



GOOD PRACTICES FOR THE USE OF VERALLIA BOTTLES FOR CARBONATED PRODUCTS

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The following observations are intended to:

- raise users awareness to the importance of controlling the internal pressure in the bottles;
 - summarize the key points related to the use of glass bottles for carbonated products. The glass production plant must check the suitability of the bottle for the internal pressure induced by the contents and its conditions of use.

This document is supplemented with recommendations from Verallia's technical-commercial services. It does not exempt users from their responsibilities.

1 – INCREASED INTERNAL PRESSURE IN BOTTLES CONTAINING CARBONATED PRODUCTS

The following elements have an exemplifying function and must, naturally, be checked according to the bottled products.

The different parameters that can influence the pressure inside the bottles are:

- the carbonation rate per g/l
- ≡ the temperature increase
- the filling level
- the sugar content
- the alcohol content

With regard to each of these values we may say that the higher they are, the higher the pressure will be. It is essential to take each parameter individually into account, but it is also very important to take their combination into account, especially when several of these parameters are at the MAXIMUM limit.

A – Carbonation rate or carbon dioxide rate (CO₂)

For an appropriate filling level, at a temperature of 20 °C, the approximate increase in internal pressure according to the carbon dioxide (CO₂) rate is as follows:

2 g/l of CO ₂	approx. 0.5 bar
3 g/l of CO ₂	approx. 1 bar
4 g/l of CO ₂	approx. 2 bar
6 g/l of CO ₂	approx. 3 bar
9 g/l of CO ₂	approx. 5 bar
12 g/l of CO ₂	approx. 7 bar
14 g/l of CO ₂	approx. 9 bar
18 g/l of CO ₂	approx. 12 bar

B – Temperature that the bottle can endure

This is a basic parameter, but unfortunately it is not always taken into account in storage, transport and marketing processes. It is necessary to determine the maximum temperature to which each product will be subject. In storage, transport and marketing, the maximum temperature to be taken into account is usually 50 °C.

Some theoretical examples for a product:

CO2 rate	20° C	30 °C	40 °C	50 °C
4 g/l	2 bar	2.5 bar	3 bar	5 bar
9 g/l	5.5 bar	8 bar	10 bar	12 bar
15 g/l	10 bar	15 bar	22 bar	30 bar

It is possible to determine a pressure evolution curve according to the temperature for a given product or product family.

C – Percentage of free volume (expansion chamber) and filling level

This parameter is intended to leave a volume of air in the neck of the bottle. It is calculated during the bottle design phase so that all tensions known and related to the product, and the purpose for which it is intended, are taken into account (expansion coefficient, sugar content, carbonation, etc.).

It is very important, in particular, if certain elements are not respected.

The increase in temperature and its effect on the expansion of the content will result in a decrease in the volume of the expansion chamber and, consequently, an increase in the internal pressure which, in turn, translates into an increase in the tensions generated on the bottle walls, which may compromise the airtightness (leaks) and even cause the bottle to break if the resistance strength is exceeded.

D – Sugar content (except fermentation)

When there are slight variations, this parameter has little influence (about one tenth of g/l); however, it can have major influence if there are large variations. In this situation, it may significantly alter the expansion coefficient of the product and consequently trigger the risk of pressurisation described above.

E - Alcohol content

In the range of sparkling wines, this parameter presents little variation and its consequences are limited, even insignificant.

2 – PRECAUTIONS FOR USE

The use of a glass packaging for a product or function for which it was not designed may present risks.

Aggressions on the surface of the glass are determining weakening factors in relation to the pressure resistance capacity for which the bottle was designed. As far as its use is concerned, the following shall be avoided as much as possible:

- aggressions caused by abrasion on the machines and during handling
- aggressions resulting from shocks in these same circuits
- various abrasions, such as washing outside or inside with abrasive elements. As a general rule, re-using

pressurised bottles is forbidden.

Another parameter that must also be taken into account regarding the risk of breakage is stacking. It combines:

- horizontal crushing forces, in addition those of pressurisation
- risk of abrasion and shock during handling
- risk of damage to adjacent bottles in case of a broken bottle. Of course, the higher the pressure, the greater the damage to adjacent bottles after a bottle has blown.