ZIMMER INDUSTRIES, INC.

The CUTTING EDGE

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Did You Say, "Plastics?"

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Remember the classic scene from the movie, "The Graduate," when the new "graduate's" uncle, giving some career advice, whispers simply in his nephew's ear, "Plastics!"

That very well may have been good advice at the time, but believe me, through the years, no materials have caused more absolute nightmares for converters around the world than the wild, wacky family of products we lovingly/hatingly call "plastics." I myself am severely "plastic challenged," when it comes to knowing the various types and classifications of plastics, but I was able to look them up. The common types include: polypropylene, high and low-density polyethylene, polyvinyl chloride, vinyl and polystyrene. Now I see why I am "challenged" by plastics. I can't even pronounce half those names.

The properties of plastics that make them so versatile, effective and multi-purpose are often the exact same properties that make them so difficult to convert. For example; plastics may be flexible, brittle or stretchable, thin, medium or thick, clear to opaque, really easy to tear, easy to tear, tough to tear or impossible to tear, have excellent "memory," or have no "memory" react readily to heat or don't react to heat at all, allow air to pass through them or actually prevent bullets from passing through them. You get the picture. So how do you cut, crease and perforate such incredibly diverse (and perverse) materials?

Cutting—skived versus ground edge

Cutting plastics with steel rules may often require an extremely sharp, sleek cutting edge. For cutting plastics in "conventional" platen diecutting, a ground edge is usually strongly recommended over the more popular shaved or skived edge. Not only is the ground edge sharper, its machine lines (grinding lines) run in the exact same direction as the cutting process. The machine lines of a skived edge run in the exact opposite direction of the cutting action. This can cause problems when cutting plastics. A sleek, ground edge may often reduce cutting pressures and produce cleaner, smoother product edges. There are several rule manufacturers, including ours, who make excellent ground edge products. See illustration 1, p. 2.

Another option for cutting (and nicking) various plastics is a patented product called MicroNik. This pre-nicked cutting rule is very sleek, in its primary (a 21 degree centerface) and secondary bevel (a 2 degree double bevel) and comes in various nicking patterns, the most common

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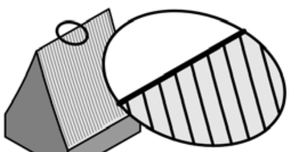

GROUND KNIFE EDGE PROFILE

Illustration 1

of which is 4 microscopic nicks (only .007"/.1778mm wide) per inch (25.4 mm). The sleek double bevel is especially helpful when cutting thicker plastics. MicroNik produces edges that are as close to "clean" and smooth as possible and is also available with 1 or 2 nicks per inch. Research is currently underway to produce even smaller nicks. See illustration 2.

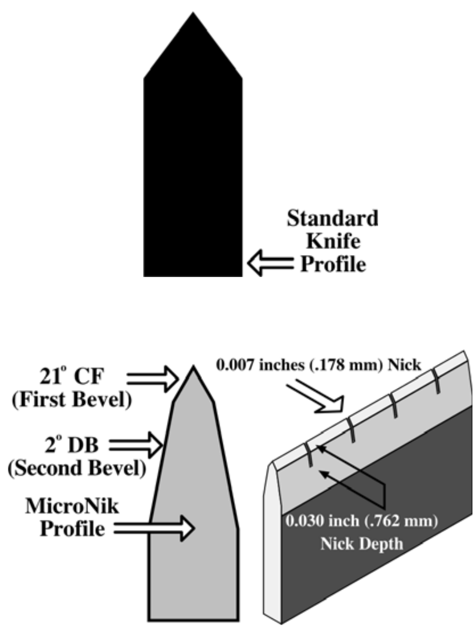

Illustration 2

Cutting—a pointed solution

Another effective method for cutting plastics, (especially plastic films) calls for the use of a specialized serrated rule (such as QC100), again with a sleek, very sharp edge. Cutting in this manner requires very sharp points and gullets (the valleys between the teeth). The points of the teeth need to be super sharp, or else the blade may tend to stretch or distort the material before the actual cutting begins. If the gullets are very sharp, this helps to create an easy, continual cutting action that allows the points of the teeth to totally pass through the film, thus completing the cut. When the gullets are not sharp, the cutting action may be hesitant and can stall or "bog" down in the gullets. This too may cause the plastic to stretch and/or distort.

This type of rule usually comes in either a 12 or 16 Tooth Per Inch (TPI) pattern. This method of cutting requires the serrated teeth to pass completely through the plastic, usually into "air" or a slot (preferably supported) or a dense brush, because the teeth, being so sharp, may be somewhat "fragile." See illustration 3. A company called Dicar of Pinebrook, NJ, USA is currently working on the development of a blanket or anvil that may allow such blades to penetrate into them without damaging the super sharp points of the rule.

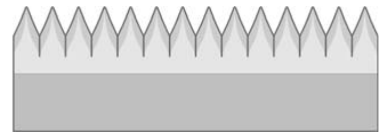

Illustration 3

Perforating—another pointed solution

For the perforating of plastics, we may begin by revisiting the QC100 type of serrated blade discussed above. There are two ways to use this blade to create a perforation. One way is to control the penetration of the blade, so that only part of the tooth is allowed to pass through the plastic. See illustration 4. This creates a perforation of variable strength. Obviously, the deeper (closer to full penetration) the teeth go into the material, the weaker the perforation.

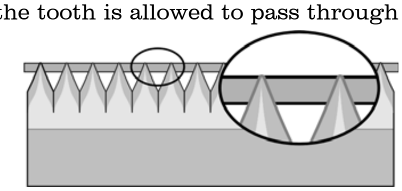

Illustration 4

The second way to use this blade to perforate is to create slots of various widths in the cutting edge. See illustration 5. The slots produce an uncut area in the material, even if the entire tooth is allowed to pass through the plastic. Increasing or decreasing the size and or number of the slots in the blade allows variations of perforation strengths. Both methods discussed above also require the blade to penetrate into air or a brush.

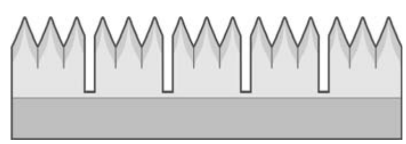

Illustration 5

Perforating—"micro" managing

In platen diecutting, a desirable alternative to conventional perf rules is microperforating rule, such as MicroMax or Invisible. These rules very effectively perforate various plastics because they have the seemingly contradictory abilities to create perforations having anywhere from 10% to 70% hold strength, yet (all) tear very easily and produce product edges that look and feel vastly superior to edges produced by conventional rules. For example, one of the more popular MicroMax patterns is 50 TPI with a .007" (.1778mm) tie (or space) between the teeth. This pattern creates a 35% hold or burst strength, (35% of the material is left uncut) yet tears very easily because each uncut area being torn is only .007" (.1778mm) wide. See illustration 6.

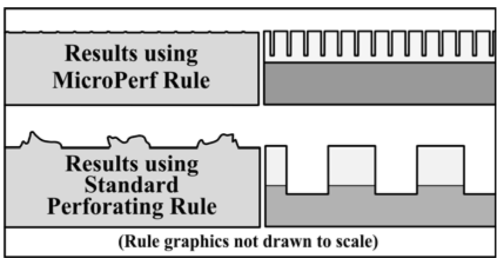

Illustration 6

Invisible microperfs are made with a V-shaped tooth, are available in tooth patterns from 30 to 120 TPI, may be made with ties as small as .002" (.0508mm), come in either coil form or lengths and are an economical alternative microperf, often ideal for thinner gauge plastics. The finer the tooth pattern, the thinner the sheet that can be perforated.

Creasing—settling the score!

The last element of converting plastic is creasing or scoring. Historically, a great deal of the scoring of plastic has been done using RF (Radio Frequency). This is an effective, yet costly process.

Other methods of scoring or creasing plastics often employ heat in various manners. Again, this is somewhat effective, yet costly.

Over 10 years ago, we developed the successful use of microperfs to "cold" crease plastic with tooth patterns normally ranging from 30 TPI to 70 TPI. Cold creasing with microperfs may be achieved by expertly controlling the depth of penetration of the perf into the plastic. See illustration 7. One way this can be accomplished is by reduc-

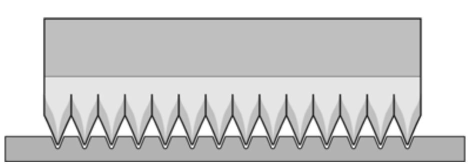

Illustration 7

ing the height of the perf rule in a die. For example, using a .930"-.934" (23.622mm-23.7236mm) height microperf in a die with .937" (23.7998mm) cutting rule. Originally, this process sometimes created creased product edges that were judged to not be "smooth enough" to the eye or to the touch. With the advent of 100 and or 120 TPI Invisible perfs, very "smooth" edges are now possible. By making sure the rule doesn't fully penetrate through the plastic and by effectively employing the different gullet depths to create the required levels of "strength," it is now possible to produce an effective, consistent, smooth, economical, cold crease.

Several companies have successfully tested thousands of feet of this product across the United States and Canada.

Another possible method of scoring plastics calls for the use of a new, unique creasing rule called MicroTrak. This product actually waves or "corrugates" the face of a conventional crease rule. See illustration 8.

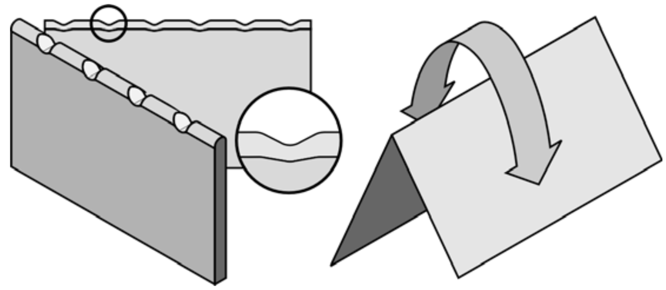

Illustration 8

The application of this type crease creates a somewhat similar effect to that achieved by the use of microperfs and may also eventually be aided by varying gullet depths and the possible addition of heat to the converting process. This process is less costly than microperfing.

So, all our little plastic friends with the names I can't pronounce, "Look out, we are coming after you, armed with some new products that will finally get you to behave (convert) exactly the way you should!"

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