically for 120s; and then put it into the water tank to use cold water to cool off to the room temperature; in which 3 samples are placed in an environment of $(4 \pm 1)^\circ\text{C}$ for 24h; and the other 3 samples are placed in an environment of $(23 \pm 2)^\circ\text{C}$ for 24h. Then put the sample bottle at a height of 1.2m; make the bottle perpendicular to the ground; and freely fall to the concrete floor with the bottom of the bottle facing downwards; check the cracking situation of the bottle and whether the bottle can stand stably.

Cold filling bottle: Take 6 sample bottles; pour water at a temperature of $(23 \pm 2)^\circ\text{C}$ into the bottle to the fill point; and then quickly seal with the bottle cap; in which 3 samples are placed in an environment of $(4 \pm 1)^\circ\text{C}$ for 24h; and the other 3 samples are placed at $(23 \pm 2)^\circ\text{C}$ for 24h. Then put the sample bottle at a height of 1.2m; make the bottle perpendicular to the ground; and freely fall to the concrete floor with the bottom of the bottle facing downwards; check the cracking situation of the bottle and whether the bottle can stand stably.

6.5.4 Internal pressure resistance of carbonated drink bottles

Take 6 sample bottles; fill the bottles with water at a temperature of $(23 \pm 2)^\circ\text{C}$ until the mouth is full; under the condition of protective devices, pressurize to 0.68MPa within 10s; hold for 13s; and observe whether the bottles are broken.

6.6 Thermal stability

Take 6 carbonated bottles for drinks as sample bottles; mark the bottles; and inject into the bottles with carbonated water solution at a temperature of $(23 \pm 2)^\circ\text{C}$ and a carbon dioxide content of $(0.80 \pm 0.02)\%$ (mass fraction) (equivalent to 4.0 ± 0.1 times the volume, the preparation method can refer to Appendix B) to the fill point; and then quickly sealed with a bottle cap. The sample is placed at $(23 \pm 2)^\circ\text{C}$ for 1h; and the total height h_3 of the edge of the bottle cap (including the bottle cap is measured together) is measured. After placing at a constant temperature of $(38 \pm 1)^\circ\text{C}$ for 24h, take out the measuring bottle height h_4 (including the bottle cap to measure together); the change rate of height is calculated according to Formula (5); and check whether the bottle is broken and standing stable.

$$X_h = \frac{h_4 - h_3}{h_3} \times 100\% \quad \dots\dots\dots (5)$$

Where:

X_h – change rate of height;

h_4 – height of sample bottle after test, in mm;

h_3 – height of sample bottle before test, in mm.

6.7 Thermal resistance

6.7.1 Change rate of capacity

Take 6 hot filling bottles as sample bottle; respectively weigh the mass of the empty bottle and fill them with water until the mouth is full. Weigh the mass of the empty bottle and water, and accurate to 0.1 g; and then measure the water temperature; and calculate the capacity of full mouth before filling hot water according to Formula (2). Empty the water; inject (the design filling temperature of the beverage $\pm 1^\circ\text{C}$) hot water to the fill point; then quickly seal the cap; place it horizontally for 30s; and place it vertically for 120s; and then put it in the water tank to cool it to room temperature and then empty it. Then fill the water at room temperature to the full mouth, respectively. Weigh the mass of empty bottle and the water, accurate to 0.1g. Measure the water temperature again; and calculate the capacity of full mouth after injecting hot water according to Formula (2). Calculate the change rate of capacity according to Formula (6).

$$X_v = \frac{V_4 - V_3}{V_3} \times 100\% \quad \dots\dots\dots (6)$$

Where:

X_v – change rate of capacity;

V_4 – capacity of full mouth after filling hot water, in mL;

V_3 – capacity of full mouth before filling hot water, in mL.

6.7.2 Change rate of height and appearance

Take 6 hot filling bottles as sample bottles; measure the height of the bottles; and then inject (design filling temperature of beverages $\pm 1^\circ\text{C}$) hot water into the bottles to the fill point; quickly seal the caps; place horizontally for 30s, vertically for 120s. And then place it into the water tank to use cold water to cool off to the room temperature; observe whether the bottle is stable, whether there is shrinkage or deformation of the bottle body; empty and measure the height of the bottle; and calculate the change rate of height according to Formula (7).

7.4.2 Determination of qualified batches

If all the inspected items are qualified, the quality of the batch is judged to conform to this Document; otherwise, the quality of the batch is judged to be inconsistent with this Document.

8 Marking, Packaging, Transportation, Storage

8.1 Marking

The product marking shall meet the requirements of GB/T 16288; and the packing box or paper tray shall have the following contents: product name, type, this Document number, capacity, height, bottle mouth dimension, filling temperature, trademark, batch number, production date, qualified certificate, manufacturer's full name and factory address, quantity, packaging box dimensions (length $\times$ width $\times$ height), transportation and storage marks.

8.2 Packaging

The packaging can be stored in cartons, trays or other packaging methods, which shall ensure that the products are not damaged or contaminated by foreign objects during transportation and storage.

8.3 Transportation

In the process of handling, loading and unloading, and transportation, it is necessary to prevent impact, extrusion, heavy pressure, and fall; and prevent sunlight and rain; as well as do not mix and transport with toxic, harmful, corrosive, volatile or odorous substances.

8.4 Storage

It shall be stored in a ventilated, cool, dry, chemical-free, harmless, and poison-free warehouse. It shall not be stacked in the open air; protect from sunlight and rain; and shall not be in direct contact with wet ground.

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