GUIDELINES AND PRACTICAL ADVICE ON HOW TO USE VERALLIA CONTAINERS: FILLING WITH CARBONATED PRODUCTS

This information sheet aims at:

- calling users' attention to the importance of checking internal pressures in bottles .
- describing essential elements as for the use of glass containers

This information sheet:

- shall be possibly integrated by suggestions given even verbally by the Customer Service Verallia Italia SpA
- shall not limit the responsibility of customers and/or users who shall in any case make sure they take any necessary precautions due to the nature of glass containers.

In particular, we draw your attention to:

- the importance of checking internal pressure in glass containers in general, with particular reference but not limited to bottles;
- the eligibility of each glass container to bear the internal pressure generated by the content it is to be filled with and by its conditions of use, shall always be verified by the customer before to order a product to Verallia Italia S.p.A.

1. Increase in internal pressure of glass containers filled with carbonated products.

The different parameters that may affect the internal pressure in glass containers, are:

- carbonation rate expressed in g/l;
- increase in the temperature a container may be subject to during its use;
- actual filling level (head space);
- sugar content;
- alcohol content.

Generally speaking, for each of these parameters, the higher the value the higher the internal pressure the container is subject to. Each parameter taken individually, is essential but it is also very important to consider their combined effect, especially when some of these parameters are present at their maximum level.

Of course, the elements - mentioned above by way of an example - have to be preliminarily checked on a case by case basis by the customer, depending on the fills the containers are intended for and on the Country they are going to be sold in.

Here below you find some broad indications.

A. CO2 or Carbonation Rate.

For an adequate filling level, at a temperature of 20 °C, the increase in internal pressure as a function of CO2 value is as follows:

2 g/l of CO2	approx 0,5 bar
3 g/l of CO2	approx 1 bar
4 g/l of CO2	approx 2 bar
6 g/l of CO2	approx 3 bar
9 g/l of CO2	approx 5 bar
12 g/l of CO2	approx 7 bar
14 g/l of CO2	approx 9 bar
18 g/l of CO2	approx 12 bar

B. Temperature the bottle may be subject to.

“Temperature” is an essential parameter and, unfortunately, is not always considered, after the delivery of the containers coming from the glass factory, in the processes for storage, transport and marketing. It is essential for each product to calculate the maximum temperature it is going to be subject to. As for storage, transport and marketing, the maximum temperature value you usually have to consider is 50 °C.

The table here below shows some theoretical examples referred to the same glass container

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

Please note that for each fill or group of fills, you have to calculate the evolution curve for pressure as a function of temperature.

C. Head space and actual filling level.

This parameter aims at guaranteeing there is a volume of air in the neck of a glass container. It is calculated when designing the container so as to consider strengths/pressures - known parameters linked to the specific product and its use (expansion coefficient, sugar, carbonation). This is extremely important when some elements are not going to be observed: an increase in temperature (expansion of the liquid fill) may lead to a very reduced and/or null volume of air between the liquid and the cap and therefore to an increase in pressure and strength/tension applied to the glass container. Such situation may degenerate to a container being hydraulically pressurized (liquid/cap contact) until possible failure if the pressure value is higher than the minimum container strength (content draining out, dispersions).

D. Sugar content (fermentation process not included).

At first, this parameter can have little effect if minimum changes occur, i.e. changes within approx. 10 g/l. However, it can become important in case of major changes. As a matter of fact, this parameter may considerably modify the expansion coefficient of the fill and reduce or eliminate the head space, thus risking to have a glass container hydraulically pressurized to failure as described in item C.

E. Alcohol content.

In moderately sparkling and/or lightly effervescent wines, this parameter has small changes and consequences are thus limited or negligible.

2. Precautions for use.

Using a glass container for a product or a purpose it was not designed for, can be dangerous.

Aggressions on glass surface are significantly increasing glass brittleness and are crucial in affecting bottle resistance to the pressure level it was designed for.

Therefore, when using a glass container, you have to limit as much as possible:

- aggression through scratches while inside the machines or during handling;
- aggressions due to contact during the above-mentioned processes;
- various abrasions, like for ex. external and/or internal washing by using abrasive materials.

You are not allowed to use such “pressurized” bottles as refillable bottles.

Another parameter to be assessed when considering the risk of failure, is stacking,as it combines:

- horizontal compressive strength that adds to the pressurization stress;
- risk of abrasions and impacts during handling;
- risk of abrasions on adjacent bottles, in case of a bottle failure. Of course, the higher the pressure the more the glass bottle burst increases the brittleness of adjacent bottles.

The limits of the specifications in the DSCP concerning internal pressure resistance, are no longer valid and cannot be taken into consideration for those containers that underwent second processing (for ex.: silk screening, satin-etching, etc.).

Our customer service is at your disposal in case of doubts, and can send you the DSCP (technical sheet) updated with the limits for use.