ABMI
Association of the Beverage Machinery Industry

Method sheet: Filler – Filling level accuracy
Sheet no.: 050103 – 1.01
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Machine: **Filler**
Criteria: **Filling level accuracy (by means of a sliding calliper), related to the nominal fill level**

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Filling level accuracy (by means of a sliding calliper), related to the nominal fill level

1. Definition: Machine and Criteria

An important parameter of a probe filling machine is the accuracy of the fill level. The fill level can be measured by means of a sliding calliper.
For all actions the relevant safety instructions must be strictly adhered to.

Further related documents:

- Analytica-EBC
- MEBAK V

2. Inspection

2.1 Scope

Detection of the fill level in filled packages by means of a sliding calliper.

2.2 Apparatus

The recommended accuracy of measurement instruments is ± 0.1mm.
A visual inspection of the used measurement devices by a person is necessary.

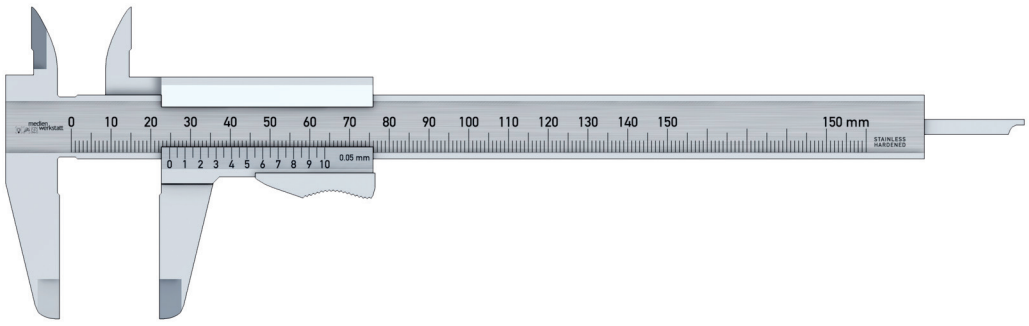


Fig. 01: Sliding calliper

2.3 Procedure

When the calliper is placed in a vertical position over the bottle, the distance from the bottle neck to the fluid meniscus in the bottle can be measured. In this case, the content of the bottles is lost. Especially for crown corked bottles, when a higher measuring fault is accepted, the bottles can be measured unopened.

3. Sampling

To check the filling quality, samples of filled packages are needed. Samples to be taken after 15 minutes of production in standard operation at nominal capacity.
Quantity of sample bottles: Quantity of one filler round, maximum 100 bottles.
Before measurement 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:

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

Standard deviation:

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

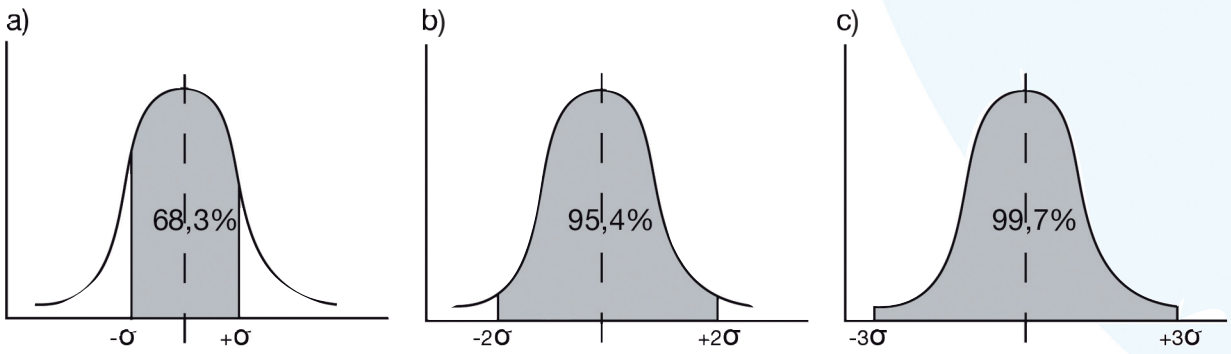
Where the random sample ranges from i = 1 to n (here: n = 100).

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

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

Fill in the results from measuring the filling volume in millimeters [mm] read from the cap.

Number n:	x_i [mm]	Number n:	x_i [mm]	Number n:	x_i [mm]	Number n:	x_i [mm]
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	

3.2.2 Data sheet part (II/II)

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

4. Evaluation and Documentation

4.1 Evaluation

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

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

4.2 Documentation

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

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

Name and signature of inspector: _____