**Perpendicularity of blown bottles (for hot fill and refill or special use)**

## 1. Definition: Machine and Criteria

One important parameter of bottles blow by a blow moulder is the axis deviation of blown bottles. The perpendicularity can be detected by means of a marking gauge.
For all actions the relevant safety instructions must be strictly adhered to.

**Further related documents:**

- MEBAK Band V
- TNO Nutrition and Food Research: Guidelines for an Industrial Code for Refillable PET Bottles, Edition 1, 1993-1994

## 2. Inspection

### 2.1 Scope

Detection of axis deviation (Perpendicularity) of empty and filled (carbonated) bottles by measuring the maximal deviation from the axis on the pilfer-proof ring.

### 2.2 Apparatus

Marking gauge with a recommended accuracy of ± 0,01 mm or indicating calliper, with a recommended accuracy of ± 0,01 mm.
Bench vice, to fix the bottom of the bottle during the measuring.
Better and easier to use is a calibrated optical measurement system.
Visual inspection of measurement device used by a person.

2.3 Procedure

Measurement of the axis deviation of blown bottles. The deviation is measured at the maximum outer diameter of the sealing ring.
The Perpendicularity depends on the nominal filling volume of the bottle.
The bottles have to be fixed in the bench vice and turn around over 360° or use the automatic device as described in the users manual. The maximum deviation is to be noted in the form bellow.
This applies only to refill and hotfill bottles or in the case of a special request by the customer.

## 3. Sampling

To check if the blown bottles are inside of the specification, samples need to be taken from each station.

Samples to be taken at nominal machine speed, after stabilization of process, suggested start of sampling after minimum 15 minutes.

Take five complete rounds, i.e. 5 bottles of each station.

3.1 Calculation

Calculate the average $\bar{x}$ of the results following the formula:

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

Calculate the resulting standard deviation $\sigma$ following the formula:

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

Where the random sample range from i=1 to n (here 5)

## 3.2 Results and data sheets

### 3.2.1 Data sheet part (I/II)

Date: _____ Line: _____ Bottle shape: _____

Preform weight: _____ Nominal volume: _____ Miscellaneous: _____

### 3.2.2 Data sheet part (II/II)

| Number n: | deviation max [mm] | deviation max [mm] | deviation max [mm] | deviation max [mm] | deviation max [mm] |
|---|---|---|---|---|---|
| | sample 1 | sample 2 | sample 3 | sample 4 | sample 5 |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | |
| 28 | | | | | |

| Number n: | deviation max [mm] sample 1 | deviation max [mm] sample 2 | deviation max [mm] sample 3 | deviation max [mm] sample 4 | deviation max [mm] sample 5 |
|---|---|---|---|---|---|
| 29 | | | | | |
| 30 | | | | | |
| 31 | | | | | |
| 32 | | | | | |
| 33 | | | | | |
| 34 | | | | | |
| 35 | | | | | |
| 36 | | | | | |
| 37 | | | | | |
| 38 | | | | | |
| 39 | | | | | |
| 40 | | | | | |

## 4. Evaluation and Documentation

### 4.1 Evaluation

Average of the results $\bar{D}$ _____ mm

Standard deviation $\sigma_{dev}$: _____ mm

$\bar{D}_{set}$ min = _____ mm

D - $\sigma$ = _____ mm

_____ $\bar{D}_{(set)} \geq$ _____ $\bar{D} + \sigma$

### 4.2 Documentation

The Test is passed if the results fulfil aforesaid equation:

Passed ☐
Not passed ☐

Name and signature of inspector: _____