STILL WINE CLOSURE & BOTTLING

Good practices guide

DIAM BOUCHAGE

EDITORIAL

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Customer Service and Technical Sales Support

As a cork professional, Diam Bouchage works in partnership with glassmakers, machine manufacturers and specialized laboratories. Permanent exchange with our partners enables us to develop precise expertise on bottling that we wish to share here with our clients.

Every week we witness bottlings which do not quite go to plan, where machines have not been calibrated correctly, the cork is incorrectly positioned or the filling level is not exact. The consequences can be irreversible once the bottle is closed! But, **by simply carrying out preliminary checks, winemakers can eliminate 99% of the risks in this crucial stage of bottling.**

This white paper enables you to anticipate this stage through information on the necessary checks and calibration procedures, what to look for and what to avoid.

Our after-sales service team is at your entire disposal for any further information: sav@diam-bouchage.com

DIAM BOUCHAGE

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What you need to know

As a reference, we will use **Cetie Guide No. 1 / 2007.**

Chapter 1

BOTTLES, CORKS AND FILLING

DIAM BOUCHAGE

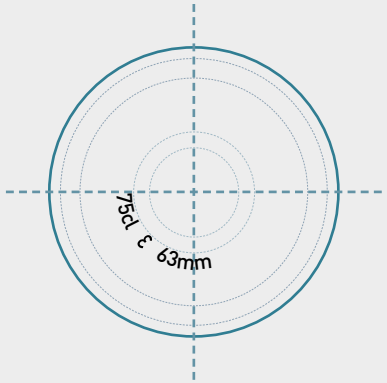
Choosing the bottle

Selection criteria

- Type of wine bottles: some bottles have a standardised shape traditionally used in the different wine regions (Bordeaux, Burgundy, Rhone, etc.).
- Bottle size: from the quarter bottle "Picolo" (20 cl) to the large-format Melchior (18 l). The most commonly used bottles are the half-bottle "Fillette" (37.5 cl), the standard 75 cl, the Magnum (1.5 l), and the Jeroboam (3 l).
- Type of neck finish: for successful bottling, a standardised finish is best.
- Aesthetics.
- Price.

Specifications

- The most commonly used bottles have a unique flat neck finish: European standard EN 12726, previously called GME 50.01.
- Finish dimensions are set: ovality and inner diameter.
- We recommend choosing a "récipient-mesure" bottle (RM) with a standard capacity guaranteed by the glassmakers. These bottles are easily identified by the 'epsilon' embossed on the bottom.
- The RM displays the manufacturer's recommended fill height at20°C (68°F).

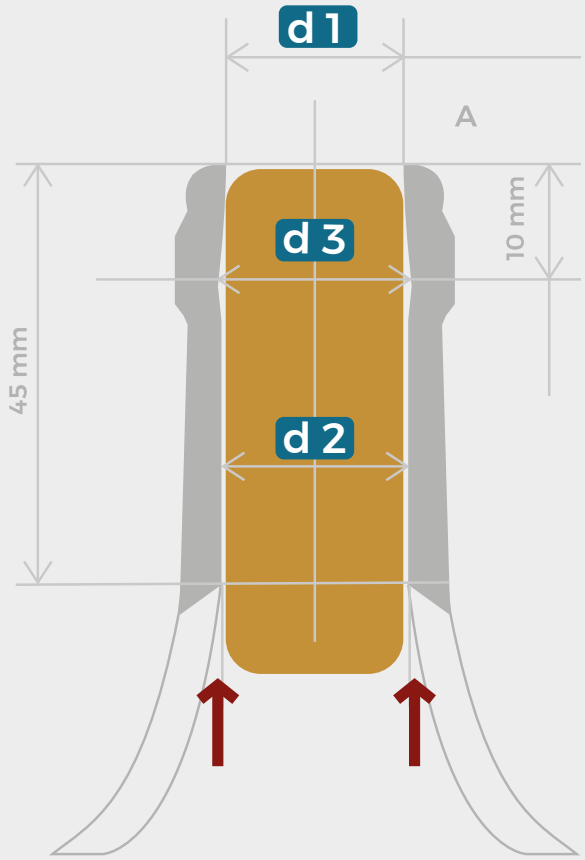


The internal profile of a wine bottle is "A-shaped".

An inverted (V-shaped) or non-standard profile can impede closure entry and cause it to rise during bottling. This can lead to problems with the seal, a risk of oxidation, as well as closure difficulties. A simple device, resembling a calliper, is used to check the inside neck profile at different depths.

Watch a video of this check

Focus on glassmaking standards



Measuring the internal diameters of a bottle EN 12726
(formerly NFH 35-100 or GME 50.01):

→ **d1 = 18.5 +/- 0.5 mm:**
measured at 3 mm below the top of the finish / max. ovality: 0.5 mm

→ **d2 > d1 = 20 +/- 1 mm:**
measured at 45 mm from the top of the neck / max. ovality: 1 mm

→ **d3** can only be 1 mm over the actual d1 diameter.

The glassmaker guarantees the internal profile of the bottle for the first 45 millimetres from the top of the neck, after which the bottle can flare out to a greater or lesser extent. If the chosen closure is longer than 45 mm, it must have enough elasticity to perfectly seal and prevent the wine from seeping between the glass and the closure.

For other neck finish types, closure validation tests should be carried out ahead of bottling.

Bottle storage recommendations

Before filling, bottles must be **clean, dry or well rinsed and drained.**

Covers under which the bottles are stored must be in perfect condition to avoid moisture or contamination issues.

Do not store in the sun to **avoid thermal shock** and warming the wine during bottling.

Do not store near chemicals (phytosanitary or surface treatment products) to **avoid any organoleptic or chemical contamination.**

Cork Specifications

More than just an ordinary closure, a cork is the winemaker's ultimate oenological act. It must allow the wine to fully develop in the bottle during ageing while ensuring respect of the originally intended aromatic profile.

Neutral

- → Refuse the presence of 2,4,6-trichloroanisole (TCA) and other compounds responsible for cork taint.
- → Also refuse any molecules that can cause organoleptic deviations.

Consistent

- → Obtain bottle to bottle consistency in wine aging (all corking steps must have been followed according to standard).

Tailored to every wine

- → Oxygen ingress without risk of oxidation or reduction (choice of stopper permeability).
- → Oxygen ingress without risk of oxidation or reduction (choice of stopper permeability).

What is cork taint?
Cork taint is a musty taste. It has also been described as a taste reminiscent of rotten wood, dust, or wet cardboard. The same characteristics can be found on both the nose and the palate.
The molecule most often blamed for cork taint is 2,4,6-trichloroanisole, more commonly known as TCA.
This molecule can be present in the cork used to manufacture the closures. There are however other anisoles (TeCA, TbA, and PcA) that can give the same deviations.
All those molecules don't always come from cork. They can develop in any wooden material (pallets, beams, floors, etc.) and contaminate the wine via the air. This is called aerocontamination.

News DIAM

Thanks to an exclusive patented process of cork "de-aromatisation", DIAM closures provide unmatched sensory neutrality.
Over 150 molecules are extracted some of which can cause organoleptic deviations, including TCA responsible for cork taint.
This manufacturing process guarantees every single closure unit. (releasable TCA ⩽ 0.3 ng/l).

Learn more about the DIAMANT® process

Choosing the right closure for a successful bottling

In addition to the above-mentioned specifications, the closure is also a technical choice that will impact the bottling process.
Here are the main elements to consider:

Appearance

→ Before bottling, make sure to check the cork branding is the one you chose!

Dimensions

→ The length of the cork must allow for enough “head space”, while ensuring fill level compliance.

→ The cork diameter must be suited to the internal profile of the bottle neck in order to provide a tight seal.

Surface treatment

→ Must be consistent to avoid any capillary migration (wicking).

→ Ensures bottling consistency and easy extraction for the consumer.

Adequate elasticity

→ Provides enough pressure inside the bottle neck to prevent any leakage or seeping.

→ A quick dimensional recovery at corking will further improve a good seal.

→ Elasticity combined with an adequate coating, will provide a safe and easy extraction force (check the cork manufacturer specifications).

Batch consistency

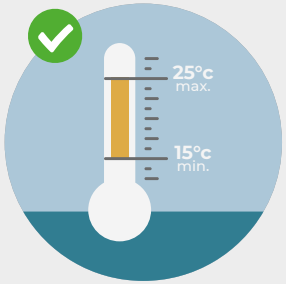
→ Key for a good bottling line performance: regular insertion, no line stop even with high-speed equipment (more information in the "Closures" chapter).

For a esthetic reasons, you can choose closures without chamfer. In this case, the cork machine must be equipped with a cork pusher. It can come as standard on the machines or be installed later depending on the manufacturer.

A cork pusher is used to drive the closure into the jaws of the cork machine without damaging the edges or creating chipping or “reboulé”.

Make sure the jaws are long enough for the chosen cork + the length of the cork pusher.

Cork storage recommendations

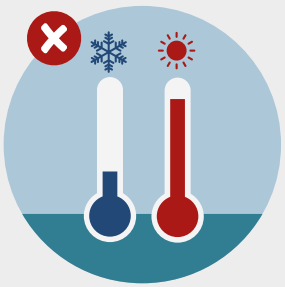


Storage temperature

Room temperature between 15°C (59F) and 25°C (77F).

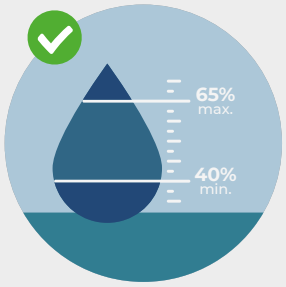
Chemicals

Keep away from any chemicals, especially those containing halophenols or chlorine.



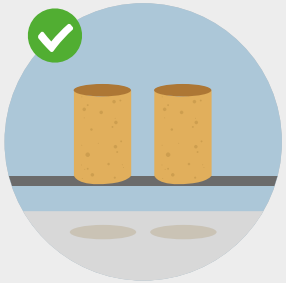
Storage temperature variations

Avoid extreme temperature variations.



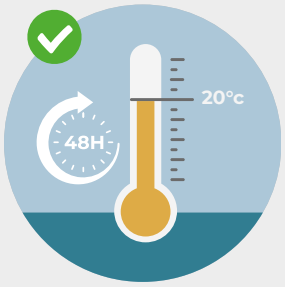
Controlled humidity

Relative humidity between 40% and 65%.



An adequate room

Above-ground storage in a clean, ventilated, and odourless room.



Preparation before bottling

Tempering at around 20°C (68F) 48 hours before bottling.

It is important to periodically check the storage area atmosphere for contamination, using a bentonite trap for example.

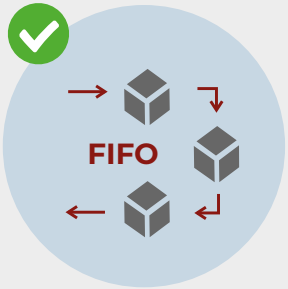
Closure use reminder

Cork dust inspection

- Before use, check that the bags of corks are dust free.
- Dust can seriously disrupt the vacuum system operation.
- It can also be found in the compression jaws and more importantly in the wine !

Shelf life

- Prefer the FIFO system: First In, First Out.
- Any opened bag should be immediately and fully used.
- The supplier must indicate shelf life on the packaging. It can vary a lot depending on the surface treatment used.



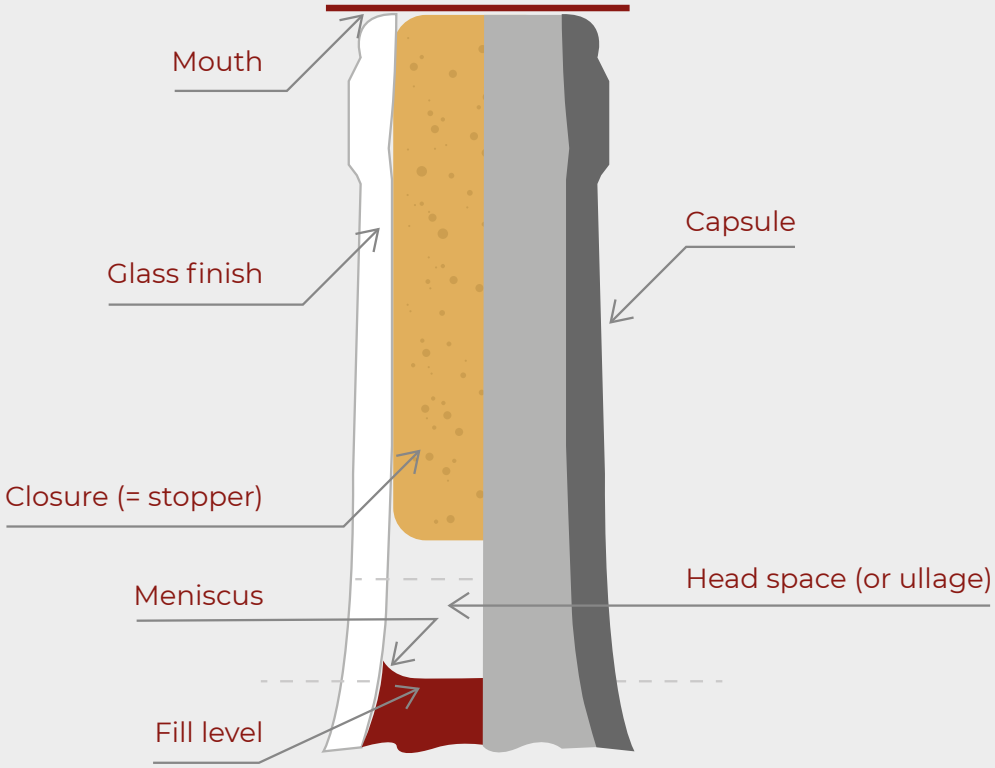
News DIAM

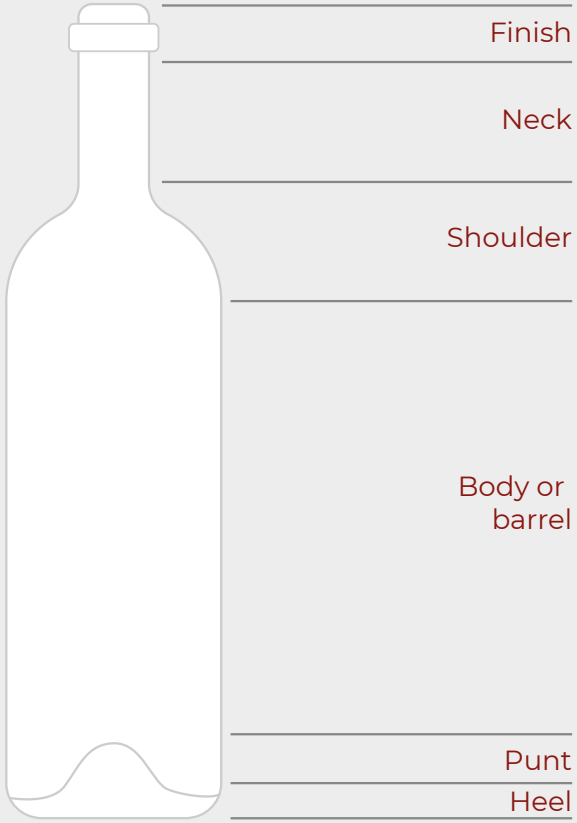
DIAM corks are guaranteed with a dust content ⩽0.3 mg/closure.

Their UBD (Use By Date)is printed on the DIAM box labels.

This UBD is the date up to which we guarantee that our corks retain their specific properties under appropriate storage conditions. The shelf life for our still wine closures is 6 months.

The filling stage: spotlight on the vocabulary





Measuring the fill level

Fill level is calculated using two very precise methods (required by customs during inspections) that are sometimes difficult to implement.

Respect the nominal volume:

→ Most of the bottles have a standard fill level. It is to be found on the bottle drawing (e.g. from 100 to 1,500 ml for still wines). This fill level must be respected to put the wine on the market.

Determine the fill level:

→ Before bottling, check the fill level specific to your bottle (epsilon)on the bottle drawing provided by the glassmaker.

→ The fill level is based on the elementary law of fluid expansion and is therefore temperature dependent.

→ Mesure the wine temperature (T°C) using a thermometer.

→ Then use this data to set the fill level by reading the chart.

Check the volume using one of the following two methods:

Both methods comply with the legislation.

Volumetric method:

→ Empty the content of the bottle into a volumetric flask with an accurately known effective capacity. The measure must be taken at the reference temperature (20°C – 68°F).

Weight method:

→ Weigh the bottle empty (m1) and full (m2). Calculate the volume using this formula: V = (m2-m1)/ mvliq (mvliq is the wine density at 20°C or 68°F of the bottled liquid).

For bottles that don't have an available fill level (epsilon) a more precise control is required.

On the bottling line, you can use a graduated ruler for quick quality controls. This ruler is very handy but not very precise (usual precision of 0.5 mm). It is not accepted by customs as official method.

Watch a video of this method

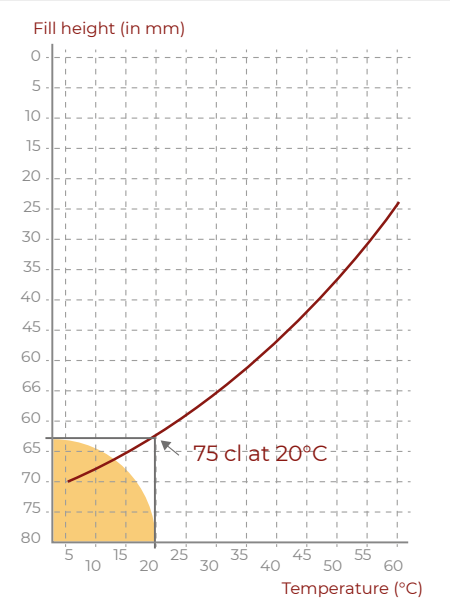
When the fill level is not available on the bottle drawing, then it has to be determined before using this method.

Elementary law of wine expansion

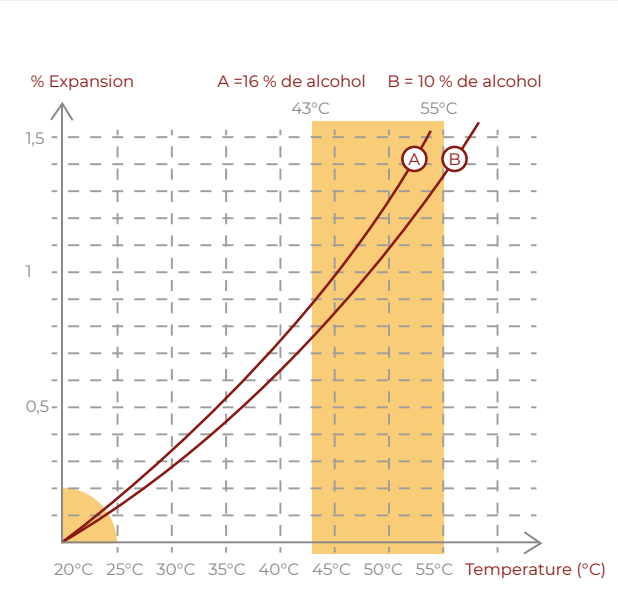
The wine expansion curve depends on two factors:

- Wine temperature:
  When the value increases, the wine expansion is higher.
- Wine alcohol content:
  When the value is higher, the wine expansion percentage will increase with the temperature.

Consequently, to determine the fill height, you must know these two values to correctly read the indications provided by the glassmaker's chart.



The glassmaker's chart shows the fill height according to wine temperature.



It also provides the expansion rate of the wine according to the alcohol level.

Checking the fill throughout the bottling process

During the bottling process, the fill level can vary over time. You must therefore make sure it is consistent.

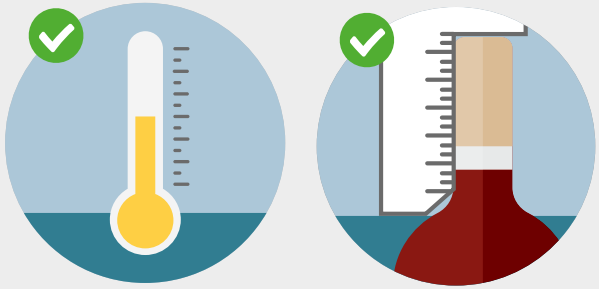
Where could a lack of consistency come from?

Deviations observed over time during bottling are related to:

- The setting variations from one nozzle to another on a same machine.
- The filler malfunctioning: mechanical problems, issues with gaskets, maintenance defects, or foreign objects.
- Temperature variations in the wine and the environment (elementary law of fluid expansion).
- An improper bottle transfer, which can cause the wine to rise.

Check regularly:

- Just as you did at the beginning of the filling process, you need to check the temperature and the fill level several times during the bottling process.
- Corrections are made by adjusting the filler to the new height, especially to compensate temperature fluctuation.

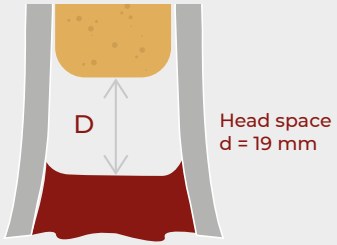


The pressure in the head space volume must also be checked on a regular basis using an aphrometer. This depends on the level of vacuum applied. When the hydraulic pressure is too high, it can cause a leak and/or the cork rising. The CETIE standard indicates the value to comply with: 0 ± 0.1 bar (relative).

Watch a video of this control

Illustration showing the impact of temperature during bottling

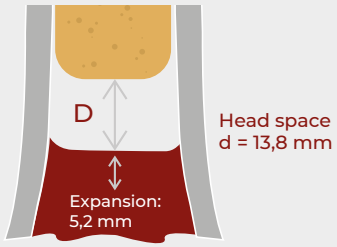
In the previous pages, we saw that it is essential to monitor the wine temperature to be able to define and check the fill height, in order to comply with the fill level. Below is an illustration of what can happen. As an example, we took a 44 mm long cork and a Ɛ63 bottle.



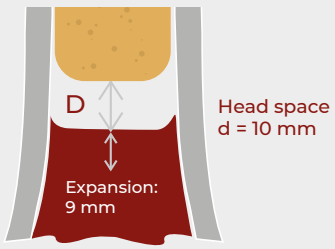
At the beginning of the bottling process, the wine temperature is 20°C (68° F)
By complying with the glassmaker's chart, our head space level is 19 mm.

After an hour, the temperature changes to 10°C (50° F)(e.g. changing tank). We continue to fill the bottles in the same way - without checking the chart again - and our head space volume is still 19 mm.

Later, during storage, **the temperature of these two groups of bottles rises to 30°C (86° F),** the wine will therefore expand.



For the first bottles in compliance with chart indications, the head space height is now 13.8 mm.



For the second bottles, the expansion is greater and the head space height is only 10mm.

That is 27% less than the first bottles! the risk of leakage and cork push-up is very high.

SUMMARY

The elements to check for bottles and corks before bottling:

BOTTLES

- Cover not damaged (risk of water or foreign object)
- No broken bottles (risk of broken glass)
- No off odours
- Corresponds to chosen model
- Validity of the conformity certificate
- Bottle's Epsilon (for those that have it)

CORKS

- Dimensions
- Branding
- Quantity available
- No visible mould
- No off odours
- UBD validity (Use By Date)
- Conformity certificate (moisture, elastic recovery, extraction force, capillarity, cork dust, absence of TCA)

Before bottling, be sure to accurately define the fill point using the **glassmaker's chart** and a **graduated ruler** to ensure **fill level** compliance.

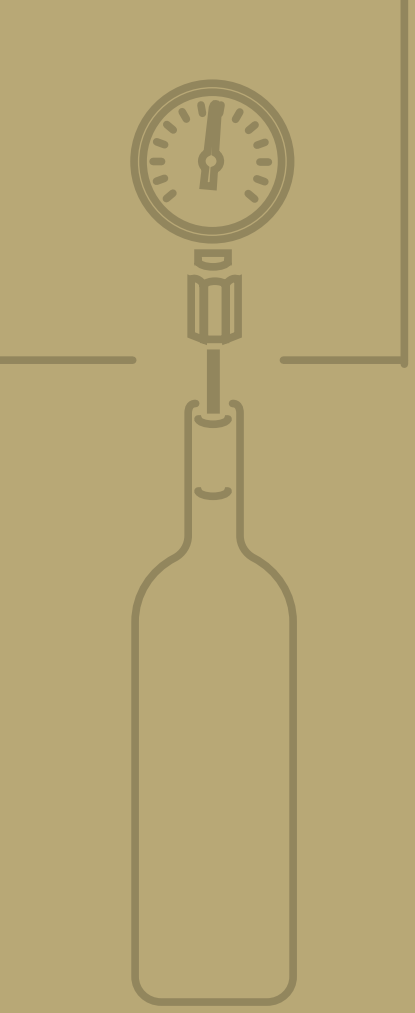
Remember that wine expands with temperature, more or less quickly depending on its alcohol content. This must be considered when measuring the fill height.

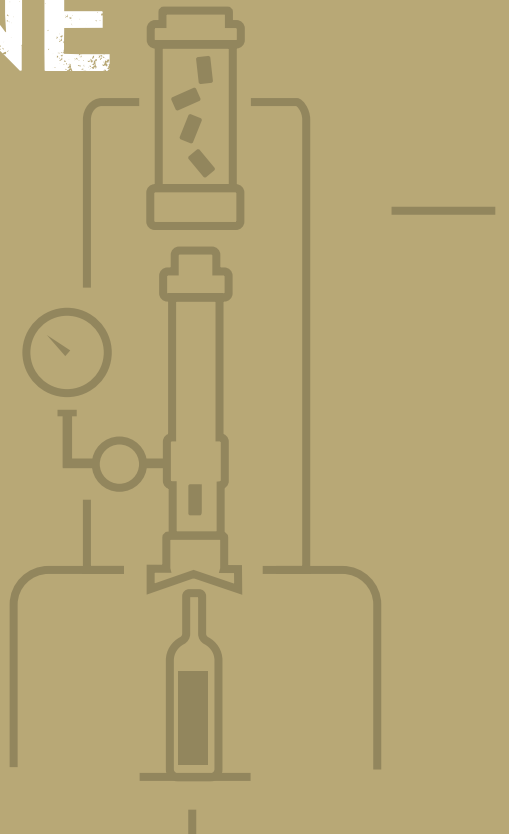
We recommend having a checklist with you on bottling day to record all the checks you performed for follow-up audits: wine, dry goods batch number, epsilon, quantities, temperature, etc.

Download the checklist

Chapter 2

THE CORK MACHINE





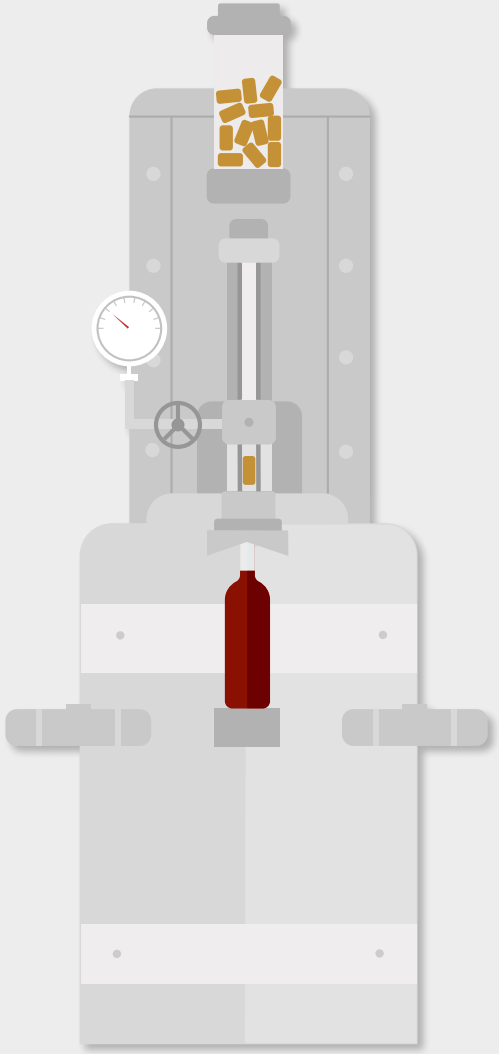
DIAM BOUCHAGE

Cork machine components

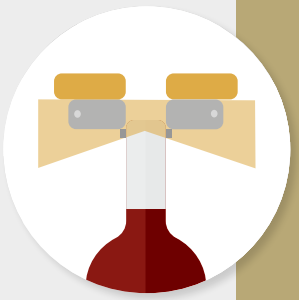
The reception hopper
→ Ensures the corks are fed and routed to the compression box.

The vacuum system
→ Used to create a partial vacuum in the bottle head space.

The cork plunger
→ Pushes the cork into the bottle through the transfer shaft.

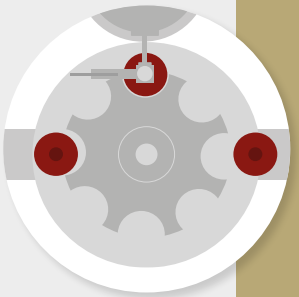


The compression box
→ Usually consists of 4 compressing jaws.
→ Compresses the cork to the required diameter: 15.5 mm + 0.5/-0
Optimum 15.8 mm.
→ Compression should be as consistent and as slow as possible.



The centering device and the transfer shaft
→ The centering device is adapted to the bottle finish.
→ It is used to center the bottle under the transfer shaft.
→ The transfer shaft allows the cork to pass from the jaws to the bottle under the effect of the cork plunger.

The pedestal and the compensation spring
→ Can be used to compensate for bottle height tolerances.



The bottle guiding system
→ Consists of the star, counter-star, and guides.
→ Used to guide the bottles to their correct position on the pedestal.

Watch a video of a running cork machine

Corking speed

The machine must be set according to manufacturer's recommendations.

	Speed per head (bottles/hour)		
	Minimum	Recommended	Maximum
Single head corker	800	**2 000**	2 500
Multi-head rotary corker	800	**1 250**	1 500

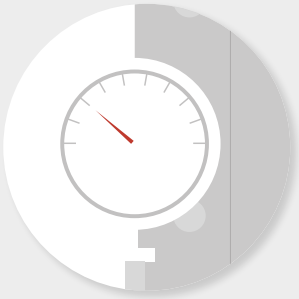
What are the consequences of a poorly adjusted bottling speed?

→ **Too fast:** this can lead to bottle shakes and wine rising up in the neck before corking.

→ **Too slow:** risk of inconsistent and short cork insertion.

The vacuum system

Use of vacuum: a fundamental step



The presence of gas in the head space can contribute to overpressure in the bottle.

It is therefore essential to create a vacuum before cork insertion.

- Creating a relative vacuum is done by extracting the ambient air in the head space before closure.
- It requires having a good understanding of the equipment (control, maintenance).
- The CETIE standard indicates the required vacuum value: 0 + 0.1 bar (relative).
- We recommend to check the vacuum after closure using an aphrometer to validate the setting (see P.15).

What are the risks of an uncontrolled vacuum?

If the vacuum is not done properly, it creates pressure in the bottle.

In case of temperature increase, there is a hydraulic risk: the wine expands and the gas pushes the closure upwards potentially creating seepage or leakage.

No vacuum also amplifies cork insertions inconsistencies.

The winemaker can decide to inert before vacuum.

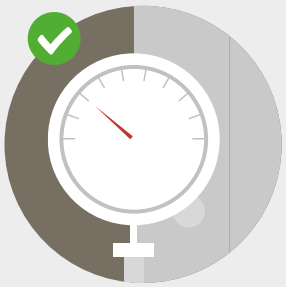
Inerting consists in replacing the ambient air present in the bottle by an inert gas (nitrogen, argon, CO_2, etc.). This limits the contact with oxygen as much as possible.

In this case, since inert gases might have lower compression capacities, the vacuum must be even better controlled to avoid cork push-up.

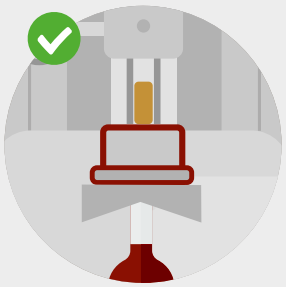
The vacuum system

Setting and checking the vacuum system

The vacuum system is susceptible to clogging easily due to potential suction of wine or dust. To ensure it works properly, it must be cleaned regularly and monitored rigorously before and throughout the filling process.

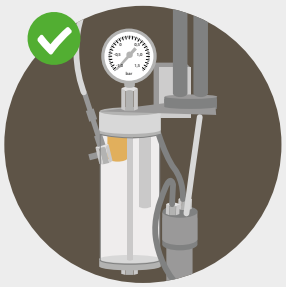


Adjust the vacuum pump according to the CETIE standard: 0 + 0.1 bar.



The bottle must be at the proper height, resting tight against the centering device.

Check the vacuum in the bottle headspace using an aphrometer.



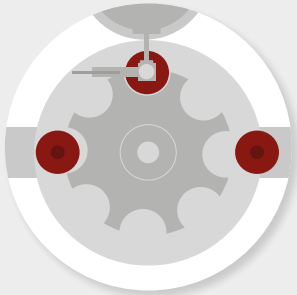
Check the equipment general condition to avoid leaks in the circuit.

A tip for checking the table is at the proper height: the bottle should not manually turn when it is placed between the centering device and the pedestal. Test 4 to 5 different bottles per corking head as their height can vary by a few millimeters.

Watch the video

The centering system

The bottle centering system



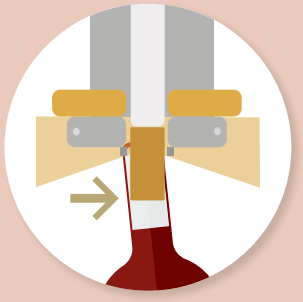
Two principles ensure effective bottle guidance:

→ Equipment suited to the type of bottles used.
Star(s), counter-star(s) and guides must be changed as needed and always be suited to the bottles shape.

→ Properly adjusted equipment for proper bottle centering.

What happens when the centering system is not properly adjusted?

1. The bottle isn't positioned correctly under the centering device : It is not aligned with the axis of the transfer shaft (angular deviation).



2. The closure hits the entrance of the neck and rolls up. It goes down into the bottle, pushed by the plunger but rubs hard against the inside of the neck. The insertion is neither complete nor correct.

Consequences:
the closure could be badly inserted, on an angle in the bottle, damaged, or folded.

The centering system

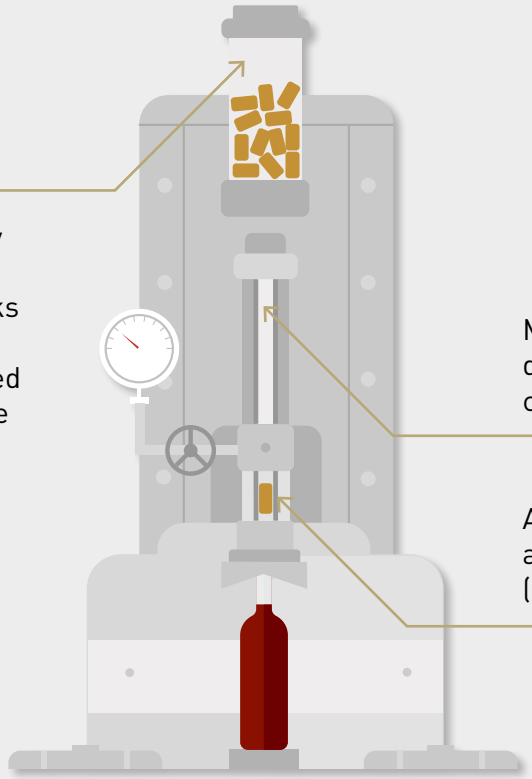
The cork distribution system

The receiving hopper and descent ducts must ensure the corks are evenly distributed without damage.

Close supervision:

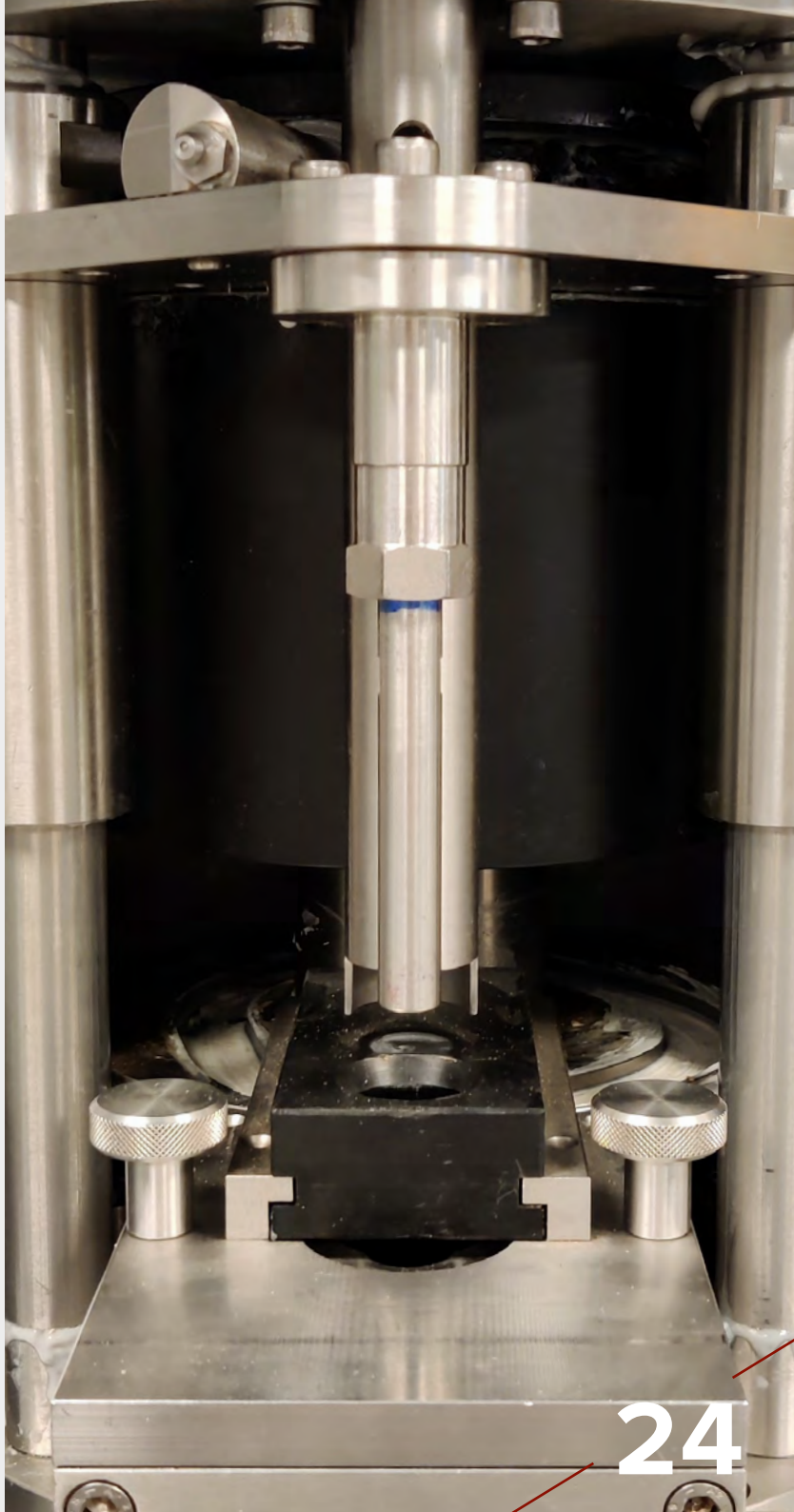
Make sure the hopper is clean.

Avoid having too many corks in the hopper: the coating of the corks supporting too much weight can be damaged by abrasion and create dust.



Match the diameter of the distribution ducts to the closures.

Adjust distribution tube height according to closure length (related risks P.31).



The pedestal and compensation spring

For proper operation, 2 controls must be made on the pedestal:

→ **Surface condition**

The surface must be smooth and clean so that the bottle can slide and keep its vertical position.

→ **Flatness**

The pedestal must be perfectly flat, so the axis of the bottle is aligned with the axis of the plunger (no angular deviation). An uneven pedestal could cause a bottle centering problem and result in improper bottling.

Here is how the pedestal moves

There are two types of pedestal : mechanical (spring-loaded) and pneumatic.

For a mechanical pedestal, initial spring calibration is 100+/-20 daN.

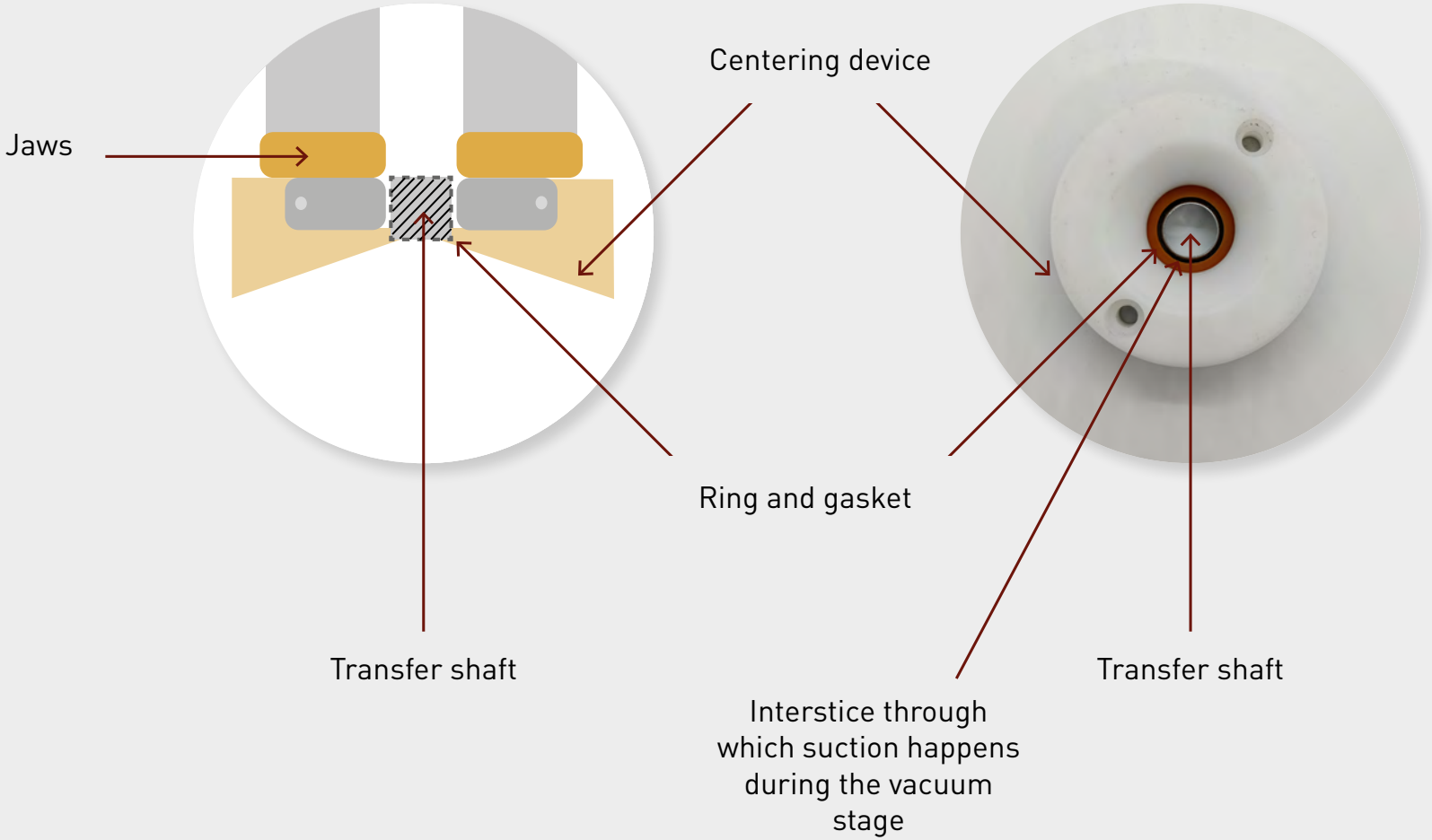
What happens when the spring if worn out or broken?

The spring does not do its job and no longer pushes the bottle up against the centering device. When the plunger pushes the closure down, the bottle will tend to descend, which could cause inconsistent insertion.

The centering device

The corker head

It is composed of the centering device and the transfer shaft.



The centering device

Checking the centering device

The centering device is used to center the bottle under the transfer shaft. There are two things to check before bottling:

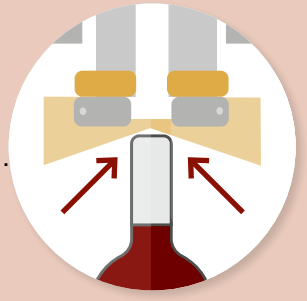
- The profile of the centering device must match the bottle finish and fit perfectly for a good seal.
- The gaskets - if any - must be in good condition for the vacuum to occur properly, with no leakage, and no risk of overpressure.

The centering device usually wears out quicker on the side corresponding to the star rotation direction.

What happens if the centering device is worn out or poorly adapted ?

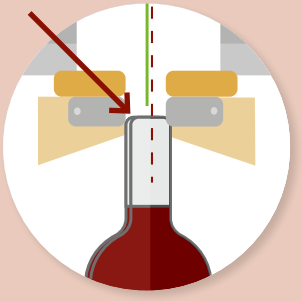
If too small:

the bottle will be positioned too low, the cork won't be properly and fully inserted. There is a risk of having a folded or skewed closure and a poor vacuum.



If too wide or worn out:

the axis of the centering device will no longer be aligned with the axis of the transfer shaft.
The cork will rub against or hit the bottle neck and be damaged.



The plunger

The plunger pushes the closure into the bottle. The steps below should be followed at the beginning of the process:

- Adjust the plunger using the nut/locknut system or electrically (in case of rotary corkers).
- The plunger must be well centered, correctly secured and clamped.
- Adjust the height for an ideal closure insertion of less than a millimeter from the bottle mouth. It should not protrude or be inserted too deep.

What are the consequences of an improperly adjusted plunger?

A wrong height

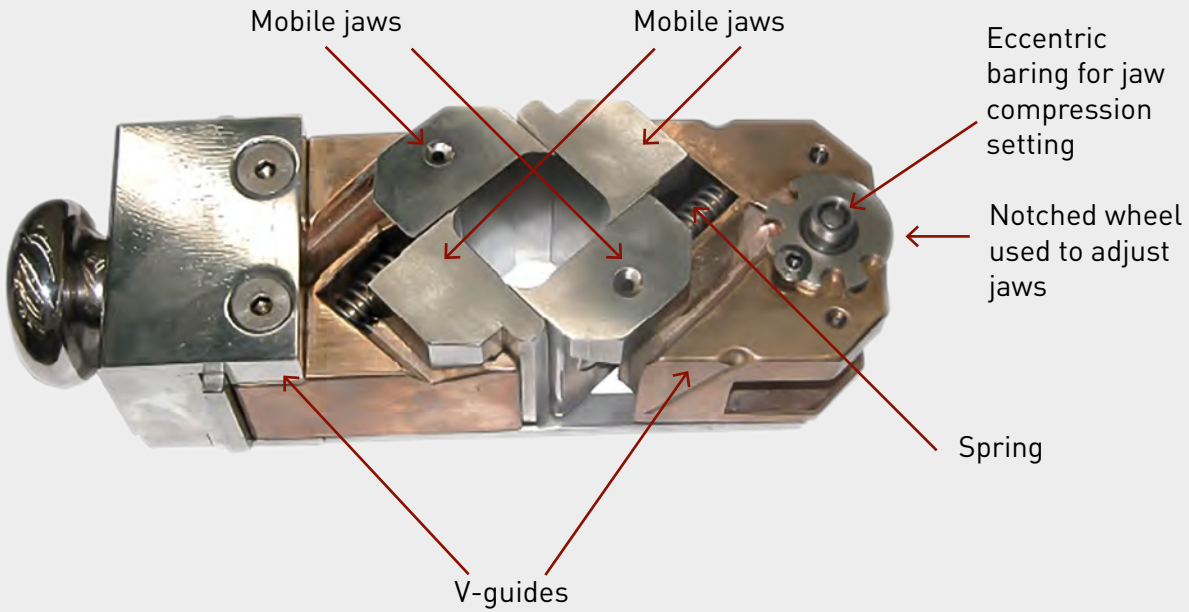
causes a bad cork insertion: too high or too low.

A slow plunger speed

(Sometimes linked to machine speed), means that the closure recovers its initial diameter too quickly when leaving the jaws. The plunger will then force the closure into the bottle and damage the cork or the coating.

The compression unit and jaws

Compression unit components

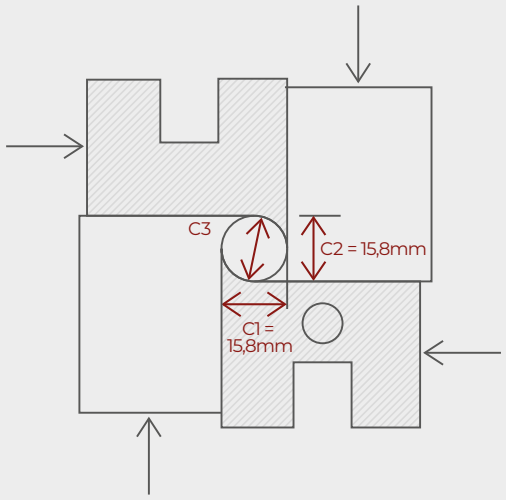


The compression unit and jaws

Adjusting and checking the jaws

The compressed jaws must form a cylinder:

- The dimensions to check are C1 and C2 (minimum diameters) and C3 (maximum diameter).
- C1 and C2 must be measured using a calibrated gauge. The diameter should be between 15.5 and 16 mm.
- The ideal dimension of C1 and C2 is 15.8 mm.
- C3 is measured using a comparator. The maximum clamping diameter of the jaws must be smaller than the inlet diameter of the transfer shaft.
- The jaws setting is the same regardless of the type of closures used and the length chosen.



Compression is checked using a calibrated two-line comparator or a gauge.

Watch the video

The compression unit and jaws

Illustration of potential mechanical issues

A common risk is the punch cut closure.

This can be due to:

- The jaws height is not adapted to the length of the closure.
- The run rate is too fast.
- The distribution tube is too high.

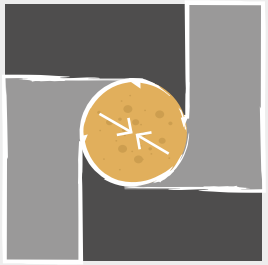
The cork protrudes from the compression unit.

The protruding part is not compressed.

The plunger inserts the cork and punch cuts it.

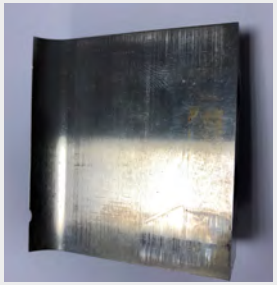
The protruding part of the cork is cut off.

The jaws are critical parts for a quality corking



Chipped jaws inevitably cause cuts of varying depths in the closures. Damaged closures can then lead to wicking and/or leakages.

Due to the extreme mechanical stress, it is normal that the jaws wear out. The clamping diameter then becomes too large and the cork is no longer compressed enough for quality insertion.



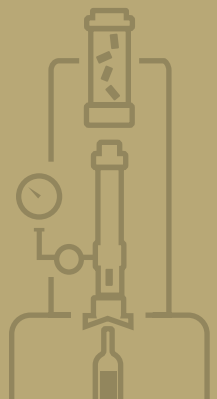
How to maintain?

- → Dismantle and check the condition of the jaws after every use and every incident, being very careful not to chip them.
- → Check the integrity of the moving parts, the surface condition (cleaning and dusting) and the lubrication (greasing).

Take a close look at:

- → Proper jaw blades position.
- → Absence of chipping on jaw blades.
- → Absence of ducts in the jaw ellipse.

SUMMARY



To optimally prepare for bottling, follow the cork machine checklist:

SETTINGS
before bottling

- Distribution tube: adjust the height according to the corks used.
- Centering system: suited to the shape of the bottles used.
- Centering device : suited to the bottle finish –good seal.
- Pedestal: flat surface - dynamic spring (bottle turning test).
- Plunger: centering • clamping • insertion height.
- Jaws: Diameter of 15.5 mm + 0.5/- 0 Ideal: 15.8 mm • no chipping.
- Corking speed: according to the manufacturer's recommendations.
- Vacuum system: 0 ± 0.1 bar (relative).

ROUTINE CHECKS
throughout the bottling process

- The vacuum in the bottle after corking, using an aphrometer.
- The quantity of corks in the hopper.
- Cork insertion: between 0 and 1mm deep.
- No liquid between glass and cork: as little as possible!

Disassemble and clean the jaws, corker head and centering device after every use AND after every incident.

On bottling day, we recommend using a checklist to record your controls for follow-up audits.

Download the checklist

To help you remember which corker parts to check when you notice a closure defect, please refer to our dedicated document.

Download the document

STILL WINE CLOSURE

Good practices guide

At DIAM Bouchage, a French company located in the Pyrenées-Orientales, we have been working for over fifteen years to offer innovative solutions for winemakers.

The company produces and markets nearly 2.4 billion closures a year. Our success was primarily built on the Diamant® process, which extracts the TCA molecules responsible for cork taint (under the quantification limit of 0.3 ng/l).

We offer a large cork range able to meet the different needs of the market in terms of oxygen delivery for desired ageing.

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