Avery Dennison Technical Bulletin 3.03

▪ Guidelines for Screenprinting

▪ Storage and Conditioning of Material Prior to Printing

Avery screenprint materials should be left in the original packaging and stored under conditions that are similar to those in the print shop. Self-adhesive films are supplied in rolls and sheets. In general, rolls are well protected against outside influences during storage when stored in the original packaging. Sheets stored for a prolonged period of time either under high pressure or at relatively high temperatures may leave impression marks from the liner, packaging or pallets. Therefore, the following is recommended:

- Store at moderate temperatures (18-23^{o}C). Storage is also possible at a min temp of + 5 ^{o}C
- Do not stack pallets on top of each other
- Process older material first (First in – First out)

If the conditions in the store are different to those in the print room, it is of utmost importance that the sheets or rolls are left in the original packaging until they adjust to the print room temperature. Failure to do so may result in deformation of the edges, which in turn creates difficulties in sheet feeding. The following table indicates the minimum time in hours required to condition material to print room temperature:

Number of sheets	**Temperature difference in store/print room**		
in the stack	**5^{o} C**	**10^{o} C**	**15^{o} C**
250	3 hours	6 hours	10 hours
1500	4 hours	9 hours	15 hours

If stacks of sheets need to be left overnight between colour runs or prior to die cutting, it is recommended that the sheets are wrapped in a moisture protective film. This will prevent moisture exchange during the night. In the case of a significant drop in overnight temperature, the sheets may need extra conditioning time in the morning before removing the wrapping.

Edgewaving

Edgewaving or wavy edges may become apparent on self-adhesive materials when films are originally cut from a roll or when a stack of sheets has been stored for a long period of time prior to being printed. In case of strong profiled waves at the edges of sheets, printing may become difficult as sheets may:

- Not lay flat on vacuum tables, both screenprint and signcutting.
- Be difficult to position against register studs.
- Be difficult to run on automatic presses as the grippers may miss part of the sheets.

Explanation

In most cases, edgewaving is caused by moisture pick-up of rolls or sheets that are cooler than the air that surrounds them. The liner at the edges of the roll/sheet absorbs moisture that condensates to the sheets. As a result the liner expands **at the edges only**. This expansion causes a deformation of the edges that is realised under pressure of a stack of sheets or under the winding tension of a roll. It is therefore almost a permanent deformation, which is difficult, if not impossible to remove. It is essential that steps be taken to prevent edgewaving.

Prevention

The following measures should be taken to prevent edgewaving:

- Always store material in original moisture protective packaging.
- Do not open packaging prior to balancing the temperature of the rolls with ambient air temperature.
- Do not leave rolls or sheets in a room that may cool down at night under 15^{o}C or in a room which is heated up.

Slight edgewaving can sometimes be reduced or even taken away by overnight exposure of the sheets in racks. This will balance the moisture content over the whole surface area.

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Guillotine Cutting of Sheets from Rolls

If sheets have to be cut from a roll, the roll must be stored and conditioned as recommended. Leave the material in the original packaging until the temperature of the material on the roll is the same as the temperature in the print room. This will prevent uncontrolled moisture pick-up at the edges of the roll and/or sheets, so edgewaving cannot occur.

Sheets cut from a roll should always be cut in the **same direction**. The best procedure is to cut the longest sheet edge parallel to the roll edge. This will reduce or eliminate register differences.

Material should preferably be guillotined at **temperatures** lower than 25°C. Use a clean, sharp and undamaged knife blade that makes an angle of 18-20°C.

Try to limit the use of silicone as much as possible. Never spray it directly onto the blade as it may 'travel' through the print room. Keeping the blade clean will prevent adhesive build-up on the blade, which may transfer to the subsequent stack edges.

The **bar pressure** should be adjusted to 2-2.4 kg/cm or 200-240 kPa.

Before cutting:

- Clean the cutting bed using a mild solvent.
- Make sure there is no adhesive residue on the blade (adhesive residues can be wiped away with a mild solvent).

Do not cut stacks **higher than 5cm**. Higher stacks may need higher bar pressure, which in turn may squeeze the adhesive out. If the bar pressure cannot be sufficiently adjusted, put one or two sheets of chipboard beneath and on top of the stack to absorb excess pressure.

Print register

Good print register is of utmost importance for the final print result. It is mainly influenced by the drying temperature and related air humidity. Avery films have been manufactured to be in balance at a temperature of 20-23°C, and relative humidity of 50-55%. Oven drying will to a certain extent, always reduce the humidity of the liner. In most cases this does not have an influence on the dimensions of the sheet and hence the print register. Excessive heating of the printed sheets has to be avoided. Generally, drying temperatures of 40-50°C will dry the links sufficiently so that the sheets can be stacked. In cases where retarding solvents need to be used, the sheets should be dried in racks rather than excessively increase the drying tunnel temperature. If sheets have released moisture and, as a consequence, have reduced size, a brief exposure to ambient conditions will often bring the sheets back to their normal size.

For exact print registration, e.g. four colour half tone printing, we recommend that sheets are passed once through the press and drying oven without printing. This will stabilise the sheet and improve register. If the first colour is not immediately followed by the second colour, wrap the stack of sheets in moisture protective material. If there are long delays between individual colour runs, cover the stack to avoid moisture exchange which may result in sheet shrinkage or expansion. Avoid extreme drops in overnight temperature in areas where the sheets are stored.

Printing

Screen ink selection

Select only screenprinting inks that are recommended by the ink manufacturers for use on self-adhesive films. Ensure that inks are used that match the performance of the films in terms of durability, flexibility etc. Always follow the instructions of the screen ink manufacturers.

Ink drying

For multicolour jobs, allow sufficient time between print colours so that the ink can properly dry. Temperature settings in the drying ovens should be adjusted in line with the instructions of the ink supplier.

If the drying temperature in the oven is too high, the ink may:

- Form a 'skin' that prevents a good thinner evaporation from the printed ink.
- Dry too quickly, which in some cases may reduce a good ink key.

Only print a next layer of ink or vanish if the preceeding layer of ink is sufficiently dry. Solvents that are 'trapped' in the film adhesive may adversely affect film performance. If inks however are dried too slowly, solvents are likely to penetrate into the film and the adhesive. High solvent retention in the film will cause an acceleration of plasticiser migration, which will make the film shrink and become more brittle. It will also reduce the initial tack and adhesion characteristics of the adhesive. Well dried inks do not suffer from these negative effects. It is therefore recommended that retarding solvents be used only if necessary (at high ambient temperatures). Never exceed the maximum amount of retarder recommended by the screen ink manufacturer.

Film and ink

Screenprinted films are composed of two different layers, that may influence each others properties. By carefully selecting the inks and following the screenprinting instructions, the required properties can indeed be realised in the printed film. If the inks and the films are not 100% compatible, some negative effects may become apparent. Examples are listed to enable corrective action whenever necessary.

1. Edge curl:

May become apparent when the film is on the liner or when applied. Generally, this is a result of an ink that is not as flexible as the film and that has been printed to the very edge of the decal. Combined with the presence of solvent in the decal, the ink layer continues to dry, while solvents continue to evaporate. This will cause the ink film to contract, which in turn will cause the edges to curl upwards.

There are several measures that can help prevent edge curl:

Solvent inks

A. Choose a more flexible ink.
B. Improve the ink drying before diecutting the decals.
C. Make sure ink solvents have evaporated completely before application of the decal to a substrate.
D. Allow for an unprinted edge on the decal if the print design allows.

UV inks

A. Make sure that the inks are 100% cured, prior to diecutting.
B. Apply printed decals only if dried: post-cure by sun radiation may promote edge curl.

2. Reduced adhesion level:
Most screenprinted self-adhesive films will show a slightly reduced adhesion level in the first period after printing. Generally, the adhesion level will become normal after the thinners have evaporated from the film. Extreme use of slow drying thinners may damage the adhesion level permanently, while they also will render the film brittle as a result of accelerated plasticiser migration.

3. Increased adhesion level of removable adhesives:
After extreme use of retarders, removable adhesives may show a significantly higher adhesion level that will make removal more difficult. Only use retarding solvents if necessary and never more than recommended by your screen ink supplier.

4. Film brittleness:
Films that are flexible by design may be more brittle once printed with harder inks or varnishes.
UV inks and varnishes in particular have to be selected carefully to prevent an embrittlement of the printed decal.

For further information, contact your local Avery Graphics representative.