

August 28, 2007

One rule fits all?

Designing a multi-purpose cutting rule to fold and tear cleanly

By: Kevin Koelsch – Technical Director, National Steel Rule

There are many applications where corrugated designers would like to incorporate a way to tear sections of the shipping container apart after it is packed, shipped and received at the destination. Many box companies are being squeezed to reduce the packaging components (inner packs, partitions etcetera) to reduce cost and landfill waste. The other objective is to use more recycled content in an effort to be more “green”. The last but surely not least on the list of wishes is to use the shipping container as the point of purchase display.

Independently, each of these three objectives is, in of itself a considerable task to achieve. When the corrugated design needs to fulfill all three concepts at once we must ask ourselves, are we asking too much? The challenges presented are:

- Corrugated has a broad variety of configurations.
 - Single wall itself has many combinations of liner, medium & liner.
 - Double wall and triple wall are thicker with more liners/layers.
 - Corrugating controls vary in adhesive, temperature and speed.
 - Corrugated varies constantly from birth to shelf in moisture content.
 - Flute sizing the medium will also vary tremendously. Some common flute designations for single wall corrugated are B, C, E & A.
 - Double wall and triple wall are merely combined assemblies of the above described flute choices. For example, BE, BC, AC etcetera.

It is apparent that the goal for tearing a display carton on site is having the display look like it has been neatly cut. This calls for a cutting rule that has very small notches every so often to keep the common cut area together until we are ready to separate them. We know that the smallest notch possible will leave the least noticeable “tag” when the paper is torn. The tricky part is figuring out what size to use.

To complicate this further, many times the tear out areas run along a crease/fold line. Not only will the design call for the display component to remain in tact until merchandising, tear apart without leaving undesirable, jagged edges but the tear rule notches must withstand the stress of folding. Based on the design, this folding must be accurate and will range anywhere from 45° to 180°. The function of creasing a corrugated sheet in itself is distressing to the material. Folding corrugated along a slit/space configuration such as the bundle breaker style or tear strip rule, relies heavily on the notch space being wide enough to contain an adequate amount of fiber content to stretch and not break. The dilemma is that the necessary amount of notch space to get satisfactory folding is too big not to leave a jagged edge when tearing.

This classic irony is then compounded by the fact that there really isn't any defined standard for what is an acceptable finished edge appearance. This is completely subjective and in these cases the standard is based on what each individual consumer products company will accept.

What is being used today?

- 1) .045" notch gap with .100" to .200" cut repeat works well on corrugated board for holding parts together during rotary die cutting with the ultimate goal of tearing them apart mechanically or by hand. A satisfactory edge finish along the tear line is achieved as long as the cutting penetration is managed and there is a decent amount of moisture content in the paper. This style of perforating rule cannot successfully be used in conjunction with folding. *Single wall corrugated applications.*
- 2) .050", .055" and .060" notch gaps are utilized with the same .100" - .200" cut repeat when the paper is dry, weak in fiber content, going through a turbulent die cutting process or any combination of the three. The finished edge result is still in most cases acceptable however the mechanical breaking (separating) of the parts requires more force and many times exceeds the equipment limitation. This style of perforating rule cannot successfully be used in conjunction with folding. *Single wall and some double wall applications.*
- 3) .070", .080", .090" notch gaps with a variety of creative short long cut repeat configurations are being experimented with in high volume, rugged die cutting operations where the corrugated moisture content and liner make ups vary over a broad range of conditions. The larger notch gap is more likely to hold through the converting processes but the resulting edge finish after the parts are separated is less than desirable. When using these larger notch gap configurations it is common to run the perforating rule in short segments (2" – 4") connected by balanced or longer runs of knife. The limiting of the perf segments helps to manage the force to break requirement. This is a juggling act between holding strength through the die cutter and separating requirement of the equipment of assembly process. This style of perforating rule can be utilized for the dual purpose of folding and tearing for most single wall applications.
- 4) As board weight and thickness increases as in double wall and triple wall applications, the notch gap gets considerably larger (.100" - .380") with proportional increases to the cut repeat length (.200" – 1.00").

There are many options that have been successful for this process. However, the degree of success is heavily weighted by the condition of the paper, press, bundle separation equipment, die rubber methods and die cut configuration. Unfortunately, all of these variables inhibit the development of a "one rule fits all" scenario. Until these conditions become more stabilized and further developments are tested it will remain necessary to utilize a combination of products to achieve the desired design/manufacturing objective.