PRINTING DEFECTS – TROUBLE SHOOTING

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ABSTRACT

For the Food Packaging Industry, the printing of different plastic films can be done in rotogravure and flexographic printing machines. According to the printing film, the printed structure (surface, lamination etc…), and the application (Fresh food, Snacks, Dairy, etc…), it often requires the use of special ink series. The choice of the ink series has to be defined according to the End Application.

The final packaging has to be in line to the End User specifications. At all stage of the production processes, tests have to be done to assure the right specifications. The printer should control all the necessary materials such as films, inks, adhesives etc…and also the finished printed (and laminated) material before sending to the End User.

As a matter of fact, there will be times when things do not go the optimum way during the printing process so that the printer needs to know all kind of “trouble shooting”.

Keywords: Printing ink, specifications, trouble shooting

1. INTRODUCTION

The production of a packaging for the food packaging industry is a multi step process involving lots of suppliers (films, inks, adhesives, printing machines etc…).

Every suppliers should have a clear view and understanding of the expectations of the End User to be able to deliver their products in the desired specifications.

This process should be well controlled, otherwise this is almost impossible to deliver a right product as so many parameters are within the scope of the packaging.

The need of a good process with a clear and defined control of quality at every steps is mandatory.

Despite films and adhesives, it is important that the correct ink is selected for the final end use application1.

Concerning inks, two major aspects can influence on the quality of the packaging: printing defects can occur during printing or the choice of the ink was not suitable for the application.
A good check list of all needed requirements as well as a good “trouble shooting” guide are necessary to avoid defect materials.

2. RESULTS AND DISCUSSION

The printing company is responsible to prepare packaging materials such as lids, doypacks for the End User.

By this responsibility the printing company should know the specifications of the End User to be able to determine all elements of the packaging material such as films, inks, adhesives and the printing process (gravure, flexo, offset etc...). Achieving high quality results in gravure or flexo depends not only on matching the ink, substrate and anilox or cylinder, but also in choosing the right characteristics of the ink to suit the environment in which the ink will be used, such as freezer, oven, outside weather proofing etc...1

These specifications should also contain all necessary information concerning the packaging line such as specific sealing conditions (temperature, time and pression) or pasteurization/sterilization such as H2O2 sterilization. A qualification job should be definitely performed to avoid any surprises for both parties, printing company and End User.

During printing some issues can occur which result in sub-optimum print quality. This is the reason why some trouble shooters were developed to help printers to solve asap the issue2.

Tables 1 and 2 are summarizing some of the most common printing mistakes that can occur during a printing job. Gravure and flexo3 are very high technology processes. When issues occur, there can be many parameters leading to the improvable result such as inks, films but also machine parameters such as cylinder (roughness), doctor blade, anilox, clichés, etc... Among all mentioned printing defects, some examples will be more detailed:

1 – REWETTING

Rewetting is a phenomenon typical by printing overprint varnishes or printing white on colors (reverse printing).

The major factors influencing the rewetting are the solvents of the inks, the chemistry of the inks, the viscosity of the inks and also some machine parameters. In general, rewetting can be avoided when the solvents used in colors and lacquers or colors and whites are different. For example, the colors can be diluted by ethanol or ethanol/ethylacetate 1:1 whereas the over print varnish will be diluted fully with ethylacetate.
Also the experience shows that this is better to cross the ink technologies. For example in reverse printing this is recommended to use for colors and white different chemistry of inks. For example, NC/PU (Nitrocellulose / Polyurethane) based colors can be used and certain PVB (Polyvinylbutyrale) or full PU white can be then printed.

The viscosities of the colors and whites or over print varsishes should be different. The viscosity of the last unit (overprint varnish or white) should be higher. Concerning the machine parameters, the following ones can be changed: the pressure can be reduced, the printing speed can be increased, another cylinder can be used (lower ink transfer/volume) etc...

2 – SCUMMING (“TONING”)

Scumming is a phenomenon typical of the gravure printing process:

Under the doctor blade, a very thin ink layer must remain between the doctor blade (steel) and the cylinder (chrome) in order to avoid scuffing of material between the two metals. Thus the ink serves as lubricant resp. gliding agent between both metals. Under unfavorable conditions this very thin ink film may print as well.

2.1. Essential factors influencing the scumming

a) Surface of the substrate

The smoother the material to be printed, the clearer a scumming film is visible. Thus, there is a greater danger of scumming on high-gloss coated papers resp. cardboard and plastic films than on rougher substrates.

b) Cylinder surface

Both too rough and too smooth cylinders may cause scumming. In a separate exposé we have described in detail the demands made on a correct cylinder surface.

c) Electrostatic charging

On materials with a tendency to electrostatic charging, the scumming film will print out more easily. This is so to say an unintended electrostatic printing support.

d) Printing ink/dilution

It goes without saying that the printing ink used and its dilution plays an important role. At the machine, one keeps trying to counteract the scumming particularly by varying the dilution. The countermeasures stated below mainly cause the scumming film to dry on the cylinder, thus preventing it from printing.

e) General machine conditions

Here, the type of doctor blades used as well as the distance between the zone of doctoring and the zone of printing are relevant. However, the "optimum conditions" dif-
fer from one machine to the next and from one printing job to the other so that it is not possible to give generally valid information.

2.2. Countermeasures

For the practice it is particularly important to know how to take countermeasures. Of course, the printer will be aware of most of these measures, but they are listed here for the sake of completeness.

a) In order to keep the degree of contact between the scumming film on the cylinder surface and the substrate as low as possible, impression should be reduced as far as possible.

b) As a first step, usually the doctor blade pressure is increased so that the cylinder will be "cleaned" by the doctor blade to a higher degree and the remaining scumming film will become thinner.

This measure may be sufficient in many cases, but frequently scumming returns after a short time and further tightening of the doctor blade would cause wear of cylinder and doctor blade so that this is not the method of choice.

c) In practice, it is often tried to obtain a better effect of the doctor blade by retarding the ink. In some cases, this step is as successful as the opposite measure of accelerating the ink's drying. In the latter case, the fact that the scumming film dries on the cylinder and can therefore not print any more is decisive.

d) The same result can be achieved by deliberately blowing air onto those parts where scumming films may be formed ("air knife, air brush"). Unfortunately, this procedure reaches its limits when halftones must be printed or scumming zones appear axially to the direction of the cylinder.

e) Electrostatic charge, which may grow on plastic films, should be carried off by all means. PVC films or certain acrylate-lacquered OPP films are particularly sensitive in this respect. Possibly, moistening of the air may also help against electrostatic charge.

Scumming is a tricky and challenging phenomenon, which often becomes visible only when changing the rolls. Apart from the fact that the printing design looks unclear, one other danger must be explicitly mentioned: on heat-sealable materials scumming films (which may sometimes even be invisible, e.g. in case of overprint varnishes) may lead to a loss of the heat-seal ability for sealing film against film. Example: a heat-sealable polypropylene is supposed to be printed with nitrocellulose inks in reverse printing; subsequently the package should be sealed with a fin seam (sealing inside against inside). For this application, the parts to be sealed later are omitted from the print.

In case a scumming film appears, already a very thin layer of heat-resistant NC based ink will prevent the sealing of the material which - as such - is heat-sealable. Such a
scumming film may also appear with heat-resistant lacquers, which is then practically invisible at the printing machine but can be detected only by means of a corresponding sealing test in the laboratory. Similar problems may arise in surface printing when an overlapping seam has to be formed (sealing inside against outside).

3 – FOAMING

The foaming is a typical phenomenon which can be seen in gravure and flexo.

The major factors influencing the foaming are the viscosity of the inks, the recirculation of the inks and the quantity of inks in the ink pans. Some bubbles can occur in the ink pan and conduct to foaming. Then some ink splash will be seen on the printed film. In general, the foaming can be achieved by simple modifications without changing the ink.

If these measures do not lead to the desired result, some anti foaming additive can be used but these additives have to be added in a very little amounts otherwise some other negative consequences can occur such as delamination, pinholing or blocking etc...

It is very important to have a good flow of the inks and to avoid any stagnation of the ink in some areas of the printing vessel in order to avoid drying in of the surface layer and splash formation.

CONCLUSIONS

During and after printing some tests have to be done to ensure the quality of the job.

Numerous articles are describing these kind of tests4-5. These quality tests have to be done by the printing company before sending the full printing material to the End User. A clear and detailed process including quality checks and defined specifications can allow the production of a packaging without defects.

This process should include all suppliers of the packaging material as well as the End User. At all steps a defined quality control process is mandatory and a Trouble Shooter can be a helpful tool.

REFERENCES


**Acknowledgements**

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**Table**

**Table 1:** Trouble Shooter – Gravure

<table>
<thead>
<tr>
<th>Adhesion (lack of)</th>
<th>Hazing or Scumming</th>
<th>Snowflakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocking</td>
<td>Miss print</td>
<td>Static</td>
</tr>
<tr>
<td>Blushing</td>
<td>Mottled print</td>
<td>Streaks (hard)</td>
</tr>
<tr>
<td>Cob Web</td>
<td>Poor trapping</td>
<td>Streaks (soft)</td>
</tr>
<tr>
<td>Cylinder wear</td>
<td>Pinholes</td>
<td>Striation</td>
</tr>
<tr>
<td>Drying in</td>
<td>Rub or Scuff</td>
<td></td>
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<tr>
<td>Foaming</td>
<td>Screening</td>
<td></td>
</tr>
</tbody>
</table>

This list is not exhaustive

**Table 2:** Trouble Shooter – Flexo

<table>
<thead>
<tr>
<th>Adhesion (Lack of)</th>
<th>Ghosting</th>
<th>Pinholing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding – smudging</td>
<td>Halo</td>
<td>Poor color strength</td>
</tr>
<tr>
<td>Blocking</td>
<td>Hickies</td>
<td>Poor ink transfer</td>
</tr>
<tr>
<td>Bridging</td>
<td>Lack of impression</td>
<td>Register</td>
</tr>
<tr>
<td>Dot deformation</td>
<td>Longitudinal marks</td>
<td>Repeat length</td>
</tr>
<tr>
<td>Dot gain</td>
<td>Marbling / ink mottling</td>
<td>Strong color strength</td>
</tr>
<tr>
<td>Feathering</td>
<td>Mechanical resistance of ink</td>
<td>Transversal marks</td>
</tr>
<tr>
<td>Fill in / ink stain</td>
<td>Moiré</td>
<td></td>
</tr>
</tbody>
</table>

This list is not exhaustive