TECHNICAL DOCUMENT

SELF-ADHESIVE LABEL
INTRODUCTION

History of the self-adhesive label

I – TECHNICAL CHARACTERISTICS OF A LABEL

- Introduction.
- Composition of a self-adhesive label.
- Different kinds of materials according to uses.

II – PRINTING TECHNIQUES

- Prepress: primary colours, screen, percentage of screen, screen ruling, Pantone and Ben-day.
- Traditional printing: UV letterpress, flexography, offset, screen, hot foil, cold foil.
- Variable printing: thermal transfer, direct thermal, ink jet.
- Die-cutting

III – DIVERSE

- Quotation
- Finishing
- Storage conditions
INTRODUCTION

HISTORY OF THE SELF-ADHESIVE LABEL

- The principle of self-sticking a product on another one, without extra glue, was discovered in 1882 in Hamburg by BEIERSDORF. The adhesive tape was invented.

- However, the first self-adhesive label was not created until 1935. Stanton AVERY discovered and launched this brand new product, in San Francisco.

- The process was developed in Europe in the early 80s thanks to the development of hypermarkets.
The label has always been considered as secondary in packaging. However, it has a major role to play in management, warning, information and in the use for the conditioned products. Its use is now very common in every kind of conditioning and has an infinite number of shapes. The label is directly linked to the process of conditioning and packaging.

The manufacturing of self-adhesive labels uses a material made of 3 parts: the paper of the label is stuck by its adhesive on another siliconed paper, which is the backing. The food industry and the sector of cosmetics are the two major sectors using self-adhesive labels.

**COMPOSITION OF A SELF-ADHESIVE LABEL**

**Basic presentation**
- Face material (printed part of the label)
- Adhesive (makes the face material stick to the product)
- Backing (paper coated with silicone to keep the label from sticking to objects before its use)

**Specific presentation**
Example of a multi-layer label:
- Face material + adhesive
- Backing
- Adhesive + backing

**Vocabulary related to the size of the adhesive label:**
- A - label width
- B - label length
- C - skeleton
- D - backing width (protector coated with silicone)
- E – centring of the label on the backing
DIFFERENT KINDS OF MATERIALS ACCORDING TO USES

FACE MATERIALS

The face material is defined by:
- printability
- caliper
- tear resistance
- whiteness/colour
- roughness
- opacity
- brightness
- stiffness
- absorption degree

Synthetic face materials:
- **polyethylene**
  - white PE: flexible and extensible + low cost
  - clear PE: flexible and extensible + low cost

- **Polypropylene**
  - white PP: stiff
  - clear PP: good transparency
  - metallic PP
  - OPP (oriented PP)

- **Polyester (or polyethylene terephthalate)**
  - white PET: total size stability, chemical and physical solidity, but very high cost
  - clear PET: high transparency
  - metallic PET

- **Others**
  - PVC (polyvinyl chloride)
  - PS (polystyrene)
  - Co-extruded films

**Composition of a synthetic face material:**

<table>
<thead>
<tr>
<th></th>
<th>PRIMER FOR INKS</th>
<th>SYNTHETIC FILM</th>
<th>PRIMER FOR ADHESIVE</th>
</tr>
</thead>
</table>

Paper face materials:
- vellum (no coated paper)
- coated paper (calendered paper)
- kromekote (supercalendered paper, passed on a very polished chrome cylinder)
- fluorescent (vellum tinted in yellow, red, orange and green)
- laid paper (white or ivory)
- silver or gold metallic paper (vacuum metalised paper with about 0.4μm of metal, or laminated aluminium on paper with 6 to 10μm of metal)
- thermosensitive paper (Thermal Economy or protected)*: vellum recovered by a thermosensitive layer holding a colourless precursor of the coloriser (leuco-colouriser), an acid developer (sulfones), an activator which makes the effect of the two reactives easier. There is a revelation when this layer is put to a temperature between 65°C and 85°C.
  - **thermal economy**: thermosensitive layer + basic material (cardboard paper)
  - **protected thermal**: layer at the surface + thermosensitive layer + basic material + protective layer (which avoids migration of the contagious elements able to react with the thermosensitive layer)

*If the thermal layer is not protected, it can blacken when in contact with a greasy substance such as UV varnish.

### ADHESIVES

Adhesives can be classified according to their chemical composition, their vehicle and their final use.

**Fixation by adhesive effect can be:**

- permanent
- reinforced permanent
- removable
- repositionable
- deep freeze
- moist surfaces
- anti grease
- special for textile

The adhesive constitution is thus variable. The surface to label is another element to take into account (smooth, rough, wet, repulsive, greasy surface).

Basically, an adhesive is a glue which cannot dry. That makes it keep its “tack” (immediate strength of adhesion on a product). It is possible to vary this adhesive strength as far as its power and length of life are concerned.

**The other characteristics of an adhesive are :**

- initial adhesion (from 20 minutes to 24 hours)
- final adhesion (more than 24 hours)
- cohesion
- release
- shear resistance
- minimum labelling temperature
- exposure temperature
- warmer temperature at short term
Chemical composition:

There are 2 main kinds of adhesives:

- rubber base
- acrylic base

Vehicle:

It is the substance which carries the adhesive up to the coating station. There are 3 systems:

- water base (dispersion)
- solvent base (solution)
- hotmelt system (100% solid adhesive). No vehicle is used. During the manufacturing, the hotmelt adhesive is carried to the coating rolls.

An acrylic adhesive is made of:

- water (dispersion)
- acrylic polymers
- anti-bacterial substance due to dispersion

A rubber adhesive has a more complex constitution:

- used in a solvent area or when heated up
- synthesis rubbers
- added resins of aliphatic or aromatic type
- plasticizer coatings under oil or liquid resin form
- mineral charges such as talc, silica, lime carbonate
- anti-oxidizing

Performances in adhesivity value:

<table>
<thead>
<tr>
<th>Coating technology</th>
<th>Solvent</th>
<th>Dispersion</th>
<th>Hot melt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical composition</td>
<td>Rubber</td>
<td>Acrylic</td>
<td>Rubber</td>
</tr>
<tr>
<td>Nature</td>
<td>Natural or synthetic</td>
<td>Dispersion</td>
<td>Thermoplastic</td>
</tr>
<tr>
<td>Advantages</td>
<td>strong initial tack, adhesion on curved, uneven, very rough substrates, efficient face to deep freeze, water resistance</td>
<td>ageing resistance, heat resistance, solvent resistance, high speed of transformation</td>
<td>high initial tack, adhesion in particular conditions, water resistance, low cost, ecological</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>not really ecological (solvents), high cost, not very resistant to plasticizers</td>
<td>weak adhesion on non-polar substrates, low resistance to deep freeze, lower water resistance</td>
<td>lower heat resistance, low plasticizer resistance</td>
</tr>
</tbody>
</table>

Note: should be stored at 23°C (+/-2°C) and at 50% relative dampness (+/-5%)
BACKING

It has a major importance for a dispensing machine. It must be 50% transparent to enable the reading of detectors. The differences between the backings are related to their thickness and mechanic resistance.

Two main backings:

- paper (Kraft or glassine)
- synthetic (polyester)

Paper backing:

- glassine: highly calendered paper, closed with a dense structure, it enables a silicone layer to be put immediately on the paper. Low basis weight and thickness, high shear resistance, almost transparent, high flexibility, insufficient dimensional stability (sensitive to damp).
- Kraft: paper with a more open structure, necessity of an intermediate layer as a basis for the silicone layer. Higher basis weight and thicker paper. Size does not depend on dampness.

Synthetic backing:
It is a transparent polyester film coated with silicone. This kind of backing has a high mechanical resistance and a good dimensional stability.

Average characteristics:

- average basis weight: 60g/m²
- average thickness: 55-65µ
- gloss > 1000 Bekk
- shear resistance (N/25mm)
II – PRINTING TECHNICS

■ PREPRESS

Primary colours
Any colour can be made from the three primary colours (cyan, magenta, yellow) and black. We use screened dots with percentages varying according to the primary colours and black. We obtain an optic melting of these coloured dots which appears to be only one colour to the human eye.

Screen
Screen is a multitude of small dots. The distance between each dot is the same. However, their size can be different. The screen dots are defined by the percentage of screen and the screen ruling.

Screen is a way to make halftones and to mix colours endlessly. Actually, a screen enables to vary the percentage of inked area in relation with the white of the face material. We can also print all the intermediate shades between plain colour and white.
Screen percentage

When a screen is said to be 40%, that means the dots cover 40% of the area.
Screen ruling
It is the number of lines per inch or centimetre. It defines the accuracy of a screen. The choice of a screen ruling depends on the details to be printed, the face material, the printing technique and the expected quality.

Pantone and Ben-day
There are two solutions to obtain a precise colour:
- the direct tone (Pantone colour): we use only one ink made by a mixture of colours when manufactured, and we print a plain colour of colour.
- Ben-day colour: we use screen dots with primary colours and black.
To find a colour on a direct tone way, the printer refers to a Pantone Matching System. For an indirect tone, he uses a Tetracolor one.

TRADITIONAL PRINTING

Rotary letterpress with UV curing
It was the first printing method for the self-adhesive label market. The printing quality is very good. This technique is convenient for luxury items. It is a relief direct printing technique. A printing shade (plate*) is recovered with ink (fatty ink) on its relief parts. When in contact with the paper, the plate puts ink.
* plate: washed-out photosensitive polymer on a polyester basis

Rotary flexography:
It is a booming market for the self-adhesive labels. The technology has greatly changed since the 90s. Rotary flexography is used for middle range self-adhesive labels. The food industry uses this kind of printing frequently, for weight/price labels for example. The flexography inks are water based (hot air drying) or photopolymer resin (UV drying). A four-colour process has a medium quality. The printing shade is recovered with a liquid ink by the intermediate of an anilox roll. The plate* is put in contact with the face material to be printed.
* plate: photosensitive polymer on a polyester base, washed-out with solvents.
**Offset**
It is a very common technique for traditional label printing, but not so much for self-adhesive labels. However, it should increase in this sector, despite a conversion speed less performing than flexography.
Flat indirect printing: the process is based on the physic-chemical transfer between fatty substance and water (antagonism). An offset plate receives ink on the parts to be printed (oleophilic parts), ink is transferred on a blanket, which transfers ink on the paper.

**Screen**
This technique enables very good quality printing and is convenient for large plain colours. It is used for particular markets such as cosmetics and oil products. The printing system is like a stencil. The ink is put on the screen which is sealed in the places where it must not be printed.

**Hot foil**
This kind of printing is adapted to luxury or festive items, such as wine, salmon... The printing result highlights the packaging, and consequently the packaged product. It enables to stamp a golden or silver film on a label thanks to a relief magnesium plate heated to 80°C. With the hot foil, we can obtain a very good accuracy in the picture, whatever the material (even the laid paper).
In the future, labels might rather be printed with machines including various printing technologies at the same time: flexography, letterpress, offset, screen. In that way, the quality would improve.

**VARIABLE PRINTING**

It is a printing technique using laser and thermal printers (direct thermal or thermal transfer) and ink jet. It is used more and more often for label printing. It enables:

- storage control (barcodes)
- information recording
- manufacturing tracking
- address labelling
- mail sorting out
- weight/price labelling

**1-Thermal transfer:**

Printing process by thermal transfer

It is almost the same process as the hot foil stamping: transferring heat-sensitive ink thanks to a heat source (print head) on a paper or synthetic substrate. Heat-sensitive ink is solid at room temperature and is on a polyester film. With the effect of heat, the ink becomes fluid and is transferred from the ribbon to the label.

**Restrictions of printing by thermal transfer**

A quality printing by thermal transfer requires an appropriate balance between:

- Printer
- Label
- Ribbon

The print surfaces (labels) are mainly characterised by their surface energy. The relation between the solid substrate of labels and the liquid components (inks, varnishes, transfer ribbon…) depends on the evaluation of the label surface energy and the superficial tension of the liquid (measured in dynes/cm). For good quality printing, the ink (or transfer ribbon) and the substrate to print must have similar levels of tension and surface energy.

The ink (or transfer ribbon) superficial tension must be inferior to the substrate surface energy. A good printability requires a surface energy between 36 and 42 dynes/cm, according to the substrates and inks used.
Sliding varnishes have a weak surface energy (inferior to 36 dynes/cm) and that of special varnishes for thermal transfer is superior or equal to 36 dynes. The slightest track of sliding varnish (compound of waxes and silicones) in a special thermal transfer varnish contaminates the latter and makes the surface energy go down.

2- Direct thermal:
The thermal print head releases thermal impulses by Joule effect (ceramic + miniature resistances).

![Diagram of direct thermal printing process]

The thermosensitive layer reacts thanks to heat (from 65°C à 85°C).

Usually, a thermal transfer printer can also make direct thermal. The user only has to remove the transfer film.

3- Inkjet:

![Diagram of inkjet printing process]

There are 3 kinds of inks for this printing process and restrictions are different from one to another:

**Acetone based ink:**
- ½ second drying
- can be used on every kind of substrate
- solvent vapours can be uncomfortable. The printer can be fit out with a condenser.
- Very good ink adhesion
Alcohol based ink:
- convenient for porous substrates
- slow drying
- average ink adhesion
- used to print egg shells

Water based ink:
- convenient only for porous substrates
- slow drying
- average ink adhesion

DIE-CUTTING

When manufactured, the face material and adhesive of the labels are die-cut, not the backing.

There are 3 kinds of die-cuttings:
- flat-bed (the die-cutting plate is flat)
- rotary (the die-cutting plate is a cylinder)
- magnetic (the die-cutting plate is engraved in a flexible sheet metal and sticks on a cylinder thanks to magnetism)

The die-cutting shapes can be used for paper or synthetic face materials.

Flat-bed die-cutting:

Rotary die-cutting:
Waste-stripping: the die-cutting shape splits the useless face material part which is then separated from the backing. It winds itself on a waste-stripping reel.

**Other technical characteristics:**
- multi-layers
- embossing
- overlaminating
- fluorescent ink
- varnish
- scratchable ink
- anti-theft wire
- hologram embossing
- printing on the adhesive
- partial or total neutralization of glue
III – DIVERSE

QUOTATIONS AND INVOICES:

The price depends on the following:
- quantity ordered and number of series
- number of colours and plates
- raw materials
- size of the label
All prices are per 1,000 labels.

FINISHING:

Labels are wound according to the dispensing machine owned by the customer:
- core diameter
- winding side and outward direction of the label
- maximum diameter or number of labels per reel

Labels can also be in plates.

STORAGE CONDITIONS:
- temperature: between 20°C and 25°C
- hygrometry: between 50 and 55% of relative humidity
- avoid UV exposure
- make the stocks turn
- keep the labels in their original packaging