WHITE PAPER

DIE-CUTTING ON THIN PET LINERS

Basic Requirements and Supporting Measures for Optimum Die-Cutting Results on Thin Liners

During the last years, thin PET liners have become very popular in the global label business. They offer many advantages to converters, brand owners and consumers alike. However, the characteristics of these backing materials make them a challenge for the die-cutting process. This white paper explains the problems that can arise when die-cutting with thin PET liners, and gives recommendations for label converters how to overcome these difficulties.

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Successful Label Cutting on Thin PET Liners

Rotary Die-Cutting

In the standard die-cutting process, the face material is compressed by the tool's cutting edge until it bursts (figure 1). The silicone layer and the backing material (liner) should remain undamaged. This kind of cutting is referred to as "kiss-cutting", as the main application for self-adhesive labelstock. Of course it is also possible to completely cut through the whole material including the liner, for example in perforations (also called "metal-to-metal" cutting).

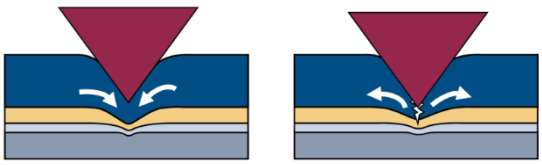


Figure 1: Schematic depiction of the typical die-cutting process

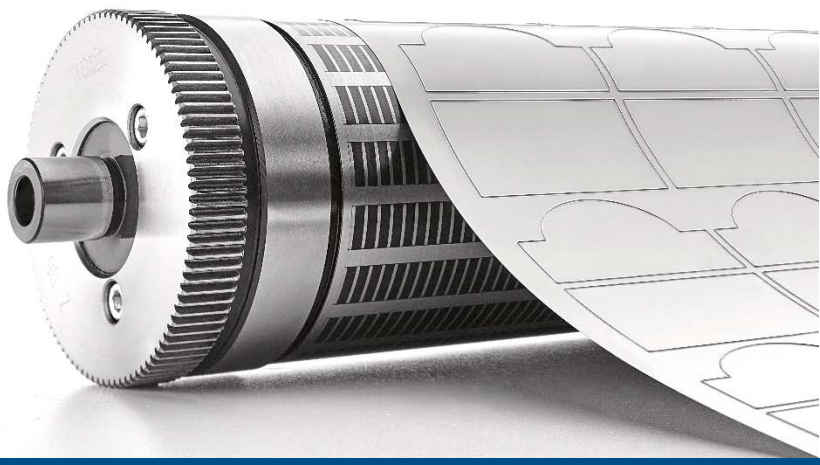
The Thin Liner Challenge

The trend towards ever thinner PET liner materials is ongoing. While a few years ago the normal thickness was 30-36 µm, 23 µm has now become the standard, and even thinner liners are already being tested. The thin PET liners are usually combined with equally thin upper filmic materials (PE, PP, MDO), although paper print substrates are also possible.

The advantages put forward by the manufacturers are principally in cost efficiency (e.g. fewer roller changes, lower transport and storage costs, recyclability), comparatively higher stability and better printing and processing characteristics. Given the numerous advantages, it is no wonder that more and more users are opting for thin PET liners. Nevertheless, they present a real challenge in the case of die-cutting.

For a better understanding, one should observe the principles of rotative die-cutting. The cutting tool has to cut through the face material and the adhesive layer, without however damaging the liner material. In contrast to paper, which ruptures relatively quickly when compressed, synthetic film materials must be fully penetrated by the cutter.

A standard glassine liner can be compressed and absorbs some of the pressure of the penetrating cutter, making it less sensitive to perforation. The PET liner on the other hand is much thinner, has only a minimal silicon layer and is practically incompressible (figure 2). This makes it particularly sensitive to damage from the cutter, although the material itself is relatively stable. Liner damage is of course absolutely to be avoided, in order to prevent web breaks during matrix removal or the label dispensing process.



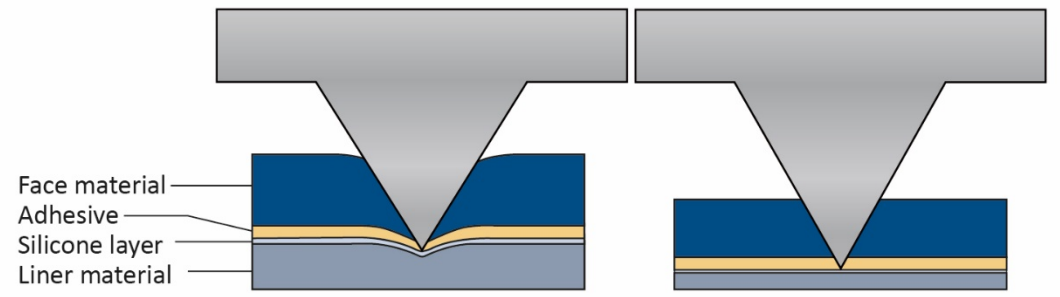


Figure 2: The left sketch schematically shows the die-cutting of a filmic material on a glassine liner; the liner yields to the pressure from above. The illustration on the right shows the difference when the same face material is die-cut on a thin PET liner. Here the die penetrates precisely to the minimally siliconized liner layer, and almost no compression takes place.

Basic requirements

What can a converter now do to make die-cutting on thin PET liners function smoothly? In principle, the basic requirements for successful die-cutting must be fulfilled: an immaculate, stable die-cutting unit as well as a high-precision cutting tool precisely adjusted to the material.

For thin liners, these requirements apply to an even greater extent. Since literally every micron counts, it is particularly important that the die-cutting unit and the cylinders are in a flawless and clean condition. The magnetic and anvil cylinders must be manufactured with minimum tolerances of three microns and be perfectly concentric and parallel, given that the tolerances of the individual components accumulate. The die cutter and cylinders, including their races and bearings, must be regularly cleaned, serviced and gauged.

Optimum Die Characteristics

In close consultation with the customer, the die manufacturer has to adjust the die height as precisely as possible to the material to be die-cut, keeping within a height tolerance of two microns. For conventional paper liners the compression of the liner must also be accounted for in determining the die height. Not only the height of the flexible die must be exactly right, however; the shape and quality of the cutting edge also play a major part. The cutting tool needs to cut through the face material very cleanly, which requires a relatively steep cutting angle and in some cases a special blade geometry.

Moreover, the edges of the blade must be very smooth, since even the smallest irregularities can lead to unclean die cuts. The SuperCut dies by Wink are produced in the “Special” variant for this purpose with a very painstaking engraving technology, which permits minimum tolerances and very smooth cutting edge. Furthermore, the tool should always be hardened, in order to cut through the soft upper material cleanly and guarantee sufficient wear protection.

Figure 3: Special engraving techniques demand the highest precision in flexible die production

Controlling the Gap

In rotary die-cutting, the so-called gap (cylinder clearance) is one of the decisive variables influencing the cutting result. It is defined as the distance between the magnetic cylinder (magnetic zone) and the anvil cylinder given normal pretension, or to express it as a formula: *Gap = (diameter of bearer rings – diameter of magnetic zone) / 2.*

For die-cutting in general, but especially when operating thin liners, it is very recommendable to use an adjustable anvil roller, which allows for variable adjustment of the cylinder gap in the smallest increments. The Wink SmartGap system combines the stability of conventional anvil rollers with the flexibility of adjustable systems. The SmartGap cylinders are solid and fully hardened, and in addition, the specially designed support roll offers particular stability at the same time.

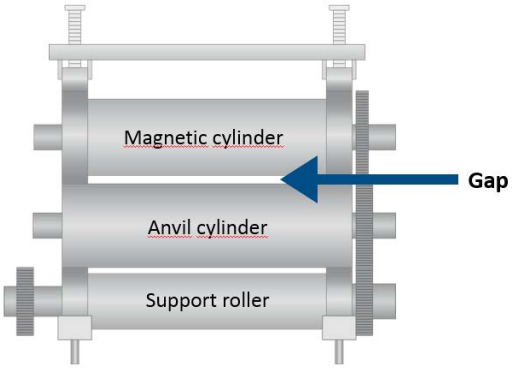


Figure 4: Schematic representation of a die-cutting unit and the gap between the cylinders

Figure 5: Close-up of the gap between the magnetic and the anvil cylinder

This unique construction provides the necessary running smoothness to process even the thinnest PET liners at high speeds. Cutting-through ("metal-to-metal", e.g. for perforations) and backside cuttings are likewise possible without difficulty. The SmartGap is operated very simply and intuitively via two rotary knobs, which make it possible to adjust the size of the gap on the drive and operator sides independently of one another.

Figure 6: The adjustable anvil cylinder Wink SmartGap permits high-precision gap adjustment

Checking Die-Cut Quality on Thin Liners

Given the high requirements described, it almost goes without saying that the results of the die-cutting should be regularly monitored during the production process. An ink test, as used with paper liners, cannot meaningfully be carried out with PET liners since the material is not absorbent. The only remaining option is very careful visual checking of the material, in which liner markings can be discerned by means of light reflections against a dark background.

It is important to note here that even a perfect die cut will almost always create an impression on the PET liner, because the upper film material must be completely cut through. As long as this marking is only minimally discernible and also occurs evenly over the whole grid, it is a sign of a successful die cut. Excessively deep die cuts can be discerned by a comparatively strong reflection and a tangible impression of the cut outline, sometimes also leaving discernible kinks in the liner material. Such defects will almost inevitably lead to web breaks, either during label production itself or in the later dispensing procedure.

Besides the visual inspection, a “snap test” is also carried out in practice to check the stability of the liner. For this test, once the matrix and labels have been removed, individual strips of the liner material are jerked apart. Clear test criteria are lacking, however, so that the decision on the die-cutting quality ultimately lies within the user’s margin of discretion. The die manufacturers will nevertheless be happy to advise on assessment of results.

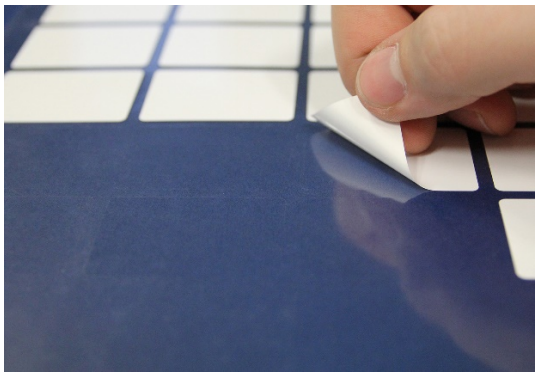


Figure 7: With an optimum die cut on PET liner material, only a razor-thin impression of the outline can be seen.

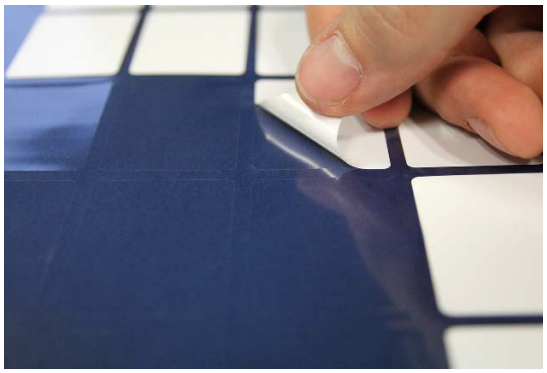


Figure 8: If the die-cut is too deep, the cut outlines will in contrast show as clear impressions (reflections) on the liner.

Overview

RECOMMENDATIONS FOR DIE-CUTTING ON THIN LINERS

- ✓ Immaculate, clean condition of die-cutting unit and all components
- ✓ Minimum tolerances of all cylinders, races and bearings
- ✓ Perfect flexible die (minimum height tolerance, special blade geometry adjusted to material, hardened tool) (e.g., Wink SuperCut)
- ✓ Continuous monitoring of cutting pressure, web tension and cutting result
- ✓ Ideally employment of a stable, bilaterally adjustable anvil roller (e.g., Wink SmartGap)
- ✓ Carefully communicate material thicknesses and characteristics to your die supplier, if possible previously send material sample for testing

Contact

For further information, please contact one of our locations below, or visit **www.wink.de** for a listing of our global partners.

WINK STANZWERKZEUGE
Lerchenstr. 12-18
49828 Neuenhaus
GERMANY
T: +49 5941-9270-0
info@wink.de

WINK US LLC
5960 Fairview Road, Suite 400
Charlotte, NC 28210
UNITED STATES
T: +1 704-496-2810
info@wink-us.com

WINK DANMARK A/S
Oliefabriksvej 59 st.tv.
2770 Kastrup
DENMARK
T: +45 32-5059-59
info@wink-denmark.com

WINK SOUTH EUROPE S.R.L.
Via XX Settembre, 4
21013 Gallarate (VA
ITALY
T: +39 0331-795-882
info@wink-south.com