# CONTROL
## is EVERYTHING!

*technology that puts* **you in control**

## BUNDLE BREAKER RULES

Maximize your die cutter yield without compromising productivity or finished quality. National has developed a systematic "family" approach of bundle breaker perforating rules to hold multiple out die cuts together until YOU want to separate them. Easy, clean breaks are a snap and the finished edges are clean and uniform. Maximize your die cutter yield without compromising productivity or finished quality.


**800-922-0885**
**908-862-3366**
**Fax: 908-862-5339**
**www.steelrule.com**


# National Steel Rule

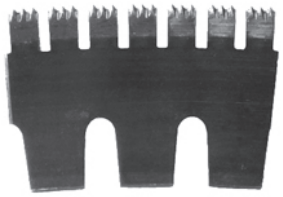

750 Commerce Road, Linden, New Jersey 07036

# BUNDLE BREAKER RULES

## GET Tear CONTROL & a beautiful EDGE FINISH!

**Standard Heights***
- 1.00" (25.4 mm)
- .970" (24.60 mm)
- .937" (23.78 mm)

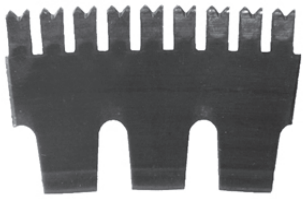
### 045 Extra Light
.045 x .155
With Corrugations



**SHOWN CUTTING WITH FLUTES**

Standard Features:
- 22.5% hold
- .375" (9.5 mm) back notch
- .230" (5.83 mm) top notch
- Symmetrically designed teeth

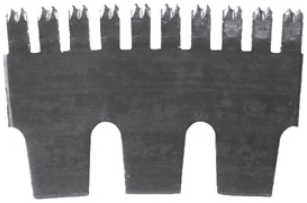
### 045 Light
.045 x .121
With Corrugations



**SHOWN CUTTING WITH FLUTES**

Standard Features:
- 27% hold
- .375" (9.5 mm) back notch
- .230" (5.83 mm) top notch
- Symmetrically designed teeth

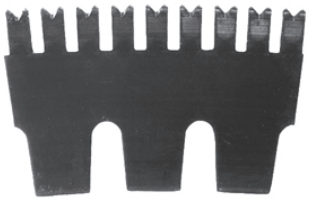
### 045 Medium
.045 x .095
With Corrugations
Light Cross Corrugations



**SHOWN CUTTING WITH FLUTES**

Standard Features:
- 30% hold
- .375" (9.5 mm) back notch
- .230" (5.83 mm) top notch
- Symmetrically designed teeth

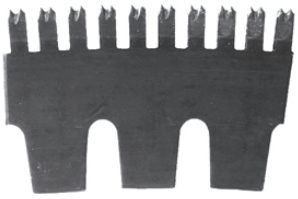
### 055 Heavy
.055 x .111
Cross Corrugations



**SHOWN CUTTING ACROSS FLUTES**

Standard Features:
- 33% hold
- .375" (9.5 mm) back notch
- .230" (5.83 mm) top notch
- Symmetrically designed teeth

### 055 Extra Heavy
.055 x .095
Cross Corrugations



**SHOWN CUTTING ACROSS FLUTES**

Standard Features:
- 37% hold
- .375" (9.5 mm) back notch
- .230" (5.83 mm) top notch
- Symmetrically designed teeth

The Bundle Breaker Family has been designed exclusively by National Steel Rule to provide a systematic solution for managing in-line ***bundle separation equipment***. These dynamic micro-perfs work equally well for "by hand" applications.

Bundle Breaker Rules can also be utilized for ***shelf ready applications*** such as tear out windows and display openings that require a cosmetically appealing edge finish after tearing. Ask about the PERFormaX line of micro perf solutions for shelf ready applications.

* will make to order. Certain restrictions apply.

National Steel Rule
750 Commerce Road, Linden, NJ 07036 - USA
www.steelrule.com

National Steel Rule

# Technical Tips

**080623_BBarticleSHORT**

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Technical Director
National Steel Rule
419.350.3415

**Systematic Bundle Breaking** *(for rotary corrugated converting)*

**Bundle Breaker:** a mechanical device designed specifically to separate 'ganged', multi-out sheets after they have been stacked in a predetermined quantity. This stack of multi out, connected parts is referred to as a 'bundle'.

**Bundle Breaker Rule:** a perforated steel rule installed into the cutting die replacing the common knife that joins one box or part to another. The purpose is to increase die cutter yield per impression by 'ganging' parts or multiples together and delivering them in a single sheet form out of the die cutter in one piece.

*In General*, bundle breaker rule is determined based on the following criteria:

a) What is an acceptable edge finish of the separated parts?

b) How easily will the wavy medium break/tear.

c) Is the bundle break tear line parallel to the flute direction (with flutes) or perpendicular to the flute direction (cross flutes)?

d) Will the bundle breaker rule be curved and installed around the die cut cylinder or straight and sit across the die cut cylinder.

There are four possibilities for utilizing bundle breaker rule:

***Feeding sheets CROSS CORRUGATION – Straight rule***
When flutes and bundle breaker rule run across the cylinder (straight rule), a small notch style works best. The nick tags present after the break are less noticeable with a smaller notch and small notches will hold surprisingly well. These break lines will generally fold up to 180º either way without a complete burst. Many times the outside and inside liners are still completely in tact. Due to the nature of this type of break, significant force must be used and possible lateral motion incorporated to complete the break.

Side note: When using BB rule as a fold line that will later be torn off, folding does not always occur directly along the BB line. When inside resistance to the folding builds from the thickness of the corrugated, the fold may wander to the weakest point which many times is a neighboring flute line. Longer cuts with small notch gaps can improve the folding accuracy.

***Feeding sheets CROSS CORRUGATION – Curved rule***
When flutes run across the machine and bundle breaker rule runs around the machine, the break line is very fragile. Curved bundle breaker rule cuts as it enters and exits the inside liner of the corrugated paper due the rotational entry and exit geometry of the blade. This minutely elongates the actual length of the cut. Larger notch gaps, from a minimum .055 (1.4mm) to .075" (1.9mm) are required. The break in this scenario is very easy. The larger notch sizes are slightly more noticeable but there is rarely any tear out or ripping from the break process. The reason for this is that the break is a function of the inner and outer liners only. The medium is fixed in this direction and has no influence on the break.

***Feeding sheets WITH CORRUGATION – Straight rule***

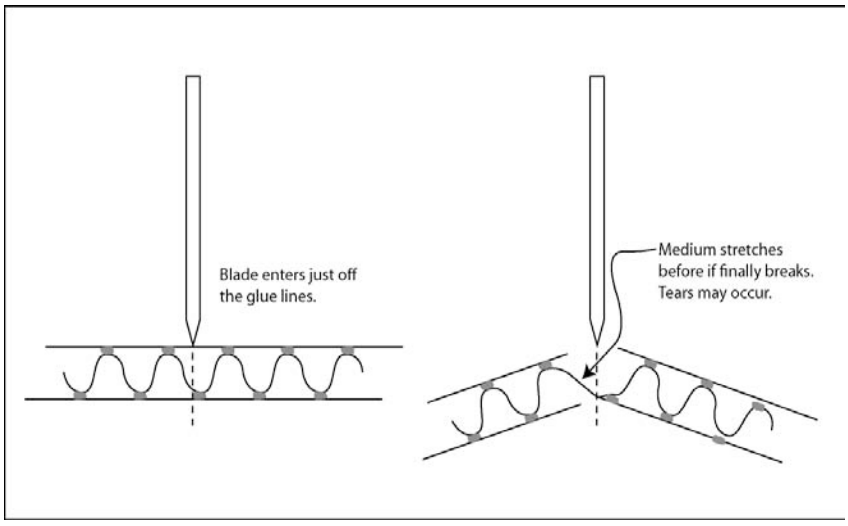
When flutes run through the machine and bundle breaker rule runs across the machine, the break is also fragile. The depth of the top notch (nicks) should be about .230" (5.8mm). Deeper top notching (nicking) will make the rule weak and likely to break prematurely. Larger notch gaps, from a minimum .055 (1.4mm) to .075" (1.9mm) are required. The edge finish with this larger nick is noticeable but very consistent and uniform making the overall appearance generally acceptable. The corrugated in this scenario with the BB rule crossing the flutes results in a rigid structure to break. When the fold is attempted, force is directly applied to the outermost liner. The medium in this case does not hamper the break due to its inability to stretch.

***Feeding sheets WITH CORRUGATION – Curved rule***

When flutes run through the machine *and* the bundle breaker rule is curved, also running through the machine, the combination becomes the most challenging to control and manage. The medium of the corrugated is the primary variable and always a factor. The first situation that affects the bundle breaking performance is the specific entry point of the bundle breaker rule. There are two extremes of this occurrence. The first is when the cutting portion of the bundle breaker rule enters the corrugated exactly centered between two flute tip glue lines. The second is when the bundle breaker cut enters exactly into a glue line. Variations occur in every position between the two extremes.

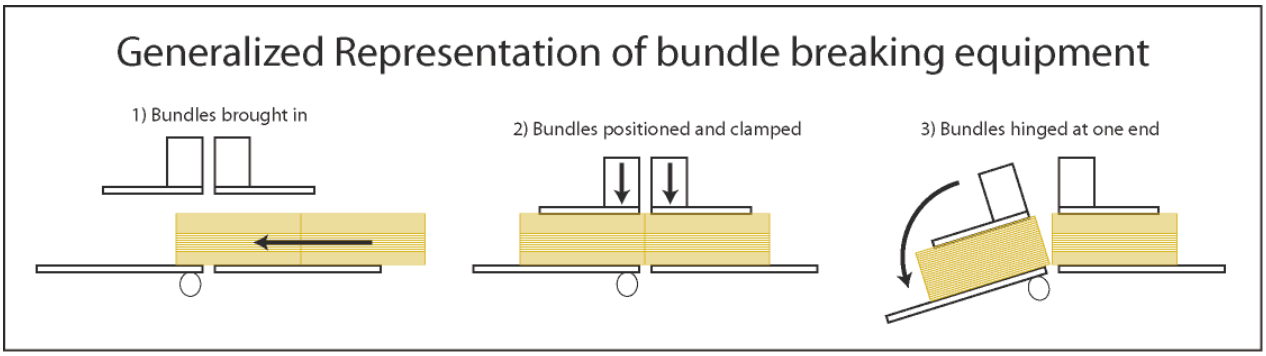
Of course, it is impractical and potentially impossible to plan the flute relationships to the blades entry position. This being the case it can be expected that inside liner breaks will occur and be fairly unpredictable.

The next situation that causes potential problems is when the bundle breaker cuts anywhere other then dead center through the glue line. When this happens the perforation line passes through the medium leaving a connected segment of paper that is dimensionally longer from a fixed glue line then the inner or outer liners are. When the corrugated is bent to be broken the medium must stretch out to full extension before it breaks. This occasionally results in an unsightly tear or ripping of the medium.




The action of the bundle breaking equipment, the height of the bundle, the grade of paper and the position where the BB rule entered the paper act together to affect the break angle. Most bundle breaker machines have four actions to break a bundle:

1) Bring the parts into the breaking equipment
2) Position and clamp the parts on both sides of the bundle breaker cut line.
3) Drop one end of the clamp platform that is holding the lead in bundle down to 'hinge' the parts.
4) Move back to a horizontal plane and convey the parts downstream. (not illustrated)




Depending on the amount of stretch the medium requires, if it isn't broken after the hinge action is employed, a tear out or ripping of the paper may result.

***More basic facts:***

Flutes going through the press and curved bundle breaker rule running parallel to the flute line is the most common practice in use today. This also happens to be the most unpredictable scenario as explained earlier. However, there are some points of note:

1) The initial products of some success were 1/8" x .045 and 1/8" x .055 (3.17 mm x 1.14mm and 3.17mm x 1.4mm). After study and consideration, these two sizes will be replaced by .121 x .045 and .111 x .055 (3.07mm x 1.14mm and 2.82mm x 1.4mm). The NEW sizes are still very close to the nominal 1/8" (3.17mm) cut segment but allow National Steel Rule to enhance the product uniformity and achieve better balance of hold percentages for the entire family of 5 products. *(see guide on pages 10 – 13)*

2) Any notch gap in low ECT single wall that exceeds .060" (1.52mm) wide, running parallel with the flutes will likely result in some tear out of the medium and consequently ragged edges.

3) Low ECT is a tougher to break cleanly then a higher ECT in general. Heavier liners including the medium tend to cut and break cleaner.

4) Curved bundle breaker takes very low force to cut due to the action of curved cutting and the intermittent forces of the blade portion and the space portion. Because of this, the curved rule can be as much as .035" (.89 mm) lower then the curved trim cutting rule. An example would be using .937 (23.78mm) BB rule with .970 (24.62mm) curved cutting rule or .970 (24.62mm) BB rule with 1" (25.4mm) curved trim knives.

5) A .230 (5.84mm) deep top-notch is recommended for all flute combinations to keep a reasonable depth standard. This notch depth teamed with the lower height BB rule keeps the top notch well away from the inside liner. Deeper top notching will only result in a weaker body of rule that will likely break over time. *Special Note: When using .230" deep top notches it is recommended to reduce the bottom notch from the standard 1/2" (12.69mm) to a 3/8" (9.52 mm) bottom notch to assure a decent amount of steel is left between the two notches.*

6) The most common issues are the parts do not stay together to reach the bundle breaker equipment or the parts stay together well enough but the finished edge is unacceptable. Occasionally the parts are held too well and do not break apart at the bundle breaker equipment without excessive crush to the caliper.

7) It is recommended that bundle breaker rule be incorporated as a continuous piece with planned breaks (joints) along the way that allow short 2" – 3" segments to be interchanged when necessary. Setting up 2" – 3" standard segments, pre-cut of each

of the 5 different hold strengths by the press will allow the operator to manage the strength of hold easily with minimal tools.

8) **When bundles won't break:**

a. Reduce the stack height. Reducing the height to the bundle breaker will reduce the force to break.

b. Replace the 2" – 3" segment(s) with a like bundle breaker rule segment that has a *lighter* hold percentage.

9) **When Multiple outs break apart at the die cutter:**

a. Replace the 2" – 3" segment(s) with a like bundle breaker rule segment that has a *heavier* hold percentage.

b. Look for beater bars, stacker wheels and any other post die cutter equipment that could be causing turbulence or commotion of the parts.

**Next Generation Bundle Breaker Rule *FAMILY***

Testing has demonstrated the numerous variables associated with bundle breaking. One variable that National Steel Rule can control is the way the cut action is designed. The listed products will be designed symmetrically with regard to the teeth patterns. Balance will be achieved in place of a random notch to teeth relationship. This design balance will equalize the forces during cutting and provide smooth consistent cutting.

**Applying Bundle Breaker**

The recommended application of the bundle breaker rule is to utilize Bundle Breaker Rule over the complete length of the common knife. Complete replacement (at least with any visible edges) results in a smooth, even cosmetic edge finish. It is also advisable to plan the intentional break up of this continuous run of rule so smaller, standardized 2" – 3" segments at lead, middle and/or trail sections can be easily changed out (see last page of booklet). By incorporating these interchangeable segments, the operator can easily increase or decrease the hold power of the bundle breaker rule. The cosmetic edge will remain constant and reliable due to the symmetry of the notch (nick) sizes of the entire bundle breaker family.

There are conditions where full replacement of the common knife may not be appropriate. When a common knife runs adjacent to small flaps or other delicate components that may be torn off at the breaking stage or when the common knife is very long and even the lightest bundle breaker rule is too strong.

Certainly, all conditions vary in this system and cannot be predicted completely. For this reason, some discretion and decision-making will be required. It is anticipated that though the system is not fool proof it does provide a scientific approach. With continued incorporation and use, it is expected that data gathering and experience will result in a good understanding of which bundle breaker product to install the first time the die is run. Until the data and learning are complete it will be necessary to expect potential changes from light bundle breaker specs to heavier specs and vise versa. In this regard, it is strongly recommended that the die maker utilize one of several quick-change device options available as stated above and demonstrated on the last page, so the operator can easily exchange one bundle breaker segment for a different one.

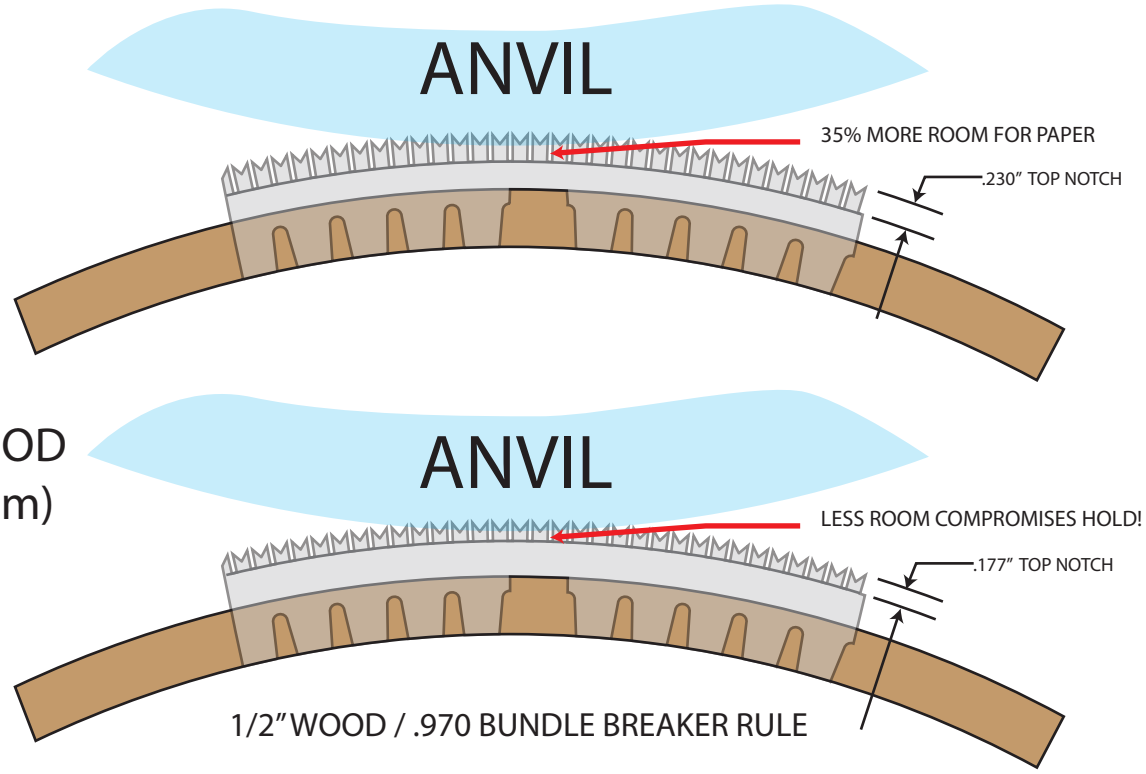
The drive for greater rotary die cutter yield is escalating. While conventional grinding of nicks is still the most popularly utilized approach, it is also the most inconsistent and time consuming. On top of greater yield, box companies strive for reduced set up and greater machine up-time. With these factors being at the forefront of discussion, it seems apparent the corrugated box plants will eventually migrate to a more scientific, systematic approach for managing the bundles of product to the pallet.

# Bundle Breaker Rules: Taking advantage of the deeper top notch.

Top_Notch_Rule.pdf - 080514

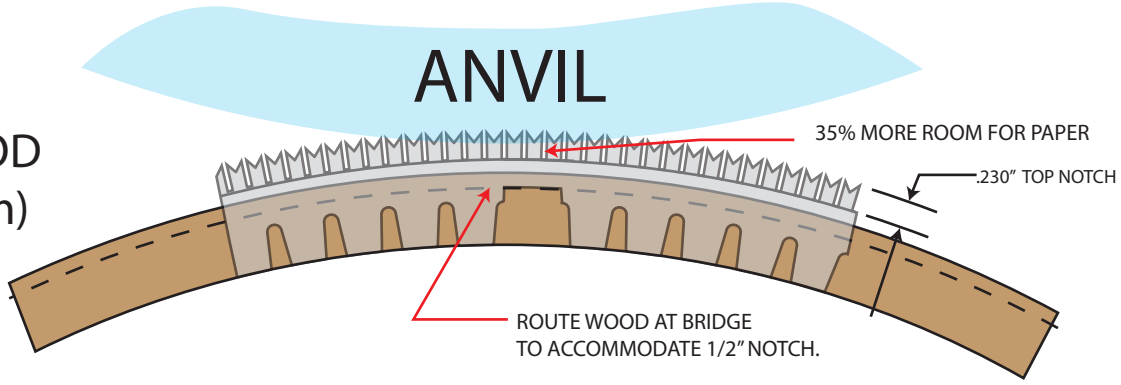
## Value of Deeper Bundle Breaker Rule Top Notch
(shown at .080" penetration)

1/2" WOOD
(12.7 mm)




## Installing Bundle Breaker Rule in 5/8" wood.
(shown at .080" penetration)

5/8" WOOD
(15.9 mm)




For rule strength, bridge notch steel rule at 1/2" (12.7 mm) and route wood down 1/8" over bridge to accept rule.

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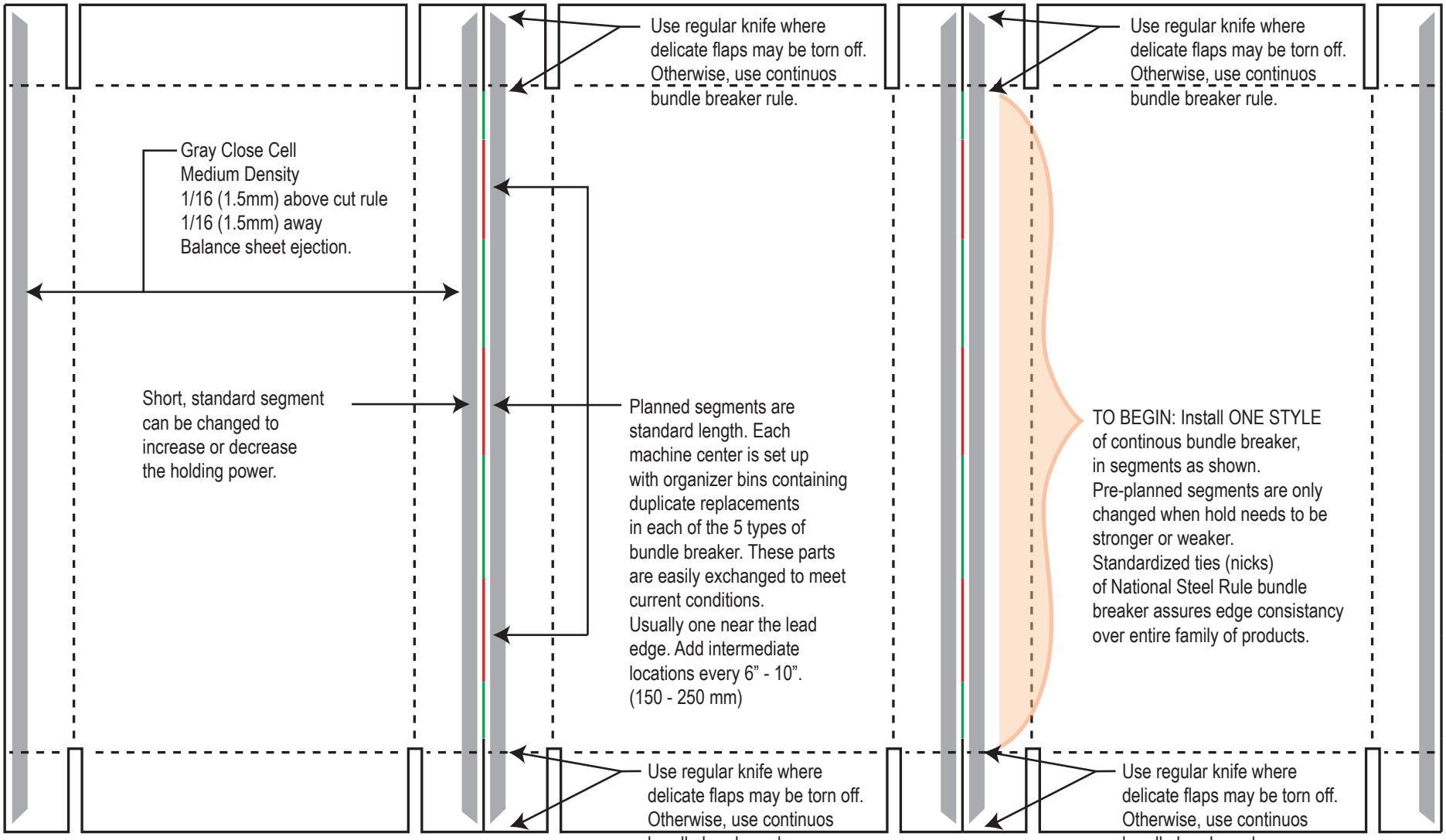
# Application Strategy for National Steel Rule's "Bundle Breaker" Family.

Install_Guide.pdf - 080514




Suggested starting rule based on flute direction.

Flute

Extra Light (.155 x .045) = 22.5%

Light (.121 x .045) = 27%

Medium (.105 x .045) = 30%

Flute

Medium (.105 x .045) = 30%

Heavy (.111 x .055) = 33%

Extra Heavy (.095 x .055) = 37%

LEAD EDGE

National Steel Rule

# Bundle Breaker Guideline pg 1 of 4

| WITH FLUTES - Single Wall | | | | .970/.990 Dies (24.64mm /25.15 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with .970 Curved and .990 SNN |
| Over 15" (382mm) and over | .937 (23.80mm) | 045 Ex Light | 045 Light | 045 Ex Light w/ segments of knife | |
| 9" - 15" (228 - 381mm) | .937 (23.80mm) | 045 Light | 045 Medium | 045 Ex Light | |
| 5" - 9" (152 - 228mm) | .937 (23.80mm) | 045 Medium | 055 Heavy | 045 Light | |
| 3" - 5" (76 - 152mm) | .937 (23.80mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |

| WITH FLUTES - Single Wall | | | | .990 & 1.00 Dies (25.15mm /25.40 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with the same height straight & curved trim knives. |
| Over 15" (382mm) and over | .970 (24.64mm) | 045 Ex Light | 045 Light | 045 Ex Light w/ segments of knife | |
| 9" - 15" (228 - 381mm) | .970 (24.64mm) | 045 Light | 045 Medium | 045 Ex Light | |
| 5" - 9" (152 - 228mm) | .970 (24.64mm) | 045 Medium | 055 Heavy | 045 Light | |
| 3" - 5" (76 - 152mm) | .970 (24.64mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |

Note 1: **The above guidelines are a suggested starting point** based on limited field study and practice. Due to the numerous variables in the die cutting process, National Steel Rule will not be held liable for failed exploitation of the system.

Note 2: **Bundle Breaker Rule can be LOWER** then the trim rule. Straight and curved bundle breaker rule can be lower in height in most cases (.020 - .030 or .5 - .75 mm). The short cut segments of the perf require less force to penetrate, however when dramatic variations of anvil wear are present, it may be necessary to increase the bundle breaker rule height.

Note 3: **Using Straight Bundle Breaker Rule** cutting across the flutes is very challenging. Replacing continuous common knives over 40" (1016mm) in one piece will be challenging. Stablizing the attached blanks through the machine requires significant holding power from the bundle breaking rule. Larger ties with higher percentage hold will be required. This required hold to get the bundle through the die cutter can exceed the bundle separation equipment's ability to break the bundles. The use of alternating knife and BB perf segments may be necessary for success.

# Bundle Breaker Guideline pg 2 of 4

| WITH FLUTES - Single Wall & Light Double Wall | | | | 1.00/1.025 Dies (25.40mm /26.03 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with 1.00 Curved and 1.025 SNN |
| Over 15" (382mm) and over | .970 (24.64mm) | 045 Ex Light | 045 Light | 045 Ex Light w/ segments of knife | |
| 9" - 15" (228 - 381mm) | .970 (24.64mm) | 045 Light | 045 Medium | 045 Ex Light | |
| 5" - 9" (152 - 228mm) | .970 (24.64mm) | 045 Medium | 055 Heavy | 045 Light | |
| 3" - 5" (76 - 152mm) | .970 (24.64mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |

| WITH FLUTES - Single Wall & Light Double Wall | | | | 1.025 or 1.030 Dies (26.03mm /26.16 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with the same height straight & curved trim knives. |
| Over 15" (382mm) and over | 1.000 (25.40mm) | 045 Ex Light | 045 Light | 045 Ex Light w/ segments of knife | |
| 9" - 15" (228 - 381mm) | 1.000 (25.40mm) | 045 Light | 045 Medium | 045 Ex Light | |
| 5" - 9" (152 - 228mm) | 1.000 (25.40mm) | 045 Medium | 055 Heavy | 045 Light | |
| 3" - 5" (76 - 152mm) | 1.000 (25.40mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |

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Note 3: **Using Straight Bundle Breaker Rule** cutting across the flutes is very challenging. Replacing continuous common knives over 40" (1016mm) in one piece will be challenging. Stablizing the attached blanks through the machine requires significant holding power from the bundle breaking rule. Larger ties with higher percentage hold will be required. This required hold to get the bundle through the die cutter can exceed the bundle separation equipment's ability to break the bundles. The use of alternating knife and BB perf segments may be necessary for success.

# Bundle Breaker Guideline pg 3 of 4

| ACROSS FLUTES - Single Wall | | | | .970/.990 Dies (24.64mm /25.15 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with .970 Curved and .990 SNN |
| Over 15" (382mm) and over | .937 (23.80mm) | 045 Medium | 055 Heavy | 045 Light | |
| 9" - 15" (228 - 381mm) | .937 (23.80mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |
| 5" - 9" (152 - 228mm) | .937 (23.80mm) | 055 Ex Heavy | 10 TPI / .066 | 055 Heavy | |
| 3" - 5" (76 - 152mm) | .937 (23.80mm) | 10 TPI / .066 | 1/16 x 1/16 | 055 Ex Heavy | |

| ACROSS FLUTES - Single Wall | | | | .990 & 1.00 Dies (25.15mm /25.40 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with the same height straight & curved trim knives. |
| Over 15" (382mm) and over | .970 (24.64mm) | 045 Medium | 055 Heavy | 045 Light | |
| 9" - 15" (228 - 381mm) | .970 (24.64mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |
| 5" - 9" (152 - 228mm) | .970 (24.64mm) | 055 Ex Heavy | 10 TPI / .066 | 055 Heavy | |
| 3" - 5" (76 - 152mm) | .970 (24.64mm) | 10 TPI / .066 | 1/16 x 1/16 | 055 Ex Heavy | |

Note 1: **The above guidelines are a suggested starting point** based on limited field study and practice. Due to the numerous variables in the die cutting process, National Steel Rule will not be held liable for failed exploitation of the system.

Note 2: **Bundle Breaker Rule can be LOWER** then the trim rule. Straight and curved bundle breaker rule can be lower in height in most cases (.020 - .030 or .5 - .75 mm). The short cut segments of the perf require less force to penetrate, however when dramatic variations of anvil wear are present, it may be necessary to increase the bundle breaker rule height.

Note 3: **Using Straight Bundle Breaker Rule** cutting across the flutes is very challenging. Replacing continuous common knives over 40" (1016mm) in one piece will be challenging. Stablizing the attached blanks through the machine requires significant holding power from the bundle breaking rule. Larger ties with higher percentage hold will be required. This required hold to get the bundle through the die cutter can exceed the bundle separation equipment's ability to break the bundles. The use of alternating knife and BB perf segments may be necessary for success.

# Bundle Breaker Guideline pg 4 of 4

| ACROSS FLUTES - Single Wall & Light Double Wall | | | | 1.00/1.025 Dies (25.40mm /26.03 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with 1.00 Curved and 1.025 SNN |
| Over 15" (382mm) and over | .970 (24.64mm) | 045 Medium | 055 Heavy | 045 Light | |
| 9" - 15" (228 - 381mm) | .970 (24.64mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |
| 5" - 9" (152 - 228mm) | .970 (24.64mm) | 055 Ex Heavy | 10 TPI / .066 | 055 Heavy | |
| 3" - 5" (76 - 152mm) | .970 (24.64mm) | 10 TPI / .066 | 1/16 x 1/16 | 055 Ex Heavy | |

| ACROSS FLUTES - Single Wall & Light Double Wall | | | | 1.025 or 1.030 Dies (26.03mm /26.16 mm) | |
|---|---|---|---|---|---|
| Common Knife Length | Bundle Breaker Hgt. | Product Suggested | Product for MORE HOLD | Product for LESS HOLD | Dies built with the same height straight & curved trim knives. |
| Over 15" (382mm) and over | 1.000 (25.40mm) | 045 Medium | 055 Heavy | 045 Light | |
| 9" - 15" (228 - 381mm) | 1.000 (25.40mm) | 055 Heavy | 055 Ex Heavy | 045 Medium | |
| 5" - 9" (152 - 228mm) | 1.000 (25.40mm) | 055 Ex Heavy | 10 TPI / .066 | 055 Heavy | |
| 3" - 5" (76 - 152mm) | 1.000 (25.40mm) | 10 TPI / .066 | 1/16 x 1/16 | 055 Ex Heavy | |

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