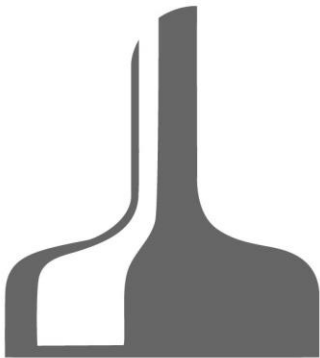


**SPECIAL TECHNICAL  
TERMS OF DELIVERY AND SUPPLY (STLB)  
FOR CROWN CORKS**

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**Preliminary Remarks**

- **This translation is only meant as a working document. If in doubt, always consult the original German Language Version of the “STLB Kronenkorken”.**
- **Some Standards, which are mentioned in this document are meanwhile (at the time of finalisation of this translation) outdated. Nevertheless (at least in most cases) the translation sticks to the original text to avoid any confusion.**

## Amendments made in relation to the previous version (27/4/2016):

<b>Section</b>	<b>Amendment</b>
Intro	'Amendments' section inserted
8.3.7	Value defined for air humidity
9	Diameter of steel finishes corrected to 26.55 mm

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****C O N T E N T S**

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**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Preface**

These STLB were drawn up by a joint DBB/VMV working group. This consisted of:

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**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Introduction**

These Special Technical Terms of Delivery and Supply for Crown Corks (STLB Kronenkorken) was agreed between the Verband Metallverpackungen e. V. representing the crown cork manufacturers in Germany and the Deutscher Brauer-Bund e. V. representing the German brewery industry in cooperation with the Versuchs- und Lehranstalt für Brauerei in Berlin e. V. (Seestraße 13, 13353 Berlin, [www.vlb-berlin.org](http://www.vlb-berlin.org)) and are aimed at the manufacturers and users of crown corks. They are to be regarded as non-binding recommendations but can be used as a constituent part of supply agreements.

Specifications and defect classifications that differ from these STLB may be stipulated with the agreement of the customer and manufacturer insofar as doing so is technically feasible and consistent with the terms and conditions customary in the industry.

The non-applicability or contractual amendment of specific clauses in the STLB shall not affect the validity of the remaining provisions that are independent thereof.

The standards referenced in these STLB relate in each case to the current versions as amended (see also standards overview, Annex 1).

The version of 'STLB Kronenkorken' dated October 2003 is superseded by this version.

**1 Scope and purpose**

Crown corks made of tinfoil or chrome-plated sheet metal are used to seal reusable and disposable bottles with finishes that conform to DIN EN ISO 12821, DIN EN 14634 (withdrawn) and DIN EN 14635 as well as DIN 6094-1 (withdrawn) and CETIE (GME 14.01 and GME 14.02, twist-off crown corks)

The dimensions of crown corks are defined in DIN 6099. These STLB apply to nominal thicknesses of 0.20 *mm* and 0.22 *mm* allowing for the tolerances set out in DIN EN 10202.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****2 General requirements**

- Crown corks must be manufactured, packaged, and made available in such a way that they are suitable for the filling, packing and distribution of the contents.
- The design of the crown cork – including the crown finish – must be such that leakages are prevented or rather its impermeability with respect to liquids and gases is ensured. The crown corks must withstand the pressures normally encountered during filling, pasteurisation, and storage.
- Suitable state-of-the-art materials (light-gauge steels, lacquers, paints, sealing materials) must be used for the manufacture of the crown corks in order to preclude any influence on or impairment of the quality of the contents (e.g. odour, taste, clarity and head stability) within the normal time frame<sup>1</sup>. The materials must comply with the food laws of the Federal Republic of Germany and the European Union as well as the recommendations of the Plastics Commission of the Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung (BfR)) as amended.
- The crown corks must be designed so that they do not damage the mouth of the bottle when capped and opened as intended.
- Crown corks from different manufacturers should be compatible with each other for the same capper settings.
- The crown corks shall have an appearance, including decoration and surface protection, that corresponds to the agreement made with the customer and that is not negatively affected by the normal pasteurisation process or on-site and off-site transport and storage conditions (cf. 4).

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<sup>1</sup> In general, 12 months until capping + 12 months after capping (exception e.g. scavengers).

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****3 Quality characteristics****3.1 Material composition**

The choice of sheet metal grade and quality of the lacquers, printing colours and sealing compounds is up to the manufacturer, and, while making allowance for the quality requirements stipulated in these STLB, will be specified according to the customer's wishes. Changes to the characteristics described in Section 3 shall be agreed upon with the customer in good time.

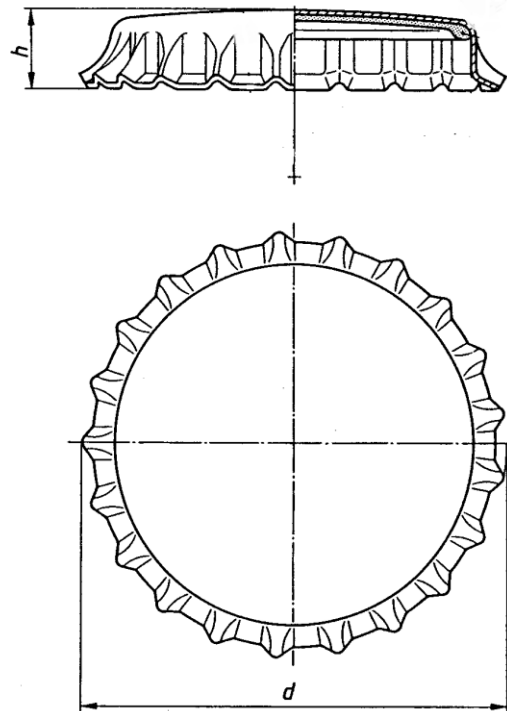
**3.2 Material**

Tinplate or chrome-plated sheet metal in accordance with DIN EN 10202.

**3.3 Dimensions; sheet thickness, hardness****3.3.1 Dimensions**

See drawing:

- Height  $h$ :  $6 \pm 0.15 \text{ mm}$
- External diameter  $d$ :  $32.1 \pm 0.2 \text{ mm}$
- Number of teeth: 21



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

## 3.3.2 Sheet thickness and hardness

See table:

Crown cork type	Sheet thickness [mm]			Material grade Designation	Rolling technique <sup>2</sup>	Hardness Nominal values
	Nominal <sup>3</sup>	Minimum	Maximum			
Pry-off crown cork	0.22	0.202	0.231	TH415	SR	61 HR
Pry-off crown cork	0.20	0.184	0.210	TH550	DR	72 HR30TS
				TH580	DR	73 HR30TS
Twist-off crown cork	0.22	0.202	0.231	TS275	SR	57 HR

- Tolerances according to DIN EN 10202 and ASTM A623M-11
- Hardness +/-4 HR
- According to DIN EN 10202 Section 9.2.1 the purchased sheet metal must satisfy the requirements below:
  - o *The material thickness must conform to the following:*
    - a) *The deviation of the thickness measured at the centre line of the strip from the agreed thickness shall not exceed ±5%.*
    - b) *The deviation of the measured thickness from the agreed thickness shall not exceed -8%/+5% when measured at any point not within 6 mm of the trimmed edge.*
    - c) *The average thickness shall not deviate from the nominal thickness by more than ±2% for consignments comprising more than 10,000 sheets (or length equivalent for deliveries in coil form).*

<sup>2</sup> SR = single reduced, DR = double reduced.

<sup>3</sup> Nominal = ordered sheet thickness (can be demonstrated to the customer by the manufacturer, if required).



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****3.4 Tin plating**

In accordance with DIN EN 10202 and the following table. Other tinplates by arrangement.

<b>Abbreviation</b>	<b>Two-sided nominal coating [g/m<sup>2</sup>]</b>	<b>Lower limit for the tin plating [g/m<sup>2</sup>]</b>
E 2.8/2.8 (E1)	2.8	2.30
E 11.2/11.2 (E4)	11.2	9.55

**3.5 Chrome plating**

At least 50 mg/m<sup>2</sup> on each side in accordance with DIN EN 10202.

**3.6 Sealing liner**

In accordance with Section 5.4 and by special arrangement. Changes require prior agreement. A conformity declaration within the meaning of Regulation (EC) No. 1935/2004 for plastic materials intended for food contact within the meaning of Regulation (EU) No. 10/2011 is to be made available for the supplied products and provided to the customer on request.

**3.7 Seal profile**

The customer must be informed of the profile (profile design with dimensions and diagram on request).

**3.8 Lacquers (inside and outside coatings)**

Changes require prior agreement. As concerns the inside lacquer, a safety certificate issued by an independent laboratory is provided upon request.

**3.9 Printed design, colour**

As per the template and colour scheme approved by the customer.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****4 Packaging, shipping, storage****4.1 Packaging, shipping, and storage of the closures**

The closures must be supplied free from microorganisms harmful to the product or health in outer packaging that precludes the closures from being impaired, contaminated or deformed under normal transport and storage conditions. The delivery of the closures in bulk containers (e.g. octabins) must comply with the general requirements for outer packaging.

The following points must be observed in addition:

- They must be storable for up to 12 months in rooms with a relative humidity of up to 60% at room temperature without the outer packing becoming damaged.
- In the case of pallet cages, a food-grade, odourless and tasteless inner bag must be used to protect the caps. This inner bag must be closed and composed in such a way that any impairment of the crown corks is precluded when stored properly (see above).
- It must be possible to simply and safely open the bulk container and, if applicable, inner bag.
- The crown corks must not be adversely affected at all by any other packaging or transport media that may be used. When new pallets are used, it must be ensured that they have not been treated with wood preservative.
- The storage and shipping conditions of the manufacturer must ensure odour and taste neutrality.
- The delivery quantity may deviate by a maximum of  $\pm 10\%$ .

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****4.2 Empty pallet cages: handling, storage, return transportation**

The emptied pallet cages are to be returned to the supplier for re-use. They must be handled, stored, and transported accordingly. Special attention must be given to preventing contamination/soiling.

Empty pallet cages:

- must be protected against the adverse effects of moisture, broken glass, dirt, chemicals, oil, or other contaminants during storage.
- must be protected against odours of all kinds.
- must be stored separately from packaging materials of the competition.
- may only be used as intended.
- must be returned in perfect condition.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****5 Special requirements****5.1 Workability**

The crown corks must not cause any disruptions in the operation of technically sound production lines (see in particular Sections 3.1, 5.2 and 7.3).

**5.2 Coating wear**

Subject to the following table (see Section 8.3.6 for measurement procedure)

<b>Style</b>	<b>Description</b>	<b>Coating wear per 25 pcs</b>
Neutral crown corks with gold and silver lacquer	Unprinted	Max. 20 mg
Single colour printed crown corks	Gold and silver lacquer or glaze, single colour printed	Max. 25 mg
Multi-colour printed crown corks	Gold or silver lacquer, multi-colour printed	Max. 35 mg
Pre-coated or aluminium-coated crown corks	Printed and unprinted	Max. 35 mg

**5.3 Corrosion resistance (transfer of iron to the bottle mouth)**

Tinned crown corks: max. 50  $\mu\text{g}$  Fe/bottle

Chrome-plated crown corks: max. 40  $\mu\text{g}$  Fe/bottle

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****5.4 Internal pressure resistance (gas release behaviour)**

In order to assess internal pressure resistance, the pressure at which the (standard PVC-free) crown corks release gas is determined.

Internal pressure resistance <i>[minimum values in bar]</i>				
Sheet thickness		Steel finish	Bottle	
			before pasteuriser*	after pasteuriser*
0.22 mm	Individual values	7	7	7
	Average value	8	8	7
0.20 mm	Individual values	6	6	6
	Average value	8	7	6

\* Depending on the product and plant, the bottler must confirm the suitability of crown corks made from 0.20 mm thick sheet before they are used for sealing products that are to be pasteurised.

**5.5 Pasteurisation suitability**

The difference in CO<sub>2</sub> content between the pasteurised and unpasteurised beverage may not exceed 0.2 g/l (see test in Section 8.4.1).

**5.6 Side impact resistance**

This quality attribute depends substantially on the sealing compound used and can be tested and evaluated in accordance with Section 8.4.2.

**5.7 Resilience with respect to vertical loading (top load)**

After being stored for a set period of time under a specified load, the crown corks must satisfy the requirements set out in Section 5.4 and/or 5.5 of these STLB with respect to internal pressure resistance and/or CO<sub>2</sub> loss.

**5.8 Twist-off values (for twist-off crown corks)**

Twist-off crown corks must demonstrate twist-off values of between 4 and 12 lbf in both immediately and 24 hours after closure.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****6 Capping throat/closure diameter**

A suitable capping throat must be used for capping. The recommended closure diameter lies between 28.6 *mm* and 28.8 *mm* (see also Annex 6).

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****7 Defect classes und AQL**

In this section, the classification into defect classes and attribution of acceptable quality limits (AQL) to the defect classes is described.

These are based on DIN 55407-2 as well as the withdrawn DIN 55407-1 and DIN 55408-1 standards.

**7.1 Sampling**

The sample size depends on the delivery quantity and inspection level in accordance with DIN ISO 2859-1 and DIN ISO 3951-1.

For a delivery lot size of  $N \geq 500,001$  items, a sample of size  $n = 500$  items that is representative of the delivery must be chosen at random. It is recommended that crown corks are chosen from a number of packaging types (pallet cages, octabins, etc.) corresponding to the square root of the number of supplied packaging units.

**7.2 Defect class categorisation****7.2.1 Critical defects (CD)**

Defects that can be assumed or are known to be hazardous. This situation is rather unlikely when it comes to using crown corks, however, which is why this defect class is not listed in Section 7.4.

**7.2.2 Major defects (MD)**

Defects that can be assumed will substantially diminish the usefulness of a product for its intended purpose or reduce the output of a plant.

**7.2.3 Minor defects (MinD)**

Defects that can be assumed will not substantially diminish the usefulness of a product for its intended purpose or represent a deviation from the standard that only minimally impacts its use.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****7.3 Defects analysis of the visually identifiable features**

The AQL values in Table 7.4 shall be agreed upon for the three defect classes.

For major defects and minor defects, an inspection by attributes is to be performed pursuant to DIN ISO 2859-1, letter N, general inspection level I, single sampling plan for normal inspection, inspection size: 500. The inspection for critical defects is performed with the same sample size, but with a single sampling plan for reduced inspection. The general inspection level II, letter Q is used.



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****7.4 Defect evaluation lists for visual inspections**

Inspection size: n = 500

Defects that adversely affect the operation of the filling plant or functionality of the container:

No.	Characteristic/defect	MD	MinD	Acceptance and rejection limits
1	Crown cork incomplete (e.g. punching error)	0.025	2.5	Acceptance number: 0 Rejection number: 1
1a	Leaky closure			Acceptance number: 21 Rejection number: 22
1b	Leakproof closure			
2	No internal coating, compound not bonded, seal missing or falling out	0.025		Acceptance number: 0 Rejection number: 1
3	Crown cork very dirty	0.025		Acceptance number: 0 Rejection number: 1
4	Crown cork deformed (deviations from cut surface plane > 0.2 mm)	0.1		Acceptance number: 1 Rejection number: 2
5	Compound over-moulding impinging toothed edge		1.0	Acceptance number: 10 Rejection number: 11
6	Compound outside the seal area defective		2.5	Acceptance number: 21 Rejection number: 22

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

Cosmetic defects that do not impair functionality:

No.	Characteristic/defect	MD	MinD	Acceptance and rejection limits
7	Extraneous caps (wrong decoration)	0.025		Acceptance number: 0 Rejection number: 1
8	Printed design offset/stamping offset	0.025		Acceptance number: 0 Rejection number: 1
8a	> 1.2 mm			
8b	> 0.8 mm ≤ 1.2 mm		1.0	Acceptance number: 10 Rejection number: 11
9	Deviation from colour original	1.0		Acceptance number: 10 Rejection number: 11
10	Scratch on outside that completely cuts through the coating <sup>4</sup>		1.0	Acceptance number: 10 Rejection number: 11
11	Registration offset > 0.5 mm		1.0	Acceptance number: 10 Rejection number: 11
12	Printed design slightly smeared or blotchy		2.5	Acceptance number: 21 Rejection number: 22

Note: In the case of several defects on one piece, the most serious defect is counted.

<sup>4</sup> Localised damage caused by the teeth of the crown is considered unavoidable and is not counted.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****7.5 Measurable characteristics (inspection by variables)**

For an inspection by variables in accordance with DIN ISO 3951-1, it shall be agreed to use special inspection level S-2, letter E, – single sampling plan for a normal inspection. The sample size shall be 9.

For checking the diameter and height, special inspection level S-4, letter K is stipulated. In this case, the sample size shall be 50.

The mean value ( $\bar{x}$ ) and standard deviation (s) are to be calculated from the measured values.

The requirements of the 'STLB Kronenkorken' are met if the two values  $\bar{x}$  and s satisfy both of the following equations:

$$\bar{x} + k * s \leq \text{upper tolerance limit}$$

$$\bar{x} - k * s \geq \text{lower tolerance limit}$$

The following are to be calculated from the measured values:  
Mean value:

$$\bar{x} = \frac{\sum x_i}{n}$$

Estimated value of the standard deviation:

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$x_i$  = individual measured values  
n = number of measured values

For 50 measured values: k = 1.885

For 9 measured values: k = 1.615

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

The tolerance limits are derived from the specifications given in Sections 3 and 5. The mean value of the tin and chrome platings from 9 measurements is compared with the lower limits in the Section 'Tin plating'.

Note: The individual inspections differ substantially in the amount of time required to perform them. A compromise between inspection accuracy and costs must be arrived at in order to keep the time required for the inspection as a whole within acceptable limits. For this reason, the scope of inspection given in Section 7.6 is recommended.

**7.6 Checklist of measurable defects**

<b>Seq. no.</b>	<b>Characteristic/defect</b>	<b>Inspection scope</b>
1	Diameter	50
2	Height	50
3	Sheet thickness	9
4	Tin plating/chrome plating	9
5	Hardness	9
6	Corrosion resistance	9
7	Short-term internal pressure resistance	9
8	Pasteurisation suitability (optional)	9

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****7.7 Checklist of measurable defects (no acceptance sampling inspection)**

<b>Seq. no.</b>	<b>Characteristic/defect</b>	<b>Inspection scope</b>
1	Coating wear	25
2	Side impact resistance (optional)	40/20
3	Top load (optional)	12
4	Internal pressure resistance on original bottles (optional)	20

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

## 8 Inspection procedure

### 8.1 Incoming goods inspection

The general condition of and legibility of the information on the packaging is to be examined when the goods are received. Sampling can then be performed.

### 8.2 Visual inspection

The visual inspection is performed on 500 crown corks. In the case of defects that affect the crown corks' ability to seal properly, the sealing test must be performed in accordance with Section 8.3.8 on a steel finish or using another suitable method, e.g. on a bottle with a perfect finish, in the Secure Seal Tester (Section 8.3.8.2).

The deviation from the cut surface plane (Section 7.4, Seq. no. 4) is tested using a feeler gauge.

### 8.3 Measuring tests

#### 8.3.1 Diameter

The diameter of the crown cork in delivery condition is measured using ring gauges.

#### 8.3.2 Height

With vertically aligned callipers, scale value 0.01 *mm*. Diameter of the upper measuring surface of at least 5 *mm*. Measurement including the coating.

#### 8.3.3 Sheet thickness

Measurement with vertically aligned micrometer. Scale value 0.001 *mm*, spherical measuring surface. Remove seal and coating prior to measuring.

#### 8.3.4 Tin plating/chrome plating

For ongoing testing, the tin or chrome plating can be analysed coulometrically in accordance with DIN EN 10202. The analysis methods in the annex to the ISO 11949 standard must be used for arbitral analyses.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

### 8.3.5 Hardness

According to DIN EN ISO 6508-1 and DIN EN 10202. Remove the seal, coating, chrome, and/or tin plating prior to measuring.

### 8.3.6 Coating wear

Coating wear is determined by way of differential weighing. 25 crown corks are cleaned of dust with dry, oil-free compressed air and a damp cloth and weighed to an accuracy of 0.1 *mg*. The weighed crown corks are placed into an abrasion drum and agitated at a speed of 20 revolutions per minute for a period of 50 minutes. Afterwards, the crown corks are removed from the drum, cleaned once more with compressed air and a damp cloth, and re-weighed following drying. The difference between the two weights is the wear.

### 8.3.7 Corrosion resistance

The analysis principle is the quantitative measurement of the iron that is deposited on the mouth of the bottle as rust (rust ring) under the test conditions described below. Nine bottles are filled with tap water and sealed using the crown corks to be tested. The surfaces of the bottles, including the mouths, must be neither hot-end nor cold-end coated.

The 9 bottles are stood in a water bath or plastic container for a period of 14 days. The water bath or plastic container must be filled with water so that the surface of the water is above the crown corks. Distilled or deionised water is to be used. The electrical conductivity of the water must not exceed 2  $\mu\text{S}$ . At the end of each working day, water is drained off so that the surface of the water is around 2 cm below the lower rim of the crown cork. At the beginning of the next working day, the container is filled up again with fresh water until it covers the crown corks. The room in which the water baths are situated must be kept at a temperature of  $21.0^{\circ}\text{C} \pm 1.0^{\circ}\text{C}$ . The air humidity should be  $60\% \pm 5\%$ .

On the 14th day, the bottles are removed from the water bath, opened, and emptied (allow to drain out) and placed upside down in a 400 ml glass beaker (high sided) that contains 15 ml of 25% hydrochloric acid p.a. Once the rust has completely dissolved in the hydrochloric acid (usually after around 30 minutes), the bottles are removed from the glass beakers and the increase in iron content in the hydrochloric acid determined using a suitable method.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****8.3.8 Internal pressure resistance (gas release behaviour)****8.3.8.1 Testing on steel finishes (gas release pressure)**

Metallic crown cork finishes (hard-chrome plated or stainless steel) with a lip diameter of  $26.55 \pm 0.05$  mm are connected to an apparatus that allows these finishes to be pushed off with compressed carbon dioxide or air in a water bath in which the finishes are completely submerged. At least 9 finishes are capped with the crown corks to be tested (closure diameter 28.6 to 28.8 mm) and after 24 hours in the above apparatus, connected to the compressed gas. The pressure is set to 300 kPa (3 bars) and increased by 100 kPa (1 bar) every minute. The result is the pressure at which each of the crown corks leaks. Caps that have leaked are disconnected from the pressure system. The test is terminated at 1,200 kPa (12 bars).

**8.3.8.2 Test using factory-capped bottles (gas release pressure)**

This test can be performed both on bottles sealed at the filling plant or bottles sealed with the crown corks to be tested in the laboratory. In each case, the closure diameter must be noted for each bottle. The test is to be performed using a Secure Seal Tester in accordance with the operating instructions for the device. The pressure increase is set to 100 kPa/min. The pressure is increased until such time as at least three air bubbles in succession escape from between the crown cork and lip of the bottle and float up. This value is then noted. Because of the danger of bottles bursting, the test is terminated at a pressure of 1,000 kPa (10 bars) for disposable bottles and 1,100 kPa (11 bars) for reusable bottles.

**8.3.8.3 Test conditions for simulating pasteurisation**

Heat bottles fitted with crown corks in a water bath to 65°C and maintain temperature for 20 mins.



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****8.4 Measuring tests following filling****8.4.1 Pasteurisation suitability**

The test is performed by measuring the loss of carbon dioxide in the bottles following simulation of pasteurisation under laboratory conditions.

To do this, 12 factory-filled bottles with a carbon dioxide content of  $5.0 \pm 0.2$  g/l and a head space of approximately 4% are cooled in a refrigerator to 4°C–5°C and left for 24 hours. Then, the carbon dioxide content of 3 bottles is determined. The remaining 9 bottles are carefully opened, immediately sealed with the crown corks to be tested and heated in a water bath to 65°C. They are held at this temperature for 20 mins. Afterwards, the bottles are cooled down to room temperature for one day after which the carbon dioxide content of each of the bottles is determined and the carbon dioxide loss compared to the average value of the three control bottles calculated. If specific bottles exhibit a greater carbon dioxide loss, the finishes of these bottles must be inspected. If damage to or discrepancies in the dimensions of the finishes are detected, the carbon dioxide loss of the bottle in question is excluded from the analysis.

Alternatively, the internal pressure resistance of 9 unpasteurised and 9 pasteurised bottles that have been sealed with the crown corks to be tested can be checked. (See 8.3.8.2)

**8.4.2 Side impact resistance****8.4.2.1 Testing the side impact resistance by analysing the gas release values using the Secure Seal Tester**

This test is performed using a Ball Impact Tester made by the company Steinfurth, Essen. Ten bottles are sealed with the crown corks to be tested and the gas release pressure determined in the Secure Seal Tester (initial value). A further 30 bottles are sealed and the side impact resistance after one, two and three impacts tested (on 10 bottles in each case). The bottles being tested are placed in the Ball Impact Tester at a recommended angle of 20°. The impact weight (35 g, cylindrical form) falls down the drop pipe and hits the crown cork. The gas release pressure is measured in the Secure Seal Tester in each case 24 hours after one, two and three impacts, respectively.

## SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS

### Evaluation:

- Crown corks with a low side impact resistance already exhibit isolated gas release values of under 5 *bars* after one impact.
- Crown corks with a moderate side impact resistance only exhibit a clear drop in pressure of over 1 *bar* after the second impact, but no value under 5 *bars* is seen.
- Crown corks with a high side impact resistance exhibit a drop in pressure < 1 *bar* not only following the first, but the second and third impacts too.

#### 8.4.2.2 Testing the side impact resistance following pre-treatment of the bottles in an ultrasonic bath

The bottle to be analysed that is filled with CO<sub>2</sub>-containing medium (approximately 5 g/l) is treated for one minute in the ultrasonic bath immediately prior to testing. This causes the CO<sub>2</sub> to come out of solution and induces a pressure increase within the bottle, making it possible to immediately detect any leaks around the crown cork. The side impact resistance of the closures is determined by means of defined impacts on the crown cork. The point of impact is set by the angle of the bottle holder (20°). The impact weight (35 g, cylindrical) is inserted into the drop tube and allowed to fall onto the crown cork from a height of 77 cm. The second impact to the crown cork is performed after rotating by 120°. The third impact to the crown cork is performed after rotating by a further 120°. A visual and/or acoustic leak inspection is performed after each impact. The test is terminated after the third impact and/or as soon as the crown cork is obviously leaking. 20 bottles/crown corks are tested, and the results evaluated as follows.

Number of leaky bottles after one impact × weighting factor of 3  
 +  
 Number of leaky bottles after two impacts × weighting factor of 2  
 +  
 Number of leaky bottles after three impacts × weighting factor of 1  
 =  
 Sum/number of bottles = impact value

#### Evaluation according to numeric value:

This allows for classification into three evaluation ranges (descending, high to low).

- A 0.00–1.00 high side impact resistance
- B 1.01–2.00 moderate side impact resistance
- C 2.01–3.00 low side impact resistance

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

Qualitative evaluation:

- Crown corks with a low side impact resistance are already noticeably leaky after one impact.
- Crown corks with a moderate side impact resistance only show signs of leakage after the second or third impact.
- Crown corks with a high side impact resistance do not leak when subjected to an impact.

Note:

In the rare event that some (few) crown corks already leak following the first impact, but following calculation, a value  $< 1.00$  is nevertheless determined, they should generally be categorised in the lower evaluation range (moderate side impact resistance).

#### 8.4.3 Top-load test

This test is performed to determine the resilience of the crown corks when subjected to a vertical load, as can occur when the bottles are stored in trays, for example. If not otherwise agreed, the test is performed using a load of 45 *kg*/bottle (441.45 *N*) applied for a period of 7 days. A test apparatus that allows for a setting of the test load  $\pm 1$  *kg* (9.81 *N*) can be used.

The decrease in CO<sub>2</sub> content or change in the gas release values/internal pressure resistance can be determined 24 hours after the load has been removed. The test is performed on 12 closed bottles. 10 bottles are used to determine the initial value of the internal pressure resistance. The initial values for the CO<sub>2</sub> content are determined using 3–5 bottles.

#### 8.4.4 Twist-off values

The test is performed on at least 10 glass bottles with twist crown finish that have been sealed in the laboratory. The use of a capping cone designed for twist caps is essential here. The test can also be performed on factory-filled and sealed bottles.

The test should be performed both immediately following capping as well as 48 hours afterwards.

The twist-off values are determined as per the operating instructions for the test apparatus being used.

The measured values should be given in *lbf in* without decimal place or in *Nm* to one decimal place. Conversion: 1 *lbf in* = 0.113 *Nm*. The measured values are used to calculate the mean value and standard deviation.

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

**8.5 Testing for extraneous tastes**

In accordance with VMV Technical Paper No. 15 "Prüfung auf Fremdgeschmack bei Flaschenverschlüssen für Mineralwasser" ('Testing for extraneous tastes in the case of bottle closures for mineral water' - *currently not available in English*).

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****9 Test apparatus**

- Coulometric measuring apparatus
- Rockwell hardness tester
- Micrometer, 0.001 *mm* gradation
- Callipers
- Ring gauges with 0.1 *mm* gradation
- Abrasion drum, see Annex 2 for specifications
- Capping machine
- White, un-coated glass bottles
- Crown cork finishes made from stainless steel with a lip diameter of  $26.55 \pm 0.05$  *mm*
- Metal-free water bath, various laboratory instruments and chemicals
- Light box as per VMV Technical Paper No. 15
- Top-load tester; see Annex 3 for specification
- Side impact tester
- Secure Seal Tester
- Device suitable for determining iron content (corrosion), e.g. photometer, AAS

Notes: An overview of testing methods for crown corks can be found in the volume 'Gebinde und Produktausstattungsmitel' (Product Containers and Packaging Materials) by the Mitteleuropäische Brautechnische Analysenkommission e. V. (Central European Commission for Brewing Analysis (MEBAK)), Chapter 3.10, published on CD-ROM in 2009 by MEBAK (85350 Freising-Weihenstephan, [www.mebak.org](http://www.mebak.org)).

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Annex 1: Standards etc.**

DIN 6094-1	Packaging – Finishes for bottles – Part 1: Crown cork finishes ( <i>withdrawn</i> )
DIN 6099	Packaging – Crown corks
DIN 55407-1	Packaging – General technical terms of delivery and supply – Part 1: Basics ( <i>withdrawn</i> )
DIN 55407-2	Packaging – General technical terms of delivery and supply – Part 2: Catalogue of errors
DIN 55408-1	Packaging – Special technical terms of delivery and supply – Part 1: Basics ( <i>withdrawn</i> )
DIN EN 10202	Cold reduced tinmill products – Electrolytic tinplate and electrolyt- ic chromium/chromium oxide coated steel
DIN EN 14634	Glass packaging – 26 H 180 crown finish – Dimensions ( <i>with- drawn</i> )
DIN EN 14635	Glass packaging – 26 H 126 crown finish – Dimensions
DIN EN ISO 12821	Glass packaging – 26 H 180 crown finish – Dimensions
DIN EN ISO 6508-1	Metallic materials – Rockwell hardness test (scales A, B, C, D, E, F, G, H, K, N, T) – Part 1: Test method
DIN ISO 2859-1	Sampling procedures for inspection by attributes – Part 1: Sam- pling schemes indexed by acceptance quality limit (AQL) for lot- by-lot inspection
DIN ISO 3951-1	Sampling procedures for inspection by variables – Part 1: Speci- fication for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteris- tic and a single AQL
CETIE GME 14.01	26 H 180 twist-off crown finish ( <i>undergoing revision</i> )
CETIE GME 14.02	26 H 126 twist-off crown finish ( <i>undergoing revision</i> )

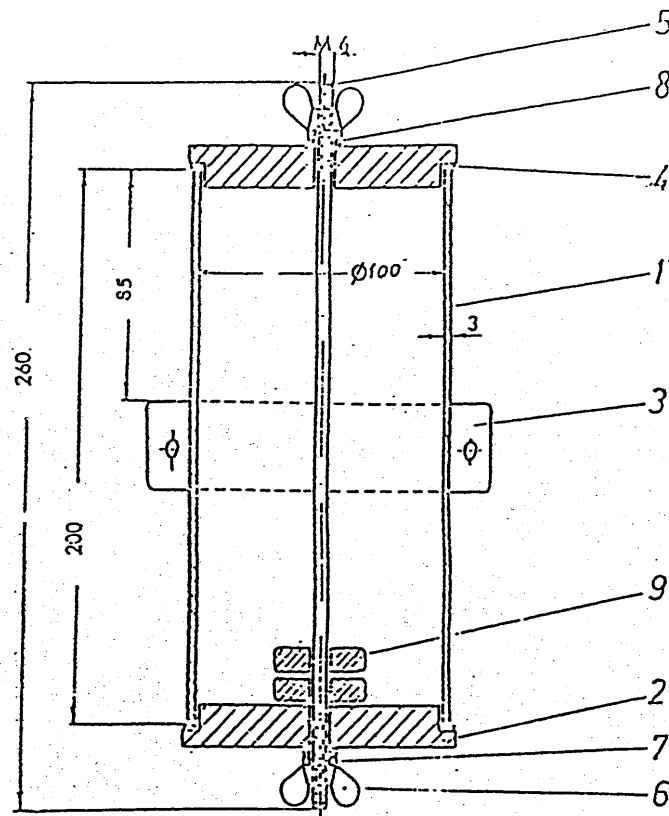
**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

ASTM A623M-11 Standard Specification for Tin Mill Products, General Requirements [Metric]

VMV Technical Paper No. 15 'Testing for extraneous tastes in the case of bottle closures for mineral water' *(attached to these STLB as Annex 7)*

## SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS

### Annex 2: Abrasion drum for determining coating wear



Pos.	Designation	Pcs.	Material	Dimensions (mm)
1	Cylinder	1	Plexiglas	∅ 100 × 200 × 3
2	End cap	2	V2A	∅ 110 × 18
3	Fixture	1	St 37	30 × 3 × 450
4	Seal	2	Rubber	
5	Shaft	1	V2A	∅ 6 × 260
6	Wing nut	2	V2A	M 6, DIN 315
7	Washer	2	V2A	A 6, DIN 125
8	Seal	2	Rubber	
9	Stones	2	V2A	40 × 25 × 10



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

**Annex 3: Top-load tester**



**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Annex 4: Objections during incoming goods inspections**

If a brewery raises objections during the incoming goods inspection, the manufacturer shall be given the opportunity to have the rejected shipment examined by a representative. A joint decision will be taken regarding its further use following a possible trial run, where appropriate.

A rejection should include the following information, if possible:

1. Delivery date
2. Packaging labelling (labels, stamps, etc.)
3. Delivery volume
4. Sample size/number
5. Number of pallets from which the sample was picked
6. Number of rejected items per defect group in the sample
7. Rejected samples

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Annex 5: Qualification of crown corks made from sheet with reduced thickness**

The following points should be noted by the bottler when qualifying crown corks with reduced sheet thickness (from 0.22 to 0.20 mm):

- Determine the diameter of previous capping throats and adjust as necessary
- Defining the specification: steel grade, incl. tin or chrome plating, sealing compound, profile
- Bottle inspection (uncontrolled reusable bottle pool)
- Final inspection with an ultrasonoscope, if possible
- Filling test at every single line, with and without pasteuriser
- Tests of filled bottles after 24 hours and after 3 months:
  - Internal pressure
  - CO<sub>2</sub> loss
  - Top load
  - Side impact
  - Closure diameter
- Regular checking of the provided specifications
- Repeat the procedure in the case of process changes
- If necessary, increase testing efforts

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS****Annex 6: Capping throats – recommendations**

Type	Sheet thickness	Diameter capping throat	Closure diameter on the bottle
	[mm]	[mm]	[mm]
Pry-off	0.20 (DR)	$\leq 28.25$	28.6–28.8
Pry-off	0.22 (SR)	$\leq 28.30$	28.6–28.8
Twist-off crown cork	0.22 (SR)	$= 28.40 - 0.1$	28.6–28.8

**SPECIAL TECHNICAL TERMS OF DELIVERY AND SUPPLY FOR CROWN CORKS**

**Annex 7: VMV Technical Paper No. 15**

Prüfung auf Fremdgeschmack bei Flaschenverschlüssen für Mineralwasser

(Testing for extraneous tastes in the case of bottle closures for mineral water, date of issue 18/1/2016 - *currently not available in English*)