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P-810.22.300 [2025-07] Glass bottles, Internal pressure resistance

Internal pressure resistance | Ramp Pressure Tester

Application/Purpose

Internal pressure resistance is an important characteristic for a glass bottle's stability.

Short-term pressures occur primarily during filling (including during pre-pressurisation). This also includes the internal pressure loads that occur during pasteurisation. Long-term pressures refer to the internal pressure load during storage and transport, depending on the CO2 content and temperature. They represent the maximum internal pressure load after shaking at 35 °C.

Internal pressure resistance is defined as the indicated burst pressure reduced by 0.1 bar.

Translated with DeepL.com (free version)

Scope of Application

All glass bottles (disposable and returnable bottles, various nominal volumes).

Principle

Attribute Test

In the attribute test, the internal pressure is increased to a specified value, and the number of broken bottles is determined.

The internal pressure in the water-filled bottle is increased at a rate of 4 ± 1 bar/s until the specified pressure is reached, and then maintained at that level for 1 minute. The broken bottles are counted.

Variable Test

In the variable test, the internal pressure is increased in stages until the bottle breaks, and the average of the pressure levels reached by all bottles is calculated. This procedure provides information about the average internal pressure resistance and the variation in the measured values.

The internal pressure in the bottle filled with water is increased in 1-bar increments until the bottle breaks. At each stage, the pressure is maintained at a constant level for 1 minute. The number of bottles that break at each pressure stage is counted.

Links

DIN 51220 Material Testing Machines — General Requirements for Material Testing Machines and for Their Testing and Calibration

DIN EN ISO 7458 Glass Containers — Internal Pressure Resistance — Test Method

Special Technical Terms and Conditions of Delivery and Purchase (STLB) for Glass Beer Bottles, German Brewers' Association (Deutscher Brauer-Bund e. V.), Berlin

Apparatus

Internal Pressure Tester, e.g., AGR Ramp Pressure Tester

Important: The clamping device must be designed so that pressure forces are applied exclusively to the bottle finish; furthermore, the internal pressure tester must be equipped with a splinter guard.

Reagents

Water

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Procedure

Pre-treatment

Fill bottles to the brim with water at room temperature

Attribute Test

Clamp the filled bottles into the testing device just below the mouth so that they hang freely or stand freely on the floor, supported only by their own weight

After closing the shatter protection device, increase the pressure at a rate of 4 ± 1 bar/s until the specified test pressure is reached

If the bottle does not burst, maintain the pressure constant for 60 ± 1 s

Then relieve the pressure in the bottle at a rate equal to the rate of pressure increase

Count broken bottles, including those that broke only when the pressure was released

According to STLB for beer bottles, the test is conducted on 80 bottles

Other agreements may specify a different sample size

Variable Test

Clamp filled bottles below the neck into the testing device so that they hang freely

After closing the shatter protection device, increase the pressure in increments of 1 bar at a rate of 4 ± 1 bar/s until the bottles break

Maintain the pressure at a constant level for 60 ± 1 s at each stage

According to STLB Beer Bottles, the test is performed on 37 bottles

Other agreements may specify a different sample size

Calculation

Variable Test

For all bottles, the following must be calculated based on the pressure levels (individual readings) at which the bottles broke:

Mean value: $\bar{x} = \frac{1}{n} \times \sum_{i=1}^{n} x_i$

Standard deviation: $s = \sqrt{\frac{1}{n-1} \times \sum_{i=1}^{n} (x_i - \bar{x})^2}$

x_i = Individual readings
n = Number of individual readings

Internal pressure resistance is defined as the indicated burst pressure reduced by 0.1 bar.

Results

Attribute Test

Number of broken bottles.

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Variable Test

In bar, with one decimal place.

Precision

Variable Test

s = ± 0,5 bar

Remarks

Test Report and Evaluation

The requirements are met if the two values for $\bar{x}$ and s simultaneously satisfy the following inequality:

$\bar{x} - k \times s \geq T_U$

with k = 1,893.

Excerpt – Sample

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