klöckner pentaplast
tips&tricks

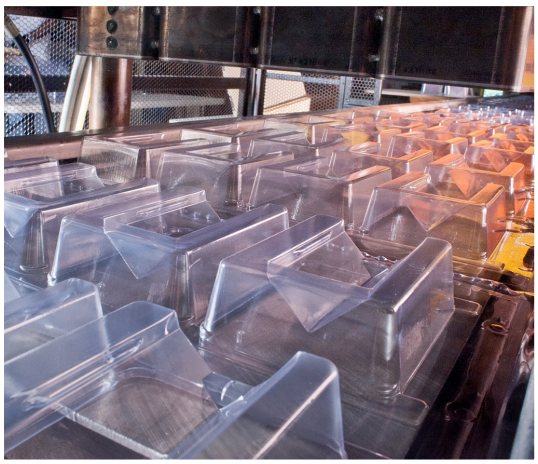
ISSUE 2 I FEBRUARY 2014

TIPS & TRICKS FOR CUTTING AND TRIMMING THERMOFORMS—MATERIAL AND TOOLING CONSIDERATIONS

For many years, blister thermoforming was synonymous with PVC forming for the majority of display packaging. Equipment and tooling were designed for this material with little regard, in most cases, to other polymer properties that have inherent properties that simply behave differently. Much of that vintage equipment is still in service today, but with very different material demands on them that could sub-optimize the modern-day thermoforming shop throughput. While there are many relevant issues around oven design and form tooling that we will save for another issue, our focus in this issue will be on the dynamics of steel-rule die trimming of polyester thermoforms.

tip 1:

WHY IS POLYESTER HARDER TO CUT THAN TRADITIONAL CLEAR THERMOFORMING MATERIALS?



On that memorable day that a thermoformer first had to trim a polyester formed part, beginner's luck may not have lasted long enough to appreciate all of the dynamics of just what the polyester film was telling the process. Material hardness was noticeably greater than the traditional PVC part, but the higher gloss and smoother surface would make the ultimate part in which any consumer goods company would be proud to package its products.

So with all of these package appearance advantages, the motivation was high to successfully make this material into premium packaging. That was a time when the thermoforming vocabulary had to expand to add terms such as "angel hair," crazing on the edges, stress fracturing, and knife dulling at unusually rapid rates—not to mention many expletives not repeated here.

tip 2:

TRIM PRESSURE

Polyesters require roughly 1.5 times the tonnage per linear inch of cut as compared to PVC at similar machine conditions. While surface smoothness and hardness do play a key role in that, so too does the comparative notch sensitivity of PVC where knife travel through the sheet could be 50% to 75% as

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the material "broke" through the rest of the way. Not so with polyester where knife travel is required at 100% to complete a clean cut. Any overage on the travel and the knife slams into the backer plate curling the knife's edge. As a result, sharpening of knives at the same run conditions is required much more frequently than on PVC tooling, with the exact increase in downtime for knife sharpening depending on variables such as total linear inches of rule, knife travel percentage, accuracy, and trim press tonnage.

Lack of adequate trim press tonnage meant that machines designed for vinyl parts might only be effective trimming 60-70% of the total rule length when producing polyester parts; thereby, requiring the thermoformer to reduce cavities per index and machine throughput by a similar percentage. This was not good news and remedies had to be found.

tip 3:

MAKE READY, FLANGE WIDTHS, AND RESIDUAL FORMING STRESS

Cleanly trimmed parts require a make-ready process to ensure the trim dies meet evenly across the entire anvil or backer plate surface. Any extra time spent up front on truing this part of the trim process will return valuable production up-time while running any job. You can also expect the job to run more smoothly when the flange width provides enough material, preferably 1/4 inch, to have good lay flat and be out of the areas close to the blister cavity radius where some residual thermoforming stress may be present. Good lay flat leads to the cleanest trim parts without cracking or angel hair. On the other hand, if you are trimming through an area of poor lay flat or high stress closer to the blister cavity, irregular cutting pressures, angel hair, and potential brittleness are at higher risk.

trick 1:

HEATED DIES

By bringing heat to the material either through a heated backer plate or a heated knife, the softening of the material immediately extends knife wear and regains full use of traditional PVC tool configurations and line throughput.

Pressure requirements are reduced by the added heat/softer material extending the useful range of the equipment. Although that does not resolve knife sharpening interruptions of the line entirely, with throughput equations improved, production variances for formed and trimmed polyester part production decrease dramatically. An additional benefit of a better finished cut edge is reduced occurrence of angel hair and edge fracturing.

trick 2:

KNIFE BEVEL

There are different schools of thought on preferred bevel for trimming polyester thermoforms. Sharper bevel knives cut more cleanly while they remain sharp, but have increased wear compared to decreased knife angles with slightly wider kerfs (knife edge thickness). With this in mind, a center bevel knife with decreased angle would be expected to withstand more strokes than a sharper, single-side bevel knife.

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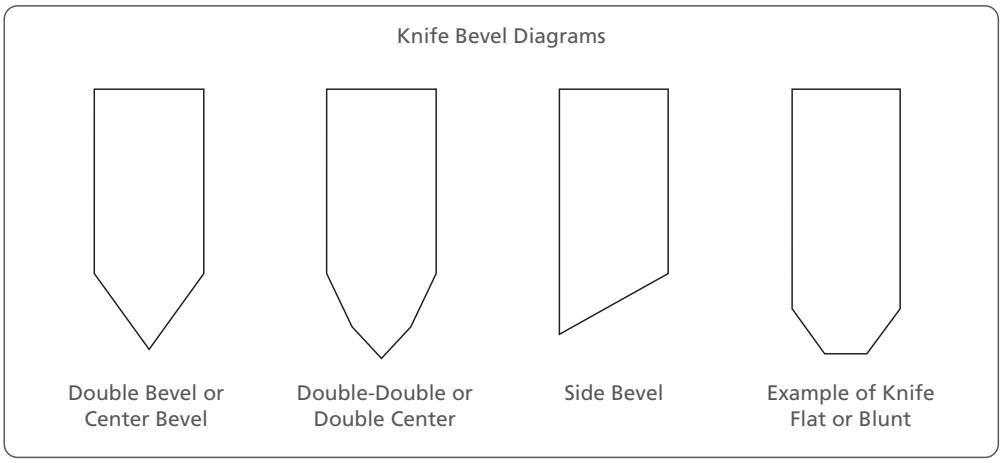
With polyester, you can expect increased knife maintenance as the increased press tonnage is already an indication that the knife will become dull more frequently than with PVC. Consult your tool and die maker for recommended bevel and kerf.



trick 3:

KNIFE KNICKING

For thermoforming machines making "pre-forms" (not form/fill/seal machines) that use up-stackers or that are making perforated easy-open features in the formed part, knick size matters. Notch sensitivity with polyester behaves differently than what may have worked for PVC. The knick on a polyester part has to be smaller to get clean separation of the formed part from the trim matrix or skeleton for optimal stacker performance. The same would be true of a perforation feature on the package to allow the consumer similar package access as they may have been used to with PVC. One common method is to knick or file a small groove in the knife itself. Another method that works well for long running jobs is to knick/mini-groove the anvil rather than knicking the die. This allows material to remain intact at that spot as there is no direct counter pressure from the cut/trim die there. Check with your tool and die maker to see if they have a recommendation based on your specific trim die and tooling configuration.

SUMMARY

These tips and tricks should help address issues you may be experiencing cutting and trimming polyester thermoforming film. As always, kp's technical support team is available should you need assistance.

Future topics TIPS & TRICKS will address:

- Down gauging—positives and pitfalls
- Part design and material selection
- Draw ratios and draft angles

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