ABMI
Association of the Beverage Machinery Industry

Method sheet: Filler – Filling volume accuracy
Sheet no.: 050102 – 1.02
Date: June 2008

Machine: **Filler**
Criteria: **Filling volume accuracy (volumetric system with a template), related to the nominal fill level**

Contents:

Filling volume accuracy (volumetric system with a template), related to the nominal fill level.

1. Definition: Machine and Criteria

An important parameter of a filling machine is the accuracy of the filling volume. The filling volume can be measured by gauging the contents of the filled package with a template. For all actions the relevant safety instructions must be strictly adhered to.

Further related documents:

- DIN 6129 – 1
- EBC Analytica # 11.3.2
- MEBAK Band V # 3.4.19
- DIN 6129 – 2
- German Finished Package Regulation (‘Fertigpackungsverordnung’)

2. Inspection

2.1 Scope

Detection of the filling volume in filled packages by means of a template. This method can only be applied to bottles manufactured as measuring containers. The bottles are produced in accordance with DIN 6129-1. Therefore the volume of the contents can be accurately measured by using a graduated template. When the template is placed in a vertical position over the unopened bottle, the volume of the contents and the distance from the sealing surface to the meniscus can be measured.

These systems may not be used for warranty issues!

2.2 Apparatus

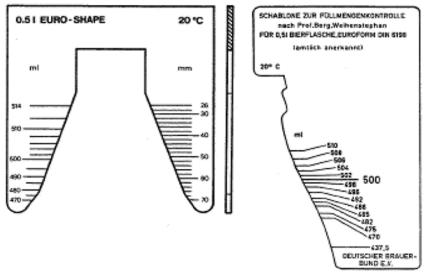


Fig 01: Template according to Dr. Berg
Permission granted by EBC.

2.3. Procedure

Place the template in a vertical position on the top of the cap of the unopened bottle and note the results on the following data sheet. Use only the right template for the specified bottle.

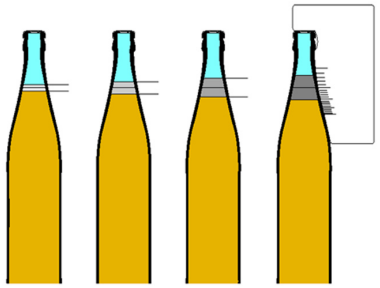


Fig. 02: Measuring with a template

3. Sampling

To check the filling quality, samples of filled packages are needed. Samples have to be taken after 15 minutes of production in standard operation and at nominal capacity.
Quantity of sample bottles: Quantity of 1 filler round, maximum 100 bottles.
Before measuring the foam has to turn to liquid and the temperature should be 20°C.

3.1. Calculation

Standard Deviation:
The standard deviation σ is the most commonly used measuring unit in statistics for the statistical spread of results, i.e. for deviations of x_i all individual values around an average $\bar{x}$ expectancy value. The estimate of the standard deviation serves as proof of the warranted value and is calculated from a random sample with an amount of n and shows the statistical spread around the average $\bar{x}$ of the random sample:

Average of the results from measuring the fill level:

$$\overline{x} = \frac{1}{n} \cdot \sum_{i=1}^{n} x_i$$

Standard deviation:

$$\sigma = \sqrt{\frac{1}{n-1} \cdot \sum_{i=1}^{n} (x_i - \overline{x})^2}$$

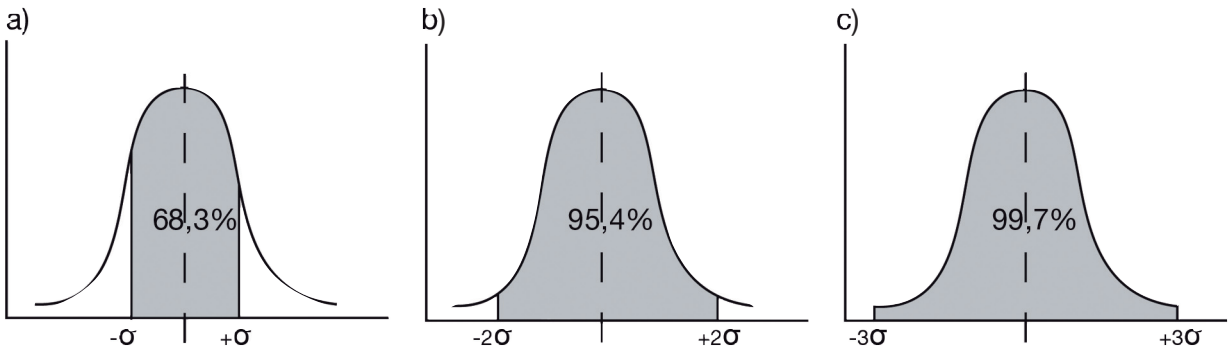
Where the random sample ranges from i = 1 to n (here: n=100)

Example of a fill level warranty:

Fill level warranty σ = 1.5 mm means:

a) 68.3% of the values in the batch are approx. $\overline{x} \pm 1\ \sigma = \overline{x} \pm 1.5$ mm
b) 95.4% of the values in the batch are approx. $\overline{x} \pm 2\ \sigma = \overline{x} \pm 3.0$ mm (95.4 - 68.3 = 27.1%)
c) 99.7% of the values in the batch are approx. $\overline{x} \pm 3\ \sigma = \overline{x} \pm 4.5$ mm (99.7 - 95.4 = 4.3%).

Assuming that the individual figures are distributed normally, which might not necessarily be the case.



3.2 Results and data sheets

3.2.1 Data sheet

Date: _____ Site: _____ Line: _____
Product: _____ Filling temperature: _____ °C

Fill in the results from measuring the filling volume in millilitres [ml] read from the template.

Number n:	x_i [ml]	Number n:	x_i [ml]	Number n:	x_i [ml]	Number n:	x_i [ml]
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	
25		50		75		100	

Average of the results $\bar{x}$: _____ ml Standard devision $\sigma_{current}$: _____ ml

4. Evaluation and Documentation

4.1 Evaluation

$$\sigma_{current} \leq \sigma_{set}$$

The filling volume accuracy is correct when the standard deviation fulfils the criteria of the following inequality:

$$\_\_\_\_\_ml = \sigma_{current} \leq \sigma_{set} = \_\_\_\_\_ml$$

4.2 Documentation

The filling volume accuracy is correct when the standard deviation fulfils the criteria of the following inequality:

$\sigma_{current} \leq \sigma_{set}$	Filling volume accuracy is o.k.	☐
$\sigma_{current} \geq \sigma_{set}$	Filling volume accuracy is not o.k.	☐

Name and signature of inspector: _____