Guide of Good Practices
for the filling of wine in BIB

I. Wine Preparation:

Control dissolved oxygen at its source

Key points:

- An extra milligram of dissolved oxygen per litre reduces shelf life by month
- Select options that reduce levels of dissolved oxygen
- Good preparation of wine before filling

1. Recommendations concerning equipment

1.1. Positive displacement pumps should be preferred to centrifugal pumps

1.2. Tanks that allow the use of inert gases to protect the wine will be preferred.

1.3. Filtration being the critical point, the method used will have to take into account as much as possible the risks of oxygen introduction.

1.4. Connections must be perfectly tight. No leak, even the occasional drop, should be tolerated. The fact that equipment is pressurized does not prevent air from getting in through the Venturi effect as soon as rapid wine flow occurs.

2. Recommendations concerning work methods

2.1. Do not operate pumps when cavities (spaces) have formed in the wine that is being pumped.

2.2. Pay attention to the filling of storage tanks which should occur from below and to the emptying of the tanks when a vortex can form drawing in gases.

2.3. Be aware that physical treatments such as tartrate stabilization via cold temperatures (although often necessary) can also increase levels of dissolved oxygen since the dissolution of gases in wine becomes greater as the temperature decreases.

2.4. As any intervention on wine should be done as much as possible in the absence of air, the use of inert gases in wine transfer circuits is advisable. Likewise drainage of the installation should be flushed by an inert gas.

2.5. Rigorous and preventive maintenance must be set up on all the elements that are critical oxygen-wise: the joints of tank doors, hoses, pumps, etc. must be regularly changed. Likewise circuits related to inert gases must be regularly tested to ensure that they are not contaminated by air.

3. Recommendations for wines that are to be filled in BiB

3.1. Choice of the wine. The characteristics of the wine are important determinants of its capacity to resist oxidation and the growth of micro-organisms. A low pH (high accidity) results in a higher level of molecular SO_2 which is the active form in prevention microbiological growth.

3.2. Low ratio of free SO_2/total SO_2 may indicate that the wine has already had a past history of SO_2 addition and combination. Wine shelf-life will generally be longer if the pH is low and the ratio free SO_2/total SO_2 is high.

3.3. The Performance BiB study noted that free SO_2 fall during the weeks which follow filling is always higher with BiB than with glass bottles. Generally the initial level of free SO_2 is slightly higher for BiBs especially in the case of fragile wines. It is frequent to observe rates of 40 to 50 mg/l even higher in the case of wines shipped over long distances.

3.4. Mix the SO_2 well added prior to filling. Lack of proper SO_2 mixing is still observed in the field. The problem is perhaps amplified because greater SO_2 is sometimes added to BiB wine than for bottled wine. It is important to measure and record SO_2 levels including after adding additional amounts.

3.5. The use of other additives commonly found on wines poses no BiB specific problems except for CO_2. Indeed, an excess of CO_2

can cause problems with the boxes when the package undergoes a rise in temperature. Gases that were dissolved in low temperatures will come out of wine in gas form, forming a bubble whose volume is added to that of the wine. Boxes for which the inside volume is fixed will then inflate and deform. In practice a rate of 1000 mg/l of CO_2 is not to be exceeded and 600 to 800 mg/l if higher storage

temperatures are anticipated. An excess in CO_2 can be treated by inert gas bubbling. The oxygen which penetrates into the BiB results in a decrease in free SO_2 and the wines become less protected against the growth of microorganisms. The presence of residual sugar will increase the risk. Consequently, sterile filtration of wines that contain residual sugar is essential.

Certain precautions relative to the physical properties of the films used

- The development of Brettanomyces yeast is occasionally observed in some packaged wines. This produces flaws linked to the production of volatile phenols (such as ethyl-4-phenol) and these flaws are sometimes mistakenly attributed to the package being described as yielding a “plastic” taste or odour.
- The prevention of this risk implies their elimination (via filtration or thermal treatment) maintaining high enough free SO2 levels and sterilizing the filling machine.
- Acetaldehyde (or “ethanal”), present in the wine might also require more attention since it may contribute the observed fall in free SO_2. This analytical parameter could be taken in consideration along with the level of dissolved oxygen when explaining the rapid fall of free SO_2 during the days following filling.

II. Filling

Achieving acceptable filling line Performance

Key points:

- Conceive of the filling line as a controllable process

- Give particular attention to wine transfer circuits
- Improve work methods to assure total quality

1. Recommendations concerning equipment

1.1. Materials – all materials, including lubricants in contact with wine, should be approved for food use and should be able to sterilized.

1.2. Circuits – good engineering practices must be respected regarding circuit design and production (tapping, welding, etc.) as well as component choices in order to avoid so-called "dead zones" which are sources of contamination. Ease of cleaning and sterilization must be a priority

1.3. Wine intake – all points must be inspected so as to guarantee a total absence of leaks; wine pressure and incoming flow rate must be well adjusted for precise dosage; a system to prevent against the water-hammer effect (surge resulting from a sudden change in liquid velocity) must be installed to protect the joints of the filling heads and the filtration cartridges.

A rigorous set of guidelines
for the filling machine

- The pump which pushes the wine towards the filters must be set according to the average flow rate of the line and not according to the instantaneous flow rate at the filling head. This makes it possible for it to work without interruption and results in less pressure surges during filtration. It is also a way of avoiding the overuse of by-pass (obligatory on positive-displacement pumps) which can cause a harmful stirring of the wine. After filtration the wine should be channeled into a buffer tank under neutral gas. Wine pressure on the outlet side of the buffer tank should be constant and regulated taking into account the possible variations in the wine level. The buffer tank can be used to prevent the water-hammer effect if it is very close to the filling machine.
- The filling machine must :

a) Create a vacuum in the bag before filling in order to prevent foaming and to limit oxygen introduction in the wine;

b) Achieve proper sealing between the gland and the filling head
c) Have an adjustable table so as to obtain the smallest possible gas bubble in the bag. The length of air cone generator (line) should be monitored and adjusted if necessary. An objective to achieve might be 5 cm or less for a BiB of 3 or 5 litres;
d) Allow the injection of an inert gas at the end of the filling;
e) Be easy to clean inside wine circuits as well as outside. Zones where wine spill retention can occur must be avoided;
f) Have a sterile liquid joint on the filling head piston which prevents air intake in the event of a joint failure;
g) Be designed in such a way that no contaminated drop from condensation or foreign element can fall inside the bag before tapping. Drops of wine on the bag are to be avoided (risk of mould, etc.)
h) The packing of the bag in the box must be done under conditions which minimize film crumpling with a minimum of physical aggression from falls, frictions, contact with abrasive surfaces and other objects that might damage the film;
i) The gluing of the boxes after bag insertion should be done in such a way that no part of the film gets stuck between the flaps and no glue point should touch the film.

2. Recommendations concerning the work methods

2.1. Systematic recommendations:

2.1.1. The cleaning and sterilization of the entire wine circuit from the tank to the filling machine must be carried out before the beginning of each filling session;

2.1.2. External cleaning of the entire filling area should be done before each fill run and after each incident having caused a wine overflow or splashing inside this area;

2.1.3. The first bags filled will be discarded due to too much dissolved oxygen, especially if inert gases are not used to flush the circuits;

2.1.4. All persons who are in contact with the filling machine must follow strict rules relative to body hygiene;

2.1.5. The amount of wine filled inside the bags must be monitored and corrected in accordance with applicable regulations;

2.1.6. A complete cleaning of the filler should be carried out at the end of each run.

2.2. Recommendations for optimization

2.2.1. The use of inert gases inside the entire wine circuit is recommended so as to eliminate any air (and thus oxygen) present in piping before sending the wine through. Pushing the wine with the use of a neutral gas can also sometimes replace a pump;

2.2.2. Dissolved oxygen controls should be done inside wine storage tanks, before in the filling machine and in the filled bags. An abnormally high rate of dissolved oxygen is a sufficient reason to stop filling. This test makes possible, among other things, the detection of an air intake somewhere along the line.

2.2.3. Microbiological sampling should be done on the first bags filled. New analyses may be justified during a fill run – after a line stop for example. The results of these analyses and sample bags should be kept for several months to create a database useful in the event of a subsequent complaint.

III. The Package

Bags and boxes: Adapting the container to the contents

Key points

- Watch out for misleading laboratory results for oxygen permeation
- Determine and verify package dimensions
- Apply recommendations for control and storage

1. General Recommendations

1.1. Relative to oxygen permeation results

Among the various types of films and taps currently available on the market, the choice will be made depending on a number of

parameters, including the type (truck, rail or ship), duration and conditions (humidity, temperature, etc.) of transport.

1.2. Master flex-cracking

Box dimensions and the quality of inner paper have a great influence on flex-cracking and film wear so one should follow the following recommendations:

1.2.1. A non-abrasive paper should be chosen for inside the box to limit wear on the film;

1.2.2. The inside dimensions of the film determine the level of freedom of movement of the bag and thus contributes to the level of flex-cracking. The internal volume of the box should be approximately equal to the nominal volume of the bag plus 0.5 litres;

1.2.3. The dimensions of the bag should also be well adapted to the form of the box. Assume that lc = horizontal length of the box in cm, wc = side width of the box in cm, hc = height of the box in cm. To calculate the dimensions of the bag in cm, apply the following rules: the length of the bag = wc + hc and the width of the bag = lc + wc + 1;

1.2.4. Beware of inks and varnishes which can alter the taste of the wine.

2. Specific Recommendations

2.1. Package supplies should be kept under controlled conditions to avoid extremes in temperature and moisture;

2.2. The storage duration of empty bags should be as short as possible, and should not exceed, under any circumstances, the duration recommended by the supplier;

2.3. Operators should randomly control the bags at reception or before filling so as to detect such defects as air trapped between film layers, gland or film welding flaws, de-lamination, etc.

2.4. The boxes should be controlled to verify dimensions as how well the sides are put together, especially the absence of edges likely to cut or wear out films.

IV. Storage of filled BiBs

High storage temperatures – the great enemy of BiB

Key points

- Low temperatures preserve the organoleptic qualities of the wine
- Reduce handling of package to a minimum
- Apply just-in-time production with minimum stocks

1. Knowledge from Performance BiB study

1.1. High temperatures are detrimental to the wine BiB shelf life;

1.2. High temperatures also have a clear negative impact on the colour (for white wines), on free SO_2 and on total SO_2. In the example of white wine (Chardonnay), stored at 20°C in BiB, with a level of SO_2 of 45 mg/l and if we estimate that the same wine will not be well protected against oxidation if the level of free SO_2 goes lower than 15 mg/l then we can observe that an increase of temperature of 10°C (storage therefore at 30°C) reduces the shelf life of the wine by almost half (from 8 months at 20°C to 4 months at 30°C);

1.3. Several studies on other forms of packaging have also shown that low storage temperatures best protect the organoleptic qualities of the wine

2. Recommendations:

2.1. Shelf life test for a period of 6 to 12 months should be conducted with sample bags taken during filling preferably at a temperature sufficient to speed up the wine ageing process. If these bags are not subject to transport stress then one might assume that the shelf-life observed through these tests might be less than in real distribution channels;

2.2. When regrouping boxes are not used, pallets should preferably be prepared with sheets (often cardboard) between each row to improve stability and reduce the constraints on BiBs close to the edges. When a different stacking procedure is used for every other row, these sheets also serve to reduce alignment induced problems;

2.3. The amount of loading-unloading undergone by the pallets should be reduced to the bare minimum;

2.4. Storage should take place in an areas exempt from all products that could communicate an off-taste or odour;

2.5. The temperature of the storage location should be kept as low as possible. Maximum temperature < 25^{o}C (recommended 20^{o}C);

2.6. Ideally these conditions should be maintained throughout the supply chain;

2.7. BiB is not designed to store wines over a period of several years. Filling centres should apply just-in-time production methods and carry minimum stocks. BiBs should be filled relative to customer orders and shipped quickly.