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PRESSURE SENSITIVE LABELLING

ON GLASS BOTTLES AND JARS

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This practical guide was prepared by the International Technical Centre for Bottling and related Packaging (CETIE)

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INTRODUCTION

This new edition is an updated version of the inter professional guide edited in September 1997 by the Chambre Syndicale des Verreries Mécaniques de France (CSVMF) under the title "Pressure Sensitive Labelling".

The purpose of the Best Practice Guides edited by CE.T.I.E. is to make available to all the actors of this business sector an inter professional reference recognized by all. They set out to define the technical bases and the state of the art of a specific domain.

Responding to the suppliers' obligation to inform their users, these guides help to guarantee the marketing of safe and healthy products and to ensure product security for the end-user, essential qualities to assure ongoing production.

Various European bodies participated in the compilation of this guide.

All diagrams and photographs shown in this guide are by way of illustration to facilitate the comprehension of the text. They do not represent either a recommendation of equipment, or the entirety of what can be found on the market.

SUMMARY

1. PRESENTATION OF THE STUDY

This document concerns only pressure sensitive labelling on glass bottles and jars.

The principal objectives of the working group are as follows:

- to give manufacturers and users a reference tool to help them carry out the operation of self-adhesive labelling and to give guarantees of security for the consumer
- to determine the specifications of each of the elements and of their interfaces
- to give to manufacturers and users a reference document for the establishment of technical documents and quality control procedures
- to facilitate diagnosis in case of malfunctions.

This guide reflects the situation at its date of publication. It was established with reference to the standards currently in force or in preparation and to the professional documents (business practices) recognized by the specialists involved in the working group.

Units of measurement

- pressures are expressed in Pascal : Pa
  10^5 Pa = 1 bar = 1.0197 kgf/cm^2 (rounded up to 1.02)

- loads are expressed in Newton : N
  1 N = 0.10197 kgf (rounded up to 0.102)

- torques are expressed in Newton-metre : N.m
  1 N.m = 8.85 lbf.in

- units of heat surface treatment for glass are expressed in CTU (Coating Thickness Unit)

- surface tensions are expressed in dynes/cm
  1 dyne = 10^{-5} N

Regulations and standards

The norms or specified reference documents do not refer to the date of publishing. It is incumbent on the reader to check their validity.

Verification of measuring equipment

Measuring equipments (gauges, callipers, pressure gauges, thermometers, hygrometers etc...) must be checked regularly and recalibrated if necessary in case of divergences. For devices used in normal conditions in conformity with their proper use, the recommended verification frequency is every 12 months maximum. This frequency is reduced in case of more intensive usage or in the case of more sensitive equipment.

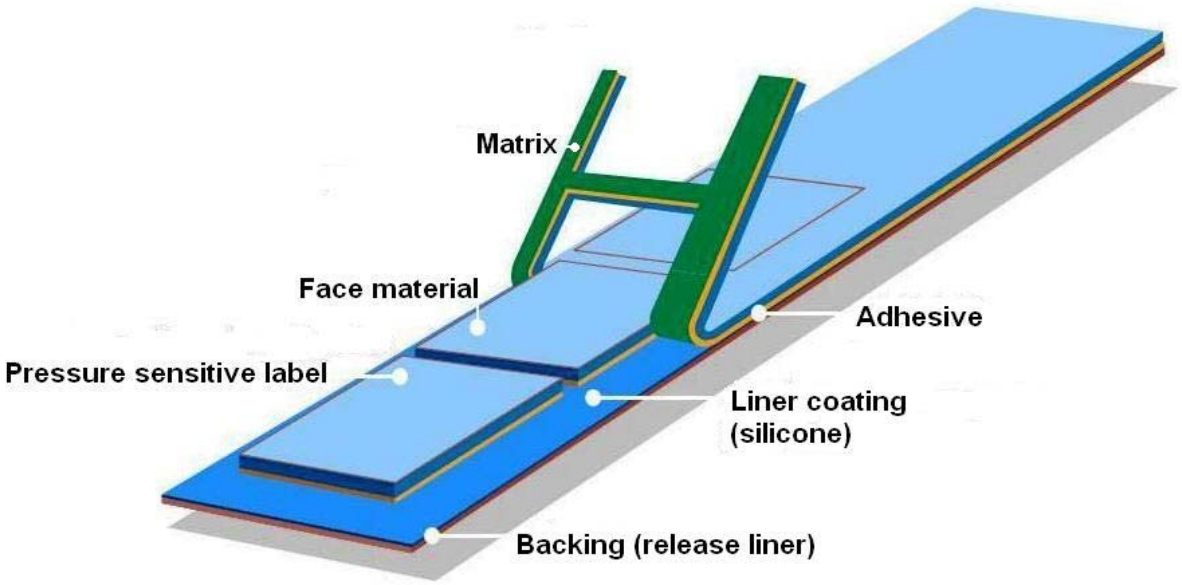
2. FUNCTIONS AND PRESENTATION

2.1 - THE LABEL

- The label is a substrate that carries legal and obligatory information
- It must adhere physically to the glass bottle or jar
- It is a marketing tool giving opportunities for creativity
- It can have a function concerning traceability, anti-counterfeit or security.

2.2 - THE PRESSURE SENSITIVE LABEL

- It is characterised by its simplicity of usage and its wide possibilities for creativity in terms of its geometry
- For its application, it requires equipment less specific than the equipment needed for wet glue labels
- It must adhere to the glass bottle or jar in a way which conforms to the end-use (ice-bucket, refrigerator etc…) and to intermediary steps in the production process (pasteurisation…)
- In certain cases it must be removable by washing after usage (e.g. for returnable bottles or jars)
- It can be transparent.



3. SPECIFICATIONS OF MATERIALS

3.1 - OVERVIEW

By definition, a pressure sensitive label is a dry label that, by the intermediary of a layer of pre-coated adhesive, sticks to the surface of the product to be labelled by contact plus sufficient and uniform pressure on the whole surface of the label.

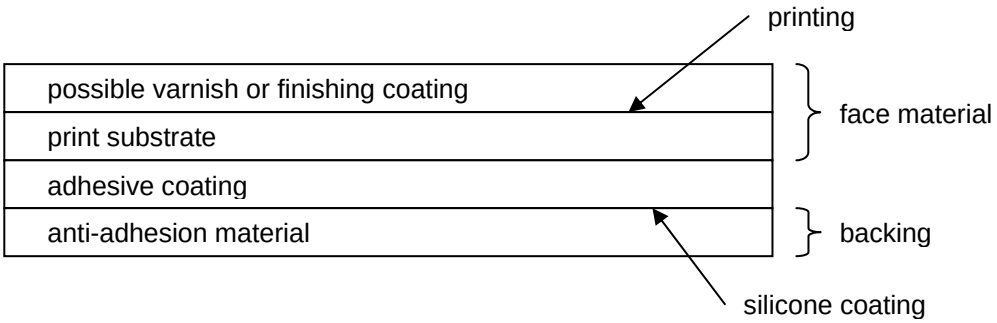
As regards the variety of substrates and adhesives, the first factor to take into account to define a pressure sensitive label is its end-use. For example, there exists a range of label stocks specifically used for wines.

3.2 - THE PRESSURE SENSITIVE LABEL

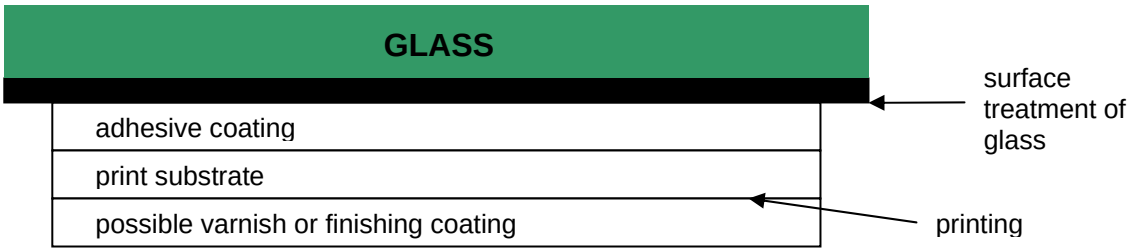
It is composed of three layers:
- the face material
- the adhesive layer
- the release liner

The print substrate (or face material) is printed then die-cut at uniform intervals according to the shape of the label; the release liner (backing) then becomes the carrier that facilitates manipulation and storage in rolls of labels ready for application.

Before application :



After application :



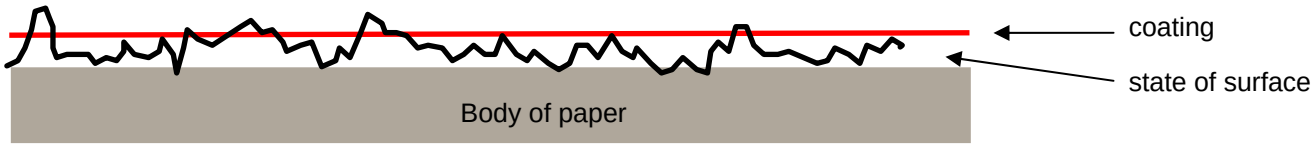
3.3 - THE PRINT SUBSTRATE

The print substrate also called face material can be subdivided into different groups and categories:

3.3.1 - Papers

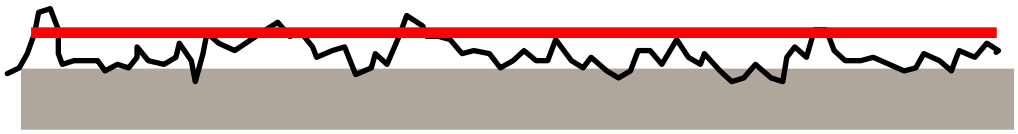
Made from cellulose fibres principally derived from pulp + additives, binding agents together with REH (humidity-resistant), anticryptogamic (antimicrobial) and other “sauces”.

A - Non-coated papers



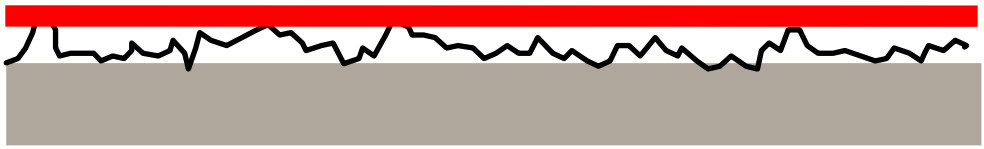
Light surface primer not covering the entirety of the surface fibres + Smoothing.

B – Coated papers



The surface coating covers the fibres, increasing the smoothness of the paper and its printability.

C – Chrome coated papers



Thick surface coating, calendared by a chromed cylinder, giving the paper a high gloss finish.

Certain papers are mechanically distorted during the manufacturing process; these are referred to as structured materials such as laid or webbed papers.

The currently used gram weights are:
- 60 to 80 gr/m^2 for typical applications like small-diameter pharmaceutical flacons (<25mm)
- 80 to 110 gr/m^2 for food processing applications, wines and spirits

D – Metallised papers

There are two families of metallised papers:
- laminated (laminated aluminium foil)
- vacuum-coated metallisation (deposit of powdered aluminium)

3.3.2 - Synthetic face materials

These are commonly called films.

- Polyethylene
- Polypropylene
- Co extruded (a mixture of polyolefines)
- Polyesters
- PVC (less and less used)

These materials are available in white or transparent, corona treated or top coated, with thickness varying from 40 to 150 microns according to the material.

3.4 - THE ADHESIVE

There are two main families of adhesives:
- rubber based
- acrylic based

The adhesives commonly used for labelling glass bottles and jars are:
- either water/solvent based acrylates: these are the "acrylic" group
- or mixtures of rubbers/resins: these are the « rubber » adhesives

PRINCIPAL COMPOSITIONS		
	Rubber based	**Acrylics**
Medium	solvents / heat	solvents / water
Base Body	rubbers	Acrylic polymers
Resins With adhesive properties	Mix of natural and synthetic resins	Acrylic resins

The "active" ingredients for an adhesive are mixtures of polymers/resins or rubbers/resins.

The "mediums" - water, solvent, heat (hotmelt) - serve only to activate the adhesion (manufacture and enduction).

Adhesives are characterized by their adhesive performances : instantaneous adhesion, adhesive strength, cohesion; see paragraph 3.8.

3.5 - THE RELEASE LINER

The release liner is also called siliconised substrate, protective substrate, liner, web carrier, backing, glassine….

Its purpose is to carry the label to the point of application. To do this, it must possess good mechanical characteristics and allow the label to be detected by the different types of optical cell.

There are two categories of release liner :

- The GLASSINES : these are highly refined papers, transparent and suitable for silicone coating. Most release liners are of this type.

- The SILICONE FILMS : usually made from polyester. Their usage is growing rapidly owing to their superior mechanical characteristics.

The quality of the siliconage determines the release force; see paragraph 3.8.

3.6 - LABEL CONVERTING

Labelstock is generally converted on continuous narrow web presses.

Almost all print technologies are used :

- **Typography**

This procedure uses a photopolymer relief form which is coated with a greasy, viscous ink transmitted through several contiguous cylinders, then finally transferred directly onto the substrate using an adjustable pressure mechanism

- **Flexography**

A liquid ink placed in an ink tray is carried by a fountain roll onto a metallic or ceramic cylinder called the anilox engraved with recessed cells, and from there to the plate cylinder with its relief photopolymer print plate that will transmit the ink by direct contact onto the substrate. The ink flow is in addition regulated by a metallic doctor blade that smoothes the ink film onto the anilox roll. The use of UV cured inks gives improved dot definition and therefore a marked improvement in print quality.

- **Offset**

The print plate is a photopolymer coated aluminium plate mounted on a cylinder. It first receives a film of water, which adheres only to the non-printed parts and then via a fountain roll, an ink film that is repulsed by the water and adheres only to the dry parts of the surface of the plate. The film of ink obtained in this way is then transmitted to the substrate via the print blanket, a sheet of textiled rubber mounted on a cylinder. The printability results are of a high level and the print quality is therefore excellent.

- **Waterless offset**

The process is essentially the same, the difference being that the water is eliminated by using a printing plate combining two polymers, one of which accepts the ink film, while the other, silicone, repels it.

- **Screen**

The print plate in this case is a screen, a sort of woven sieve of which some parts of the mesh are blocked using a photosensitive emulsion. The ink is forced through the open parts of the mesh by the action of a « squeegee » that scrapes the ink over the screen. The print pattern is thus reproduced on the substrate by the same principle as a stencil. This technology has the advantage of being able to use a wide range of inks and to give high intensity and gloss. Frequently, screen printing is used in combination with another print technology, on the same press. The unit is then often referred to as the screen « unit » (the same term can be used for other print technologies).

- **Gravure**

The print form is a metallic cylinder covered with a layer of copper that is engraved with cells which fill with the fluid ink, which is scraped and then directly transmitted to the substrate. This method offers high quality but also high costs that limit it to printing very long runs. Today, gravure is not often used for printing self-adhesive labels.

- **Digital printing**

Several technologies are used in this category: thermal printing (which requires a thermo-sensitive substrate), electro-photography (typically used for desktop printers or laser photocopiers), and ink jet (which is non-contact, i.e. with no direct contact between the print head and the substrate).

Once again, it is important to note that one of the unique features of adhesive label printing is being able to combine these various technologies; the classic case being the addition of a screen unit to offset or flexo presses machines or flexo.

The print units are able to apply varnishes, for example to protect the ink layer, to give a glossy effect, or an “embossed” effect (e.g. for a screen-printed "braille" varnish), etc.

To these print technologies we can add various label decoration solutions:

- **Hot foil**

A heated relief plate is applied to a metallised polyester film coated with a thermoplastic varnish. The metallic layer is thus sealed onto the substrate.

- **Embossing**

This is done with a raised (or male) embossing plate and a concave (female) plate, which together give an embossed relief to the substrate.

- **Plastic coating**

This operation consists of laminating of a plastic film on the printed substrate, in order to protect the label or to maintain its sheen.

These operations can be carried out in line (which is the usual way) or off line, using a separate machine.

Complex operations can equally be done online or separately :

- Reverse printing of text onto the adhesive layer
- Laying down a siliconised fluid to create a pattern of non-adhesive areas
- Undercutting on the back of the web
- Folding (multi page labels, pouches)
- Inserting RFID chips/inlays
- Personalization by printing variable data (inkjet or thermal)
- Laying down magnetic patterns

Finally the label is die-cut to shape and separated from the matrix waste : the latter is then separated from the release liner and wound onto a spool. The backing along with the finished label is rewound onto a roll.

Next the label rolls pass an inspection device, that will detect any damage to the web or missing labels, and the labels may also be rewound and separated into smaller or narrower rolls on a turret rewinder.

There are other ways of finishing labels without removing matrix waste, e.g. by packing in sheets or in fanfold.

3.7 - RECOMMENDATIONS FOR STORAGE

3.7.1 - Duration of storage

Self-adhesive labelstock is a product with limited shelf life before converting (generally 2 years, sometimes 6 months).

This shelf life is further reduced by converting and storage of the printed rolls by the label converter.

The converter indicates on each of the rolls the date of manufacture by means of a label placed in the core. This ensures traceability.

From this date onwards it is advisable to limit label storage to a maximum of one year, in storage conditions as defined below.

If end-users have any doubts about the usability of a roll, they should consult the label supplier.

3.7.2 - Storage conditions for labels

- Warehouse temperature should be 15 to 25°C and relative humidity 50 to 55%.
- Labels should be stored in their origin packing.
- Avoid exposing them to the sun rays (UV).
- Rotate stocks so that the oldest materials are used first (FIFO).
- Stack the rolls of printed labels with the cores in vertical and not horizontal position.
- Do not stack rolls more than three high.
- 24 to 48 hours before applying them, remove the labels from their original (plastic film) wrapping and to put them in an environment where the label paper can re-humidify while maintaining a correct temperature for application and adhesion. We recommend therefore to not stock the labels at a temperature below 15°C nor at a relative humidity exceeding 55% (example : wine-cellar).
  If the ambient conditions around the labelling operation do not conform to these limits, move the labels to the labeller at the last minute and keep supplying the applicator regularly.

3.8 - TERMINOLOGY

The picture below gives simplified notions of technical terms.
See annexe for the professional definitions and the list of FINAT test standards (FINAT = **F**édération **IN**ternationale des fabricants et transformateurs d'**A**dhésifs et **T**hermocollants sur papiers et autres supports - International Federation of Manufacturers and Converters of Adhesives and Hotmelts on papers and other substrates).

Term	Description	Units	FINAT test	Test N°
TACK	- Sticking power in general - First contact without pressure	Newtons	Instant adhesion (Loop Tack)	FTM9
ADHESION	- Initial adhesion (after 20 min) - Final adhesion (after 24h)	Newtons	Peel resistance at 300 mm/min when peeled at 180° (FTM1) or 90° (FTM2)	FTM1 FTM2
COHESION	- Internal resistance	time	Static shear resistance	FTM8
RELEASE	- force necessary to separate the face material from the backing relative to width of sample and speed. - high release : strong force needed to separate - low release : little force needed to separate	N/m	Anti-adherence force (delamination) at low (FTM3) or high (FTM4) speed	FTM3 FTM4

The tack contributes to a satisfactory initial adhesion onto the bottle. Note that a surface treatment of the glass and the shape of the bottle can both influence this initial adhesion.

The tack varies significantly according to the temperature (very low temperature give weak tack) and presence of humidity (adhesive-specific products can satisfy these ambient conditions).

3.9 - HOW TO CHOOSE A LABEL ?

Specify first of all the **end-use sector** :

- drinks: wine, water, soft drinks…
- food sector: oils, jam, canned vegetables…
- pharmaceutical products
- cosmetics
- household products
- industrial chemistry

Next, choose the **print substrate** :

- paper : coated mat or gloss, non-coated, metallised, structured or patterned paper, other…
- film : white or transparent, mat or brilliant, PE, PP, PET, PS, PVC, other…

Specify required **functionalities and resistances** :

- permanent or semi-permanent adhesive, repositionable or removable, washable, luminescent, transparent…
- suitable for pasteurization
- resistant to high temperatures > 100°, to freezing, to chemical products, to sea water…
- approved for direct or indirect food contact
- suitable for refrigerator or ice-bucket
- anti-cryptogamic (anti-microbial) treatment
- other

Define the **print design and shape** of the label :

- number of colours, 4-colour photo reproduction, hotfoil application, embossing, numbering…
- diecutting tool, made up of several parts

The actors concerned by this are:

- the end user
- the printer
- the manufacturer of the label applicator
- the supplier of the container to be labelled

A **dialogue between these various actors** is essential to specify these different points and also the following ones :

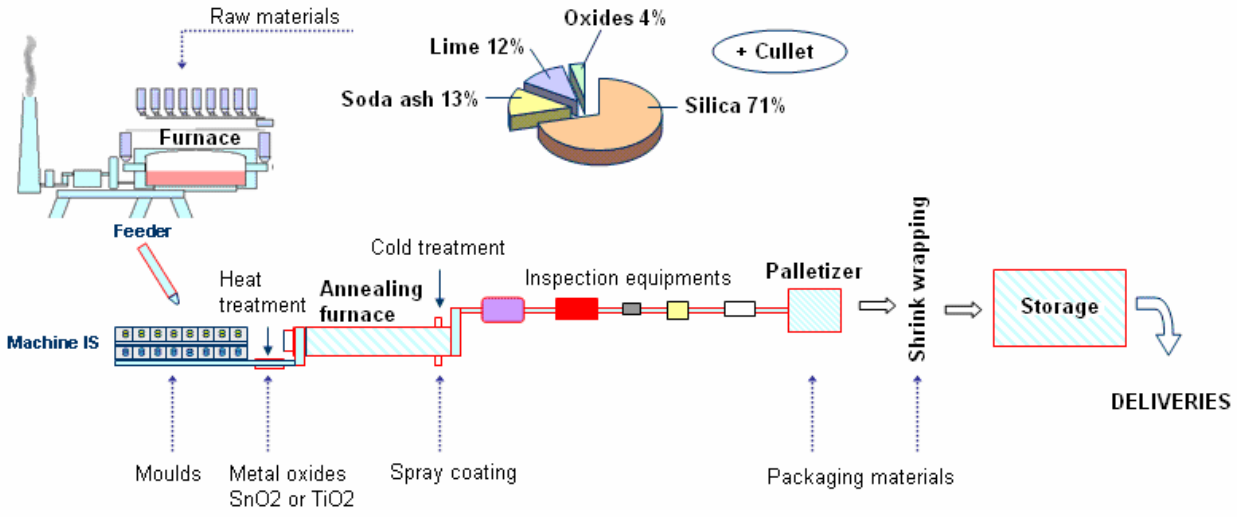
- for the label applicator: roll core diameter, gap between labels, roll direction, maximum roll diameter, machine speed, presence of a “magic eye”
- for the container: its form, the positioning of the label
- the temperature of the container at the moment when label is to be applied (for products packed when hot)
- if there are specific characteristics asked for such as reverse printing, patterned adhesive, and special approvals required…
- the annual estimated volume; the quantities by order and by delivery size
- the product currently used and whether there are any possible problems encountered while working with this product

Warning : transparent substrates require special labelling conditions: label size, position relative to the seam on the bottle, application conditions, static electricity… It is recommended to consult the suppliers.

3.10 - THE GLASS CONTAINER

3.10.1 - Overview

Below is a general outline of the process of glassmaking.



Starting from a drop of liquid glass, bottles or jars are made in two steps : in the IS machine, the drop is first pressed or blown into preliminary mould and then blown into a finishing mould. The finished bottle is extracted from the mould and transported through an annealing furnace where it is slowly cooled.

The characteristics of bottles and jars which can have an influence on pressure sensitive label application are :

- the shape
- the dimensional tolerances
- the surface treatments

3.10.2 - The shape

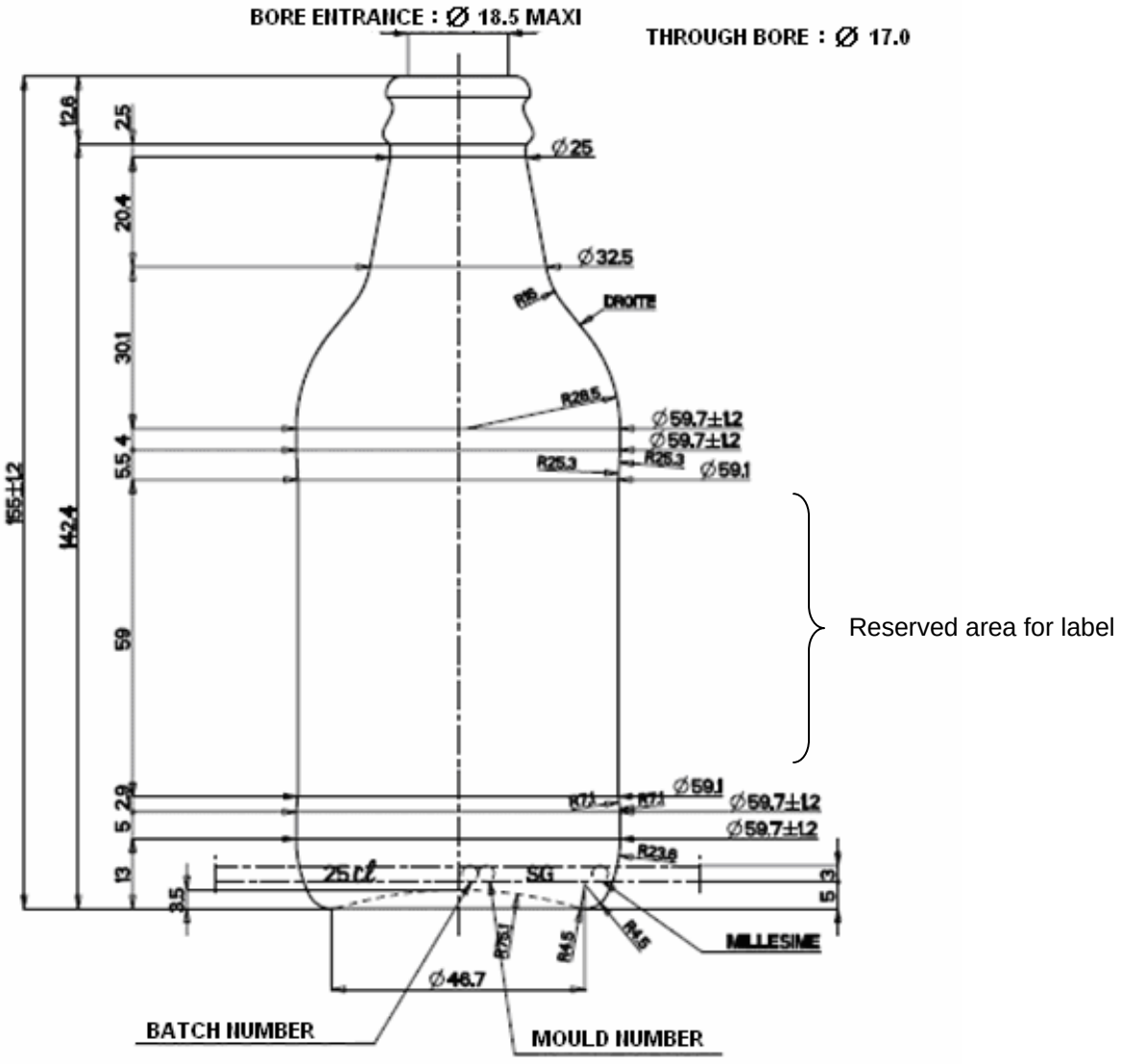
The shape is defined by the glassmaker's drawing which may or may not include the surfaces to be labelled. If the plan lacks precision, contact the glassmaker.

Some recommendations with regard to these drawings :

- If the bottle is made by several glassmakers, check that the drawings are identical

- the surfaces to label must be developable and smooth (without unevenness, scratches, etc).
- the bottle may be designed with a reserved area to help protect the label

Example of glassmaker's design :



3.10.3 - Dimensional tolerances (height, diameter)

Because of their manufacturing process (heat moulded products cooled outside the mould), glass bottles and jars undergo thermal constraints that can cause deformations.
The theoretical dimensions of glass bottles and jars are accompanied by dimensional tolerances noted on the drawings and based on document references such as the followings :

- for the bottles using the NF H 35 077 standard – the tolerances are defined by a formula in proportion to the nominal values (height, diameter, verticality)

- in some cases complementary technical reference sheets produced by CSVMF (Chambre Syndicale des Verreries Mécaniques de France) or CETIE (Centre Technique International de l'Embouteillage et du Conditionnement) can be used. For example the Technical reference sheet CSVMF n° 703-1 covers the correct alignment of the surfaces to be labelled.

Before starting to design any product decoration, it is essential to verify that the designs of the label and of the applicator are compatible with these specifications.

3.10.4 - Surface treatments

A – Usefulness of surface treatments

Surface treatments applied on bottles are essential. Their functions are as follows :

- **to protect the bottle against abrasions**
  These abrasions can occur on the filling line, or during transportation, depalletisation and usage by the consumer. The incidence of these abrasions can be:
  - on the aesthetic appearance of the bottle – presence of scratches or of scuffed surfaces affecting the quality aspect of the bottle
  - loss of mechanical resistance of the bottle especially in bottles made to be filled with liquids under pressure.
- **To ensure smooth movement of bottles** along production lines and especially on filling lines to avoid logjams and falls. Without surface treatment the movement of bottles along conveyors would be impossible.
- **In certain cases, to ensure easy handling of bottles when stored in cellars** (risks of sliding when piled up)

B – Nature and implementation of surface treatments

There exist two types of treatments applied externally to bottles and jars. These two treatments are complementary :

- Hot coating

This is the depositing of a layer of metal oxide (SnO_2 or TiO_2) on bottles when hot (about 600° C). This treatment "hardens" the outer skin of the glass. The bottle passes through a tunnel in which the metal oxide is pulverized in the form of a mist, and adheres on the surface of the glass.

The thickness of this deposit is measurable and is of several Angstroms (Å).
The unit of measure used is the CTU (Coating Thickness Unit – 1 CTU = 3 to 4 Angstroms).

The thickness specifications are on the order of 30 to 60 CTU according to the type of item and the desired result in terms of protection and of appearance.

This hot surface treatment is fixed permanently on the glass and does not change over time.
It has no direct incidence on the adhesion of the label.
It is also a prerequisite for an adequate cold coating.

- Cold coating (about 100 to 150 °C)

This is the laying down of a protective film to reduce the coefficient of friction of the glass.

There are on the whole two families of products :

- temporary ones that are usually based on oleic acid. The application is carried out by passing the bottle through a chamber where the agent is present in the form of a mist. The product "sticks" on the hot-coated surface.
- permanent ones, either from the family of the polyethelenes or from acrylic copolymers. This product is deposited by being dusted onto the bottles (using pneumatic spray nozzles). The product "sticks" on the hot coated surface.

The product used is chosen by the glassmaker taking into account the required result in terms of anti-scratch, friction and aesthetic criteria.

There is no silicone in the products used for cold-coating.

There is no specific treatment for pressure sensitive labelling.

Cold-coating is not fixed permanently onto the glass and is removable. In this respect, it can therefore be partially or entirely eliminated at the time of the washing.

Cold-coating can equally be affected by extended storage of the empty bottles (cf recommendations for storage).

The thickness of the cold-coating deposit is not measurable. Controlling the quantity deposited is done :

- by controlling the parameters of the process : temperature, concentration, flow, pressure
- by checking the appearance of the bottles (absence of spots, homogenous distribution)
- by checking the two essential parameters :
    - o scratch resistance = whether or not the bottle scratches under controlled conditions
    - o friction = whether the bottles slide easily when side by side

C – Potential label application problems arising out of surface treatments

Excessive cold-coating can have a direct incidence, or in combination with other parameters, on the adhesion of the labels.

The reaction of a cold-coated surface can more or less to evolve over time. In the case of usage of bottles made more than 24 months previously, it is recommended, before label application, to carry out adhesion tests using the labels to be applied.

In case of problems, a measure of surface tension (ink or pencils) can be used to verify the state of surface of the glass and its compatibility for label adhesion. For adequate adhesion, surface tension must be greater or equal to 38 dynes.

3.10.5 - Orientation

Depending on the shape of the bottle, of possible engravings or the need to position the label away from the seam, it may be necessary to orient the bottles at the time of labelling.

This orientation used to be done by means of a mechanical positioning notch, generally located on the body (called a Meyer notch) or on the base.
The dimensions and position of the notch are defined on the drawing but if necessary further information can be obtained from the glassmaker.
It is essential as well to verify the compatibility of the labelling equipment (direction of rotation, position and shape of the label beak, etc …) with the bottle and its notch.

The techniques of positioning bottles is tending to move towards optical systems. These systems can give a direct positioning of the label, using a special indicator on the bottle (a notch or also the seam, positioning dot or spot…etc)

It is equally vital to look out for :

- the precision of positioning of the label especially when it must be matched to an engraving or an indicator on the bottle or a particular shape of the label
- the definition of the size of any possible label emplacement – the dimensions of this emplacement must take account of precision of application in vertical or in horizontal axes

It is necessary as well to check with the manufacturer of the labeller the compatibility of application precision.

4. LABELLING MATERIALS AND CONDITIONS OF APPLICATION

4.1 - APPLICATORS FOR PRESSURE SENSITIVE LABELS

There are 2 types of machine :

- linear machines, easy to operate and suitable for small quantities
- rotary machines, which give better labelling precision and are used for larger volumes

4.1.1 - Linear machines

The labelling unit, consisting of the roll of labels, stripper plate (beak), rotary drive and smoothing roll, is mounted directly on a linear conveyor.

The product to be labelled :

- is stopped
  - is rotated
    - the label is applied
      - then the label is smoothed

These machines are characterized by the application of one edge of the label followed by a complete smoothing.

⇒ Synchronisation to projection

These machines are limited by their speed : 1,000 to 3,000 bottles an hour.

4.1.2 - Rotary labellers

The bottles are positioned by an entry worm drive and held in position in cradles.

The pressure sensitive labelling units can then be positioned at different points. One can combine pressure sensitive labelling and traditional labelling.

The important factors of this type of machine are :

- better labelling precision with rotary labellers (lower speeds per bottle) that with linear machines.

  Precision depends on :
  1) precision resulting from the application by the adhesive head
  2) tolerances of web position
  3) ovality of the container (NF H 35 077 standard)
  4) with a system of indexing, greater precision can be obtained
  5) in some cases, precision of the label on the release liner.

- the modularity

- the possibility of very high running speeds

- the investment cost

In general these machines are characterized by the positioning of the label along its median axis. Each half is then smoothed using brushes or sponge rollers. These labellers can handle irregularly shaped containers.

Speeds : 3,000 to 60,000 bottles an hour.

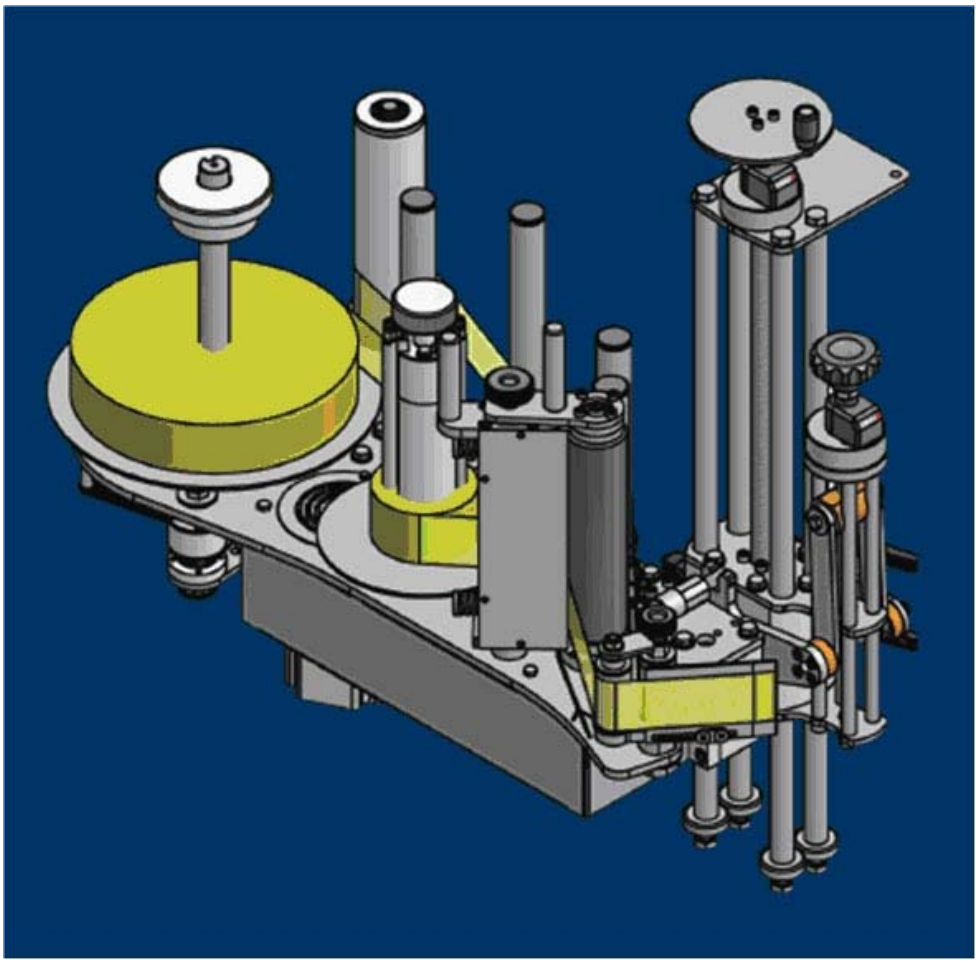
4.2 - THE PRINCIPLES OF LABEL APPLICATION

4.2.1 - Description of a linear machine

A labelling head is composed of :

- a mandrel on which is mounted the roll of labels
- a tension bar (roller bar controlling the rate of advancement of the web) to provide linear tension to the web carrying the labels. At this point there is a photolectric cell (or a detector) designed to regulate the rate of advance of the label as it leaves the stripper plate.
- a stripper plate that will separate the label from the liner. This must be parallel to the angle of labelling of the container.
- a system of sequential traction of the web, regulated by the cell.
- a system to provide uniform and homogenous application pressure on the whole surface of the label : brushes, silicone pressure pads, rollers; the roller quality is very important, it is preferable to use semi rigid rather than soft foam coatings : 20 – 40 shore D.
- a system for rewinding the release liner

There must be speed synchronization between the rate of advance of the label and the linear speed of the surface of the container as it rotates.



4.2.2 - Description of a rotary labeller

The application principle is identical but these machines give better control and better regularity in the positioning and orientation of the bottle.

4.3 - THE OPERATION OF PRESSURE SENSITIVE LABELLING

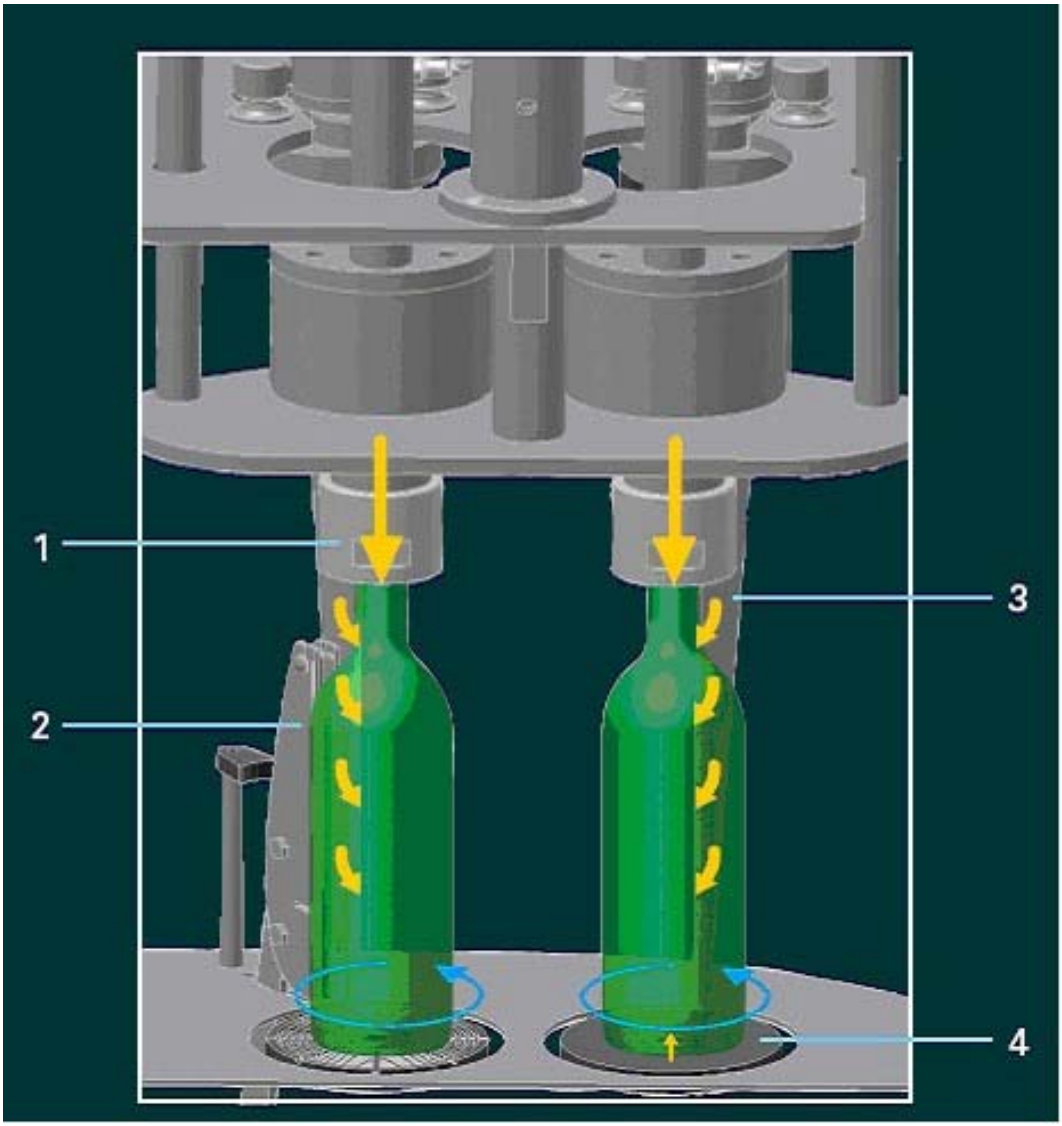
4.3.1 - Condition of surface of bottles and jars

The bottles and the jars must be :

- dry at the moment of labelling
- clean, i.e. free from dust or grease

For labelling bottles after storage in a cellar (e.g. for vintage wine), it is imperative to wash and dry the bottles just before labelling.

Systems for drying bottles are available.



Outline of a device for drying bottles

4.3.2 - The labeller

All machines must possess a certain number of adjustment possibilities and basic characteristics :

- adjustability of the position and tension of the liner
- parallel alignment of the stripper plate relative to the surface on which the label is to be applied
- the height of the stripper plate must be at least equal to the length of the label on the liner
- system of adjustability of the position and sensitivity of the photoelectric cell (or thickness or capacity detector)
- tension control on the smoothing rollers
- the web must be perfectly aligned with the stripper plate
- pressure rolls must be kept clean; avoid using worn rolls by changing them regularly

- do not use soft foam rollers which distort more easily
- adjust the roll pressure according to the hardness of the foam used
- avoid using labels which are too big (H x L) relative to the surface to be labelled. This can cause the labels to crease or bubble either at the time of labelling or later when humidity rises. The wider and higher the surface, the greater is the risk of appearance of defects.

4.3.3 - The labelling process

A – Warning

Over and above the quality of the components, the success of the labelling operation depends on the conditions in which this operation is carried out and in particular the following elements :

- correct condition and adjustment of the equipment

- training of staff in charge of the inspections, settings and execution of the operation

- checks which must under all circumstances be carried out when starting up the labelling operation and at regular intervals during the process. The results of these checks must be noted down and recorded.

It is important to conform to the supplier's specifications when changing to a new batch of labels or of bottles.

Adjustment or maintenance of equipment should be done only by specially trained technicians. The dates of each adjustment and the setting values must be noted down and recorded.

B – Speed

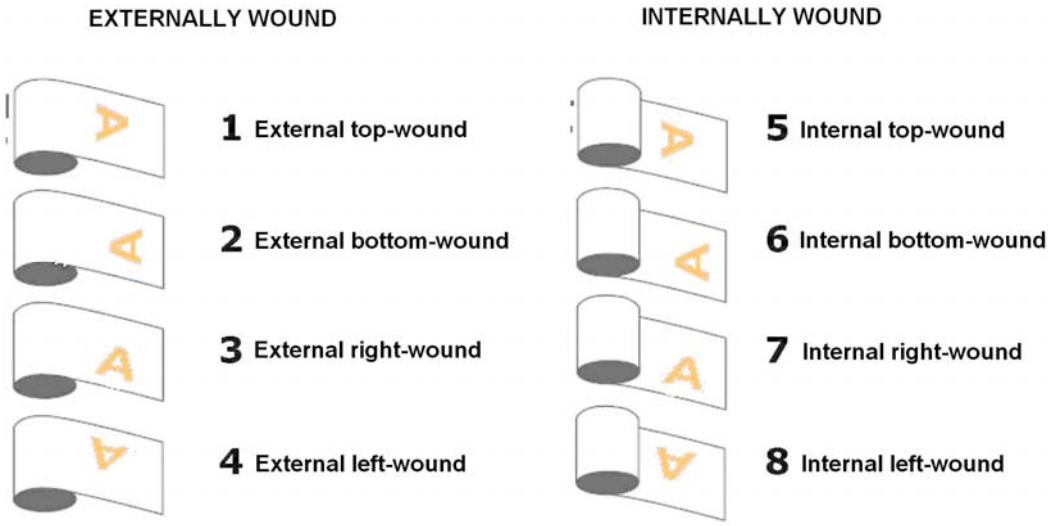
Do not exceed the maximum authorised speed fixed by the constructor of the equipment. The speed must be adapted depending on the shape of the containers and the dimensions of the label.

C – Precision

This depends on all the elements : label + bottle + machines + accuracy of settings.

D – "Roll" mandrel

It is preferable to use mandrels of 76 mm of diameter that distort the labels less when coming to the end of the roll. The type of unwinding, exterior or interior (see diagram), is specified by the constructor of the equipment. Exterior unwinding is preferable.



E – Stripper plate

This must be at right angles to the surface on which the label is to be applied (for labels to go on the body of the bottle) or parallel to the item profile (neck label). The plate must have a height at least equal to the length of the label on the release liner.

F – Advancing the label

When the stripper plate separates the pressure sensitive label from the liner, it releases the leading edge of the label whose advance is regulated by the position of the photoelectric cell (or detector) that “sees” the edge of the label or a positioning dot on the liner.

The spacing between two labels (matrix) must be 3 mm. In the case of small labels, this spacing out can be reduced.

The tension on the release liner must not be so high as to break it, but the liner must nonetheless remain stretched. As an order of magnitude tension should be 10 to 20 N for paper liners, 20 to 30 N for synthetic ones.

G – Rotation of the container to be labelled

Ensure that the drive which rotates the bottle or jar gives a uniform and constant rotation. Rotation speed must correspond to linear speed at which the label is delivered (failure to ensure this leads to vertical creases or to breaking of the web).

Check that the support rollers rotate freely.

H – Pressure roller (or smoother)

The pressure sensitive label adheres to the container due to the pressure of the smoothing roller. The pressure must be sufficient but not excessive.

The height of the roller must be adapted to that of the label and ideally equal to it (but never less). Its hardness must be between 30 and 60 shore D.

For transparent self-adhesives, do not smooth with brushes or soft foams.

The functional quality of the springs (or other systems of applying pressure) should be checked regularly.

Replace worn parts with original equipment supplied by the constructor.

I – Ambient conditions

In case of excessive humidity (e.g. fog), it is best to suspend operations. Ambient working temperature should be not less than 10 to 15°C. Record and store details of labelling conditions for dry materials.

4.3.4 - Applications

There are several factors that come into play in label application. This means that the quality of the pressure sensitive labelling is conditioned by several elements.

Once applied, the label must remain in position and stable in normal conditions of storage and use of the product. Only synthetic labels can give substantial dimensional stability under conditions of variations in ambient humidity.

It is evident that an adhesive selected to stand up to conditions of an ice-bucket must withstand freezing water for long enough for the product to be consumed.

For vintage wines, it is preferable to use either a label paper which has undergone an anticryptogamic treatment, i.e. anti mildew, or a synthetic one.

The face material, the nature of the adhesive and the quality of application of the label will all have an influence on its ability to match the shape of the bottle.

5. CONTROLLING THE LABEL APPLICATION OPERATION

5.1 - CHECKING THE POSITIONING

The positioning of the label depends on the labels, the labelling equipment and the container being labelled.

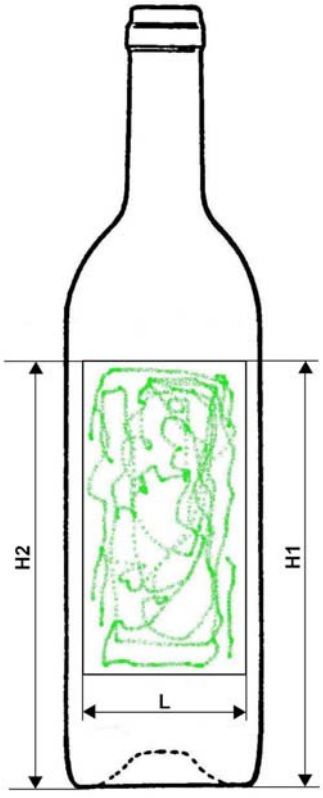
5.1.1 - Height at which the label is applied

The variations are generally not very significant (± 1 mm).

At the time of the printing/converting of the label, the regularity of the centring of the label on the liner is important, notably when changing label rolls.

5.1.2 - Verticality of the label

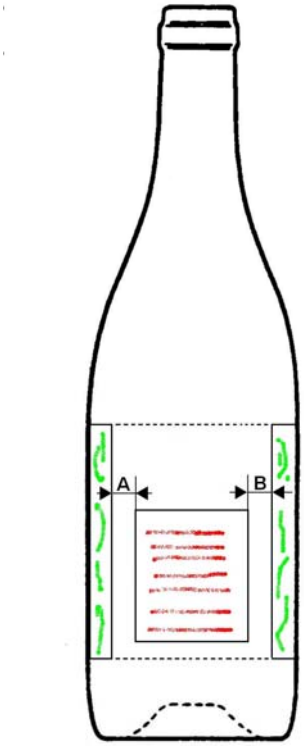
Vertical deviations are of the order of 1% of the width of the label between its two edges.



$|H1 - H2| < 0{,}01\ L$

In the case of a wraparound label, the graphics must take that situation in consideration right from the start of the label design.

5.1.3 - Positioning between front and back labels



$|A - B| \leq 2,5$ mm on rotary labeller
$\leq 4,5$ mm on linear labeller

5.1.4 - Visual test

The aesthetic qualities of the labelling operation can be appreciated by lining up 10 items for visual examination.

When starting the labelling operation, check by this visual test the first 30 to 50 applied labels. During the course of production this visual test should be carried out at regular intervals, and at each change of roll and of batch of bottles.

5.2 - CONTROLLING THE ADHESION BETWEEN LABEL AND GLASS

Label ten articles (preferably empty) with the appropriate label.
Cover the label completely with a light spray of water, immediately following its application onto the article.
Wait one minute before starting a visual examination.
If bubbles or creases appear, it means that the label did not contact the glass surface at these points.
Re-calibrate the label applicator such that no part of the surface of the label shows bubbles or creases when sprayed with water. The whole adhesive-coated surface must be in contact with the glass.

This test will help to obtain the optimum setting of the labeller and will minimize potential problems of bubbles on the labels.

On varnished or synthetic labels, the spray test is not sufficient. In these cases, one must observe the articles when empty, looking from the inside, to see if the adhesive is everywhere in contact with the glass.

Carry out this test at every setting change on the labeller and at every change of shift

5.3 - LABELLING DEFECTS

The labelling defects most often encountered are creases (horizontal or vertical) and bubbles.

Bubbles are due to an absence of initial adherence between the adhesive and the bottle.

Note : Only certain adhesives are repositionable enabling this defect to be evenly corrected.

5.3.1 - Creases at the moment of labelling

The crease appears immediately after labelling, normally crossing the left label to right.

Factors that play an important role in the formation of horizontal creases:
- foam roller too soft
- incorrect alignment of the label exit plate when using an "Automatic labeller"
- irregularities in the articles being labelled
- unconventionally shaped containers, concave or convex.
  Particular attention must be paid to label positioning on non developable surfaces.

Vertical creases
- synchronisation :
  --> Speed of movement of the article to be labelled and speed of the label as it comes out.

Diagonal creases
- bottles which move up during application.

5.3.2 - Creases or bubbles after automatic labelling

Creases or bubbles appear a little time after the automatic labelling, especially when the bottle undergoes changes of humidity or of temperature.

Factors that play an important role in this formation of creases or of bubbles :
- pressure and hardness of the label application equipment
- bottle storage in conditions of high condensation, or in refrigeration
- bottles with excessive surface treatment

Note : The use of papers treated for moisture resistance can improve the situation, but the nature and the performance of pressure rollers are also very important in resolving the problem.

5.3.3 - Creases or bubbles occurring during storage of articles

If the irregularities in the surface of the glass are too great, this creates zones of non-contact between adhesive and bottle which are almost imperceptible at the start, but these are the zones where bubbles and maybe creases will form.

In areas where there is full contact between the adhesive and the glass, the label paper will not change with changes in humidity and temperature; on the other hand the zones where this contact is imperfect will facilitate the expansion or retraction of the label.

We also can note that surface treatments of containers accentuate these defects when the container is subjected to sudden changes in ambient conditions.

If we look closely at containers with pleats or bubbles in the label, visible from the inside of the glass, we will see that all creases or bubbles are based around a zone of non-contact between the adhesive and the glass.

In both cases, because of the geometric irregularities of the container, the pressure settings of the applicator on the labelling equipment are very important.

The formation of bubbles is accentuated in environments of high humidity (for example packing in wooden crates where the wood has high moisture content.

In the case of bottles stored horizontally in cartons, the storage carton must be adapted to the vertical weight so as to avoid contact between the bottles; avoid stacking palettes on top of other palettes, use storage racks.

A special case

In the case of a traditional (wet glue) labelling, we frequently see ripples at the edges of the label. They do not appear generally in normal conditions of storage, but more often in damp conditions.

For conventional labels, a machine deposits the glue in lines. Between the lines, there are zones of non-contact that will be more sensitive to rising humidity.

With self-adhesives, similar ripples are principally caused by using too soft a foam roller on an automatic labeller, thus inhibiting good adhesive-glass contact, especially on the ends of the label. This is accentuated if the papers used are not treated for moisture-resistance.

6. CHECKLIST OF DEFECTS AND THEIR CAUSES

6.1 - AT THE TIME OF LABELLING

6.1.1 - The label does not stick :

- incorrect group applicator settings, incorrect labelling pressure
- check smoothing
- check synchronisation applicator/conveyer
- state of surface of the article
- dust, humidity, condensation
- thermal shock
- choice of the adhesive not suited to the surface tension of the container
- check date of manufacture of the label
- temperature too low (<10° C)

6.1.2 - The label fails to detach itself from the liner :

- incorrect web tension
- bad adjustment of the predispenser
- wrong type of stripper plate
- labelling equipment not adapted to label
- state of release liner
- material defect linked to bad storage
- release too strong
- lack of silicone on the liner

6.1.3 - The label detaches itself from the liner before application :

- dirt on the roller
- release too weak
- web path not adapted to label type
- internal unrolling if small-format labels being applied
- date of manufacture of labels

6.1.4 - The web does not move :

- check machine operating system, see instructions for use

6.1.5 - The web does not move smoothly :

- check for dirt on the drive rollers
- roll mandrel not of correct size

6.1.6 - The web breaks :

- web tension too strong
- micro-tears on the edges of the label roll
- liner damaged
- bad splice between rolls
- label roll fixed too tightly
- release liner too thin or of wrong type
- insufficient web width

- silicone defect
- speed too high
- too many variation in speed
- pellets of adhesive matter in the works
- web incorrectly aligned in the labeller
- incorrect choice of stripper plate

6.1.7 - The web fails to stop between each label :

- residue of matrix waste between the labels
- bad label detection : cleanliness, settings, wear, transparent face material

6.1.8 - The label sticks onto the back of the release liner :

- the roll of labels got damp
- roll to tightly locked, warping
- inks or varnish insufficiently polymerised

6.1.9 - The label wrinkles :

- synchronisation of conveyor belt
- hygrometry

6.1.10 - The label goes on skewed :

- labels already skewed on the web
- bad positioning of the product
- bad centring of the label on the web
- web alignment relative to conveyor
- alignment of the label applicator and the conveyor (stripper plate, ...)

6.2 - AFTER LABEL APPLICATION

6.2.1 - The label blisters, wrinkles or comes off :

- thermal shock
- hygrometry
- storage conditions
- choice of adhesive / substrate / storage conditions
- degradation of substrate over time
- non-uniformity of application pressure (adhesive surfaces not in sufficient contact with the glass at the end of each application)

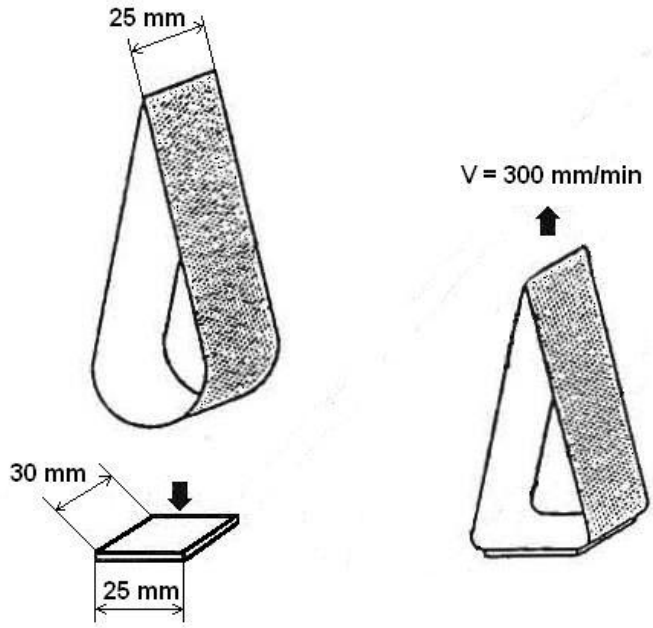
6.2.2 - The label deteriorates :

- choice of adhesive
- choice of substrate
- choice of print method and protection of printed surface (varnish, lamination,...)
- check substrate (migrations,...)
- check for any external aggressions

ANNEXE : FINAT TESTS

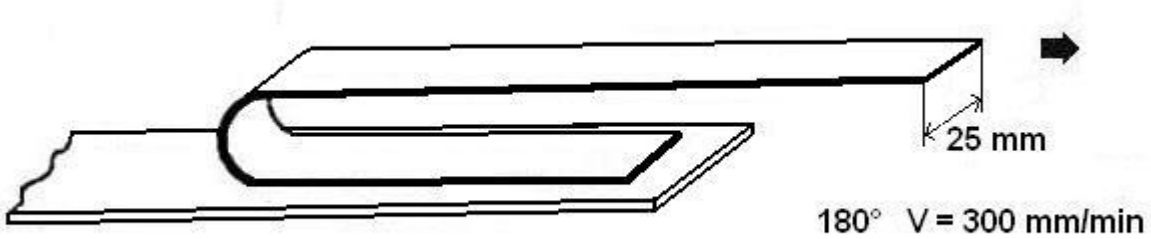
- **Instantaneous adhesion (Tack) – Test FINAT FTM 9**

Definition : The instantaneous adhesion of a self-adhesive material is expressed as the force required to unstick, at a given speed, a loop of the material (with the adhesive on the outside) of which a predetermined area has been previously placed in contact with a standardised substrate



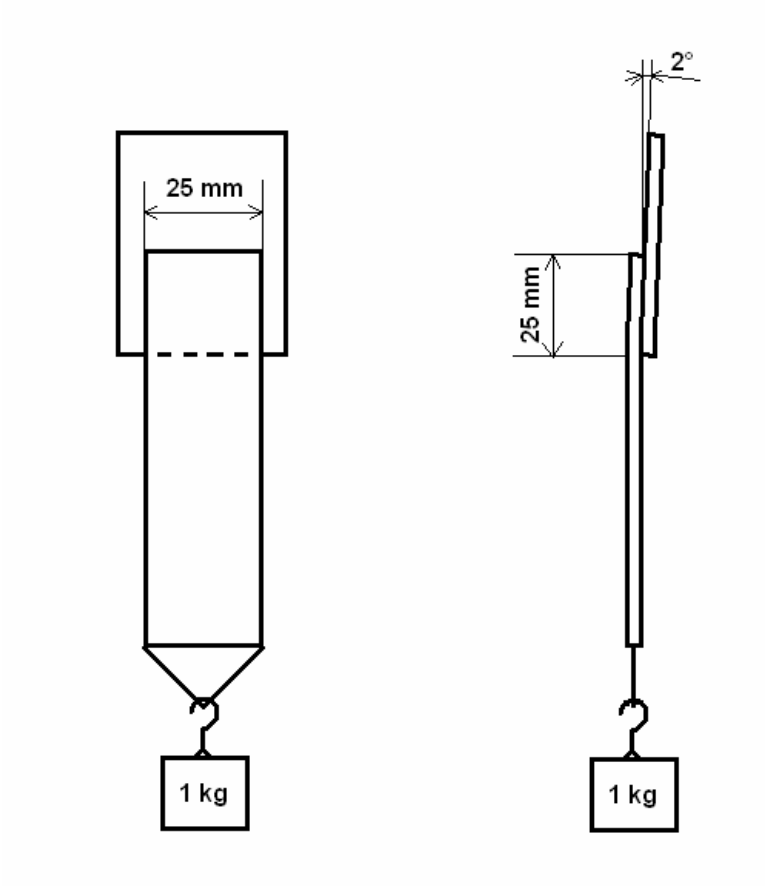
- **Peel adhesion – Test FINAT FTM 1**

Definition : The peel adhesion (at 180°) is defined as the force required to remove, at a defined angle and speed, a self-adhesive material which has been applied under controlled conditions onto a normalised test plate.



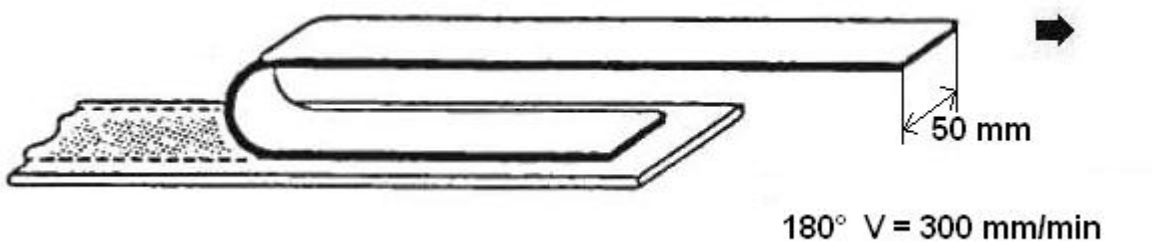
- **Cohesion : Static Release Force – Test FINAT FTM 3**

Definition : The static release force on standardised surface is defined as the time necessary to separate by parallel traction under the effect of a constant force of 1 kgf, a surface measuring 25x25 mm of adhesive product from a standardised flat surface.



- **Release : Ply separation force – Test FINAT FTM 4**

Definition : The delam force (anti-adhesion) is defined as the force required to separate a self-adhesive material from its liner or backing (or vice versa) at an angle of 180° and a speed of X mm/minute.



- **List of FINAT tests (FTM)**

FTM 1	Peel adhesion (180°) at 300mm per minute
FTM 2	Peel adhesion (90°) at 300mm per minute
FTM 3	Low speed release force (delam)
FTM 4	High speed release force (delam)
FTM 5	Resistance to elevated temperatures
FTM 6	Resistance to ultra-violet light
FTM 7	Silicone coat weight
FTM 8	Resistance to shear from a standard surface
FTM 9	Instantaneous adhesion (Loop tack measurement)
FTM 10	Quality of silicone coated substrates: release force
FTM 11	Quality of silicone coated substrates for self-adhesive laminates: subsequent adhesion
FTM 12	Adhesive coat weight
FTM 13	Low temperature adhesion
FTM 14	Dimensional stability
FTM 15	Surface tension of corona treated plastic films
FTM 16	Chemical resistance – Surface test (Spot method)
FTM 17	Chemical resistance - Immersion method
FTM 18	Dynamic shear
FTM 19	Recycling compatibility of self-adhesive labels
FTM 20	Fluorescence and whiteness
FTM 21	Ink adhesion (basic method)
FTM 22	Ink adhesion (advanced method)
FTM 23	Die strike evaluation test
FTM 23b	Die strike evaluation test on filmic release liners
FTM 24	Mandrel hold
FTM 25	Evaluation of quality of silicone coverage using an aqueous colorant (Stain test)