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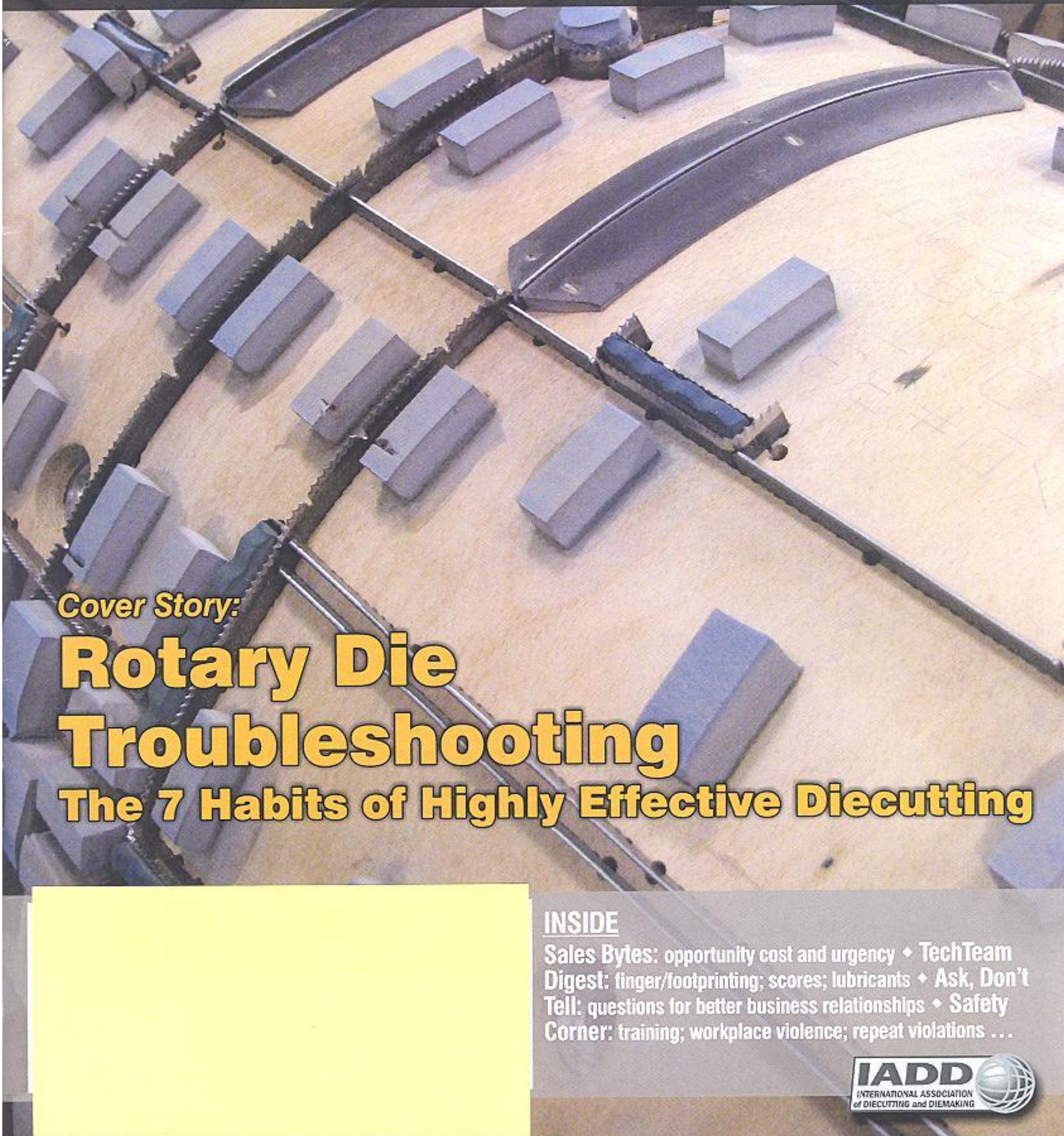

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The 7 Habits of Highly Effective Diecutting

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IADD INTERNATIONAL ASSOCIATION of DIECUTTING and DIEMAKING

Troubleshooting Problems in Rotary Diecutting

The 7 Habits of Highly Effective Diecutting

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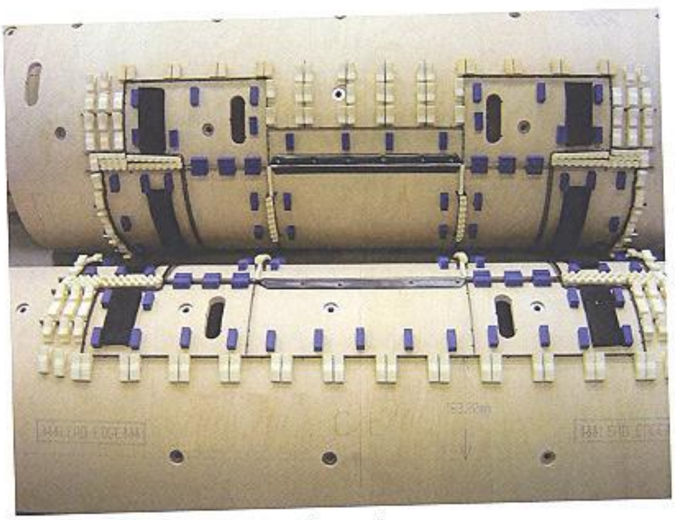


Diagram 1

Diagram 2

Editor's Note: The following article, which is Part 1 of 2, was adapted from a presentation at the IADD•FSEA Odyssey. Part 2 will appear in the October 2012 issue of The Cutting Edge. *For more information about the 2013 Odyssey, visit www.OdysseyExpo.org.*

Provide press-ready tooling

When we talk about the Seven Habits of Highly Effective Diecutting, we start off with providing press-ready tooling. To be efficient at running a production line, obviously your tooling has got to remain in good condition.

When dies are new, they are probably in the best condition they will ever be (see Diagram 1). As soon as they have run a number of impressions, things start going backwards. Poor maintenance (see Diagram 2) or poor repairs (see Diagram 3)—like employees who are not educated about how to miter rule effectively—are other causes of declining performance. That can lead to rough cutting surfaces, such as this diecutting anvil that's been beaten up from over-impression (see Diagram 4).

In a conveyerized plant like the one in Diagram 5, there is roll stock coming in to the corrugator, with everything going down the production lines, and there's no access for a forklift to get in and back out of the lines. Therefore, if a machine goes down because of poor repair or maintenance, you can create a jam that will eventually shut the corrugator off. With machines running at 800 to 1,000 feet a minute (243.84 to 304.8 meters), you know how quickly you will be backing the lines up. So again, poor maintenance and dies not in running condition will create big problems.

I'm a very big fan of having some sort of repair facility within a plant. You can have a stationary facility as you see in Diagram 6 on the left or you can have something as simple as a mobile crash cart like that on the right that you can wheel out to the press. What you don't want is for your employees to have to walk 200 meters (656 feet), clip off a piece of rule, fit it and take it back and fit it again, and end up with the one that was 0.125" (3.175 mm) short causing the problems to begin with. Sooner or later frustration is kicking in, the clock is running and you are watching the displays on these machines with dismay. The display shows the average speed per minute and how much downtime has been experienced. When that red number is cranking, somebody up in the office who is monitoring these numbers is asking what is going on with the Number 6 machine? So let's find out what is going on.

A good way to identify the condition of your tooling is to use a tag system. A tag like what is shown in Diagram 7 is very nice because it has three colors on it all in one and it is perforated between each color.

Diagram 3

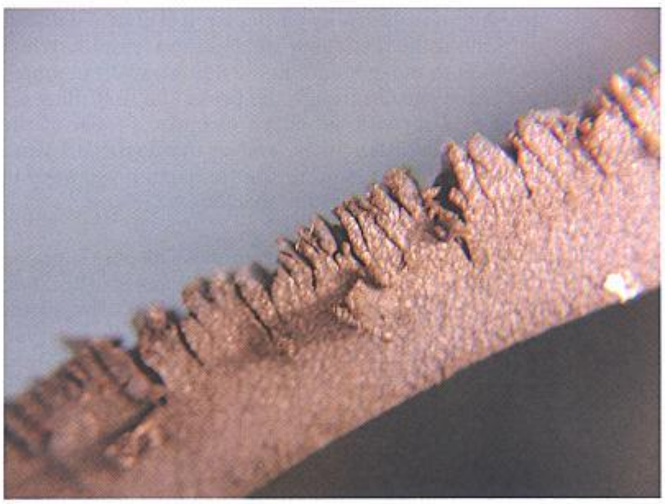


Diagram 4

Obviously, green means go, and if the tag is green on a die in a rack, it tells the operator or the pulling coordinator when he's pulling the tools for that day that all his dies have been inspected. A green tag indicates that they are in running condition, and he can bank that they are going to meet the demands of the run.

A yellow tag on a die will indicate that there is some moderate damage—perhaps the paper is being packed as we see often around the lead edges. That just needs to be scraped out, or perhaps the rubber removed and put back on. There is no actual damage yet. However, if you let the yellow go back on the rack without fixing it, it will eventually become a red tag. Usually what happens with a red tag is that the die is so severely damaged, it might be beyond the skill sets of the people within the repair shop. Now you are forced to send it out to the commercial diemaker, and you could be down a day or two.

While many die shop owners provide repair services as a service to their customers, it can be difficult to make it be profitable. There is the cost of sending a driver out, bringing them back, taking the time of one of your best guys to analyze the problem, tying to fix it quickly and then getting the die back to the customer. Often the die shop owner feels guilty charging more than a couple hundred dollars, when in reality what he or she is charging does not even cover the cost. It's a tough situation. The best thing you can do is educate your good customers and provide them with the necessary training so they can monitor the condition of their tooling and not let a yellow tag become a red.

The first thing to educate them about is proper storage. Obviously, we don't want to see something like the situation in Diagram 8.

Diagram 5

Diagram 6

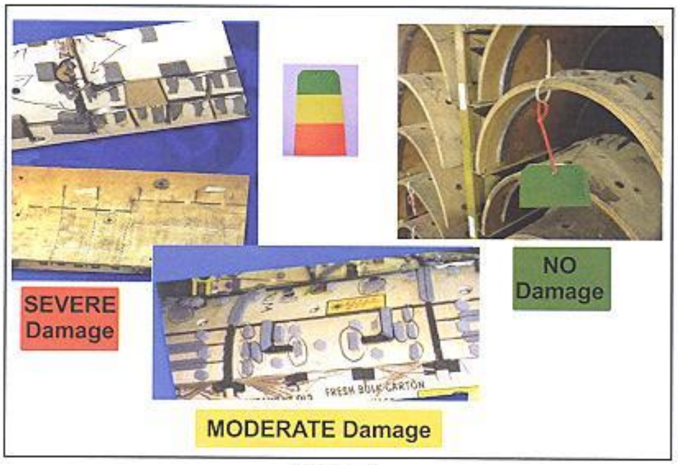


Diagram 7

Diagram 8

Another point to stress is the importance of having the proper repair equipment. For example, a lot of repair facilities have a saddle shell like the one in Diagram 9 to do the repairs. That's nice for putting rubber on, but it's no good for something like joining radial rules. You can't put both halves of the shell on, so you might not realize that you've got an over extended radial knife. If you don't correct that problem, we know that the scraping back and forth creates a problem.

At one time, those rules were perpendicular and touching and had continuity, and now it has created a gap. What do you think is going to happen? The operator is going to put more impression on to try and get it to cut. One solution to this is to use rule guards. For dies that do not have the laser cut standoffs, rule guards can be bolted on and incorporated within the cutting die. I like to see them on both sides of the radial rules (see Diagram 10).

Control dimensional accuracy

The second of the Seven Habits is to control dimensional accuracy (see Diagram 11). This is certainly an issue and here's a particular test that I did that with the same die which yielded these results. When we want to make a cutting die and we want to match the board speed through the press, the first thing we need to determine is what's the print repeat of the machine, because at the end of the day that's what we are matching, and for that to happen you need to know the undercut of the machine.

The undercut of the machine is typically stamped on the side frame of the press (see Diagram 12). That, along with the cylinder diameter of the print plates mount to 2 times the undercut, is going to give you that diameter times pi, which will give you the circumference. So when you calculate your shrink factor, you want to match it; otherwise you are going to be pulling the sheet through the diecut net faster than the print section, or perhaps retarding it if it's too small, resulting in wrinkling of the sheet, print registration issues and dimensional accuracy problems.

The other issue we often overlook is the expansivity of paper. Expansivity is the change in the dimensions of a material, such as paper, because of a change in the ambient relative humidity of the atmosphere surrounding the material. The phenomenon is usually expressed as a percentage, and is general several times greater in the cross direction of a paper than in the machine direction, because fibers expand much more in diameter than in length when wetted. Hygroexpansivity is of considerable importance where the dimension of paper is critical, such as in multicolor offset printing (source: Etherington & Roberts Dictionary).

Primarily, paper can fluctuate as much as .6 of a percent. Note again that this phenomenon is usually expressed as a percentage. This is an important measurement because

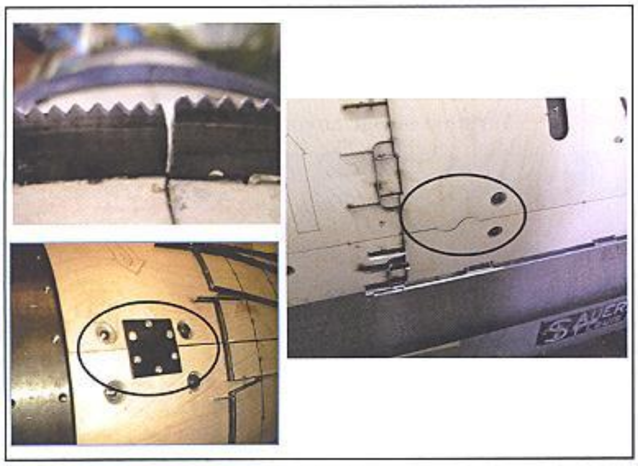


Diagram 9

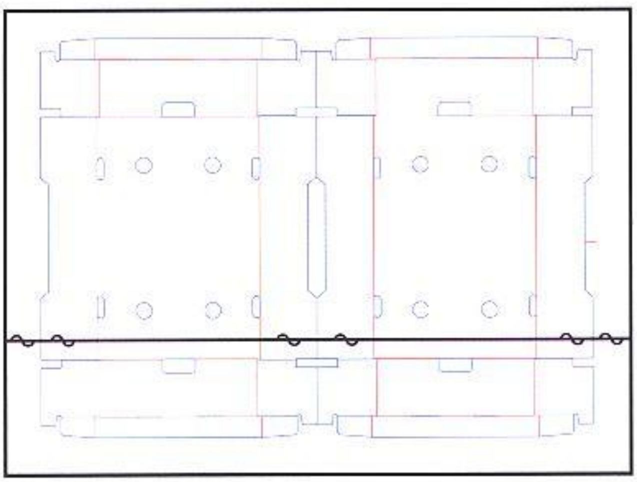


Diagram 10

Diagram 11

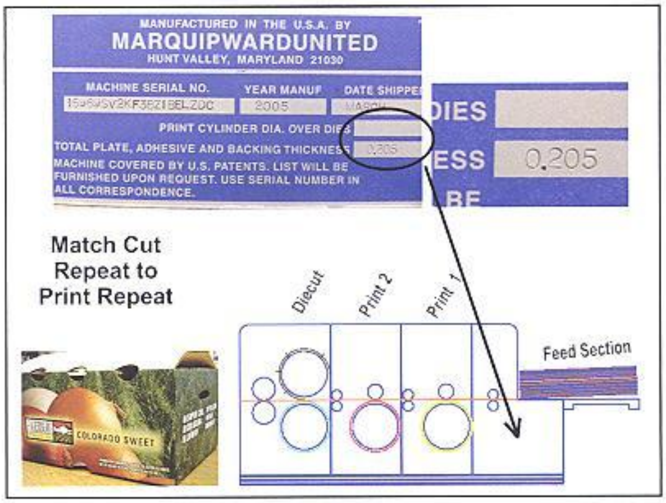


Diagram 12

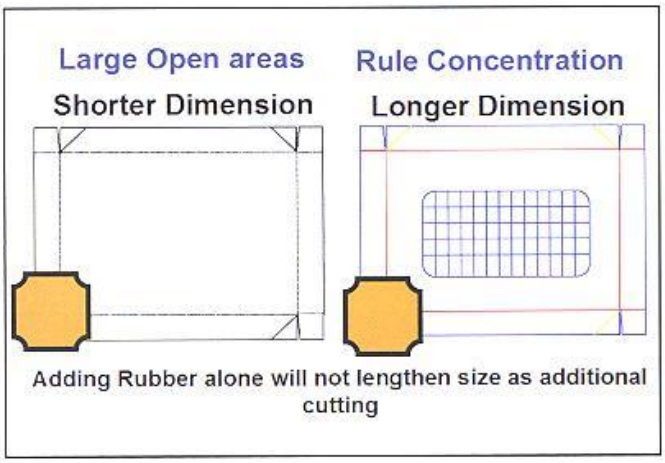


Diagram 13

if someone calls me to say they are having dimensional problems on their rotary diecutter, if they are off 0.125" over 60" (3.175 mm over 1,524 mm), then they are doing very well; if they are off 0.125" over 15" (3.175 mm over 381 mm), then they have an issue. We've got to express dimensional accuracy in the form of a percentage.

If someone says they have a 60" (1,524 mm) diecut blank and needs to hold 0.03125" (.7938 mm) dimension, paper is not going to hold a dimension like that. You can diecut it today and take it outside in the humidity, and it will swell. Take it out into the desert, and it will shrink. Diecut it after the corrugator and within 30 minutes you will see it lose .5 to .6 percent simply by releasing moisture. So you've got to understand the substrate you are working with and realize that when you talk percentage of dimension, that's a lot better than someone saying they are off 0.125" (3.0175 mm).

Variable speed anvils (VSAs) that are typically found on machines like SUN Automation's MicroGrind can compensate the sheet up to 2.5 percent. The way these machines work, when the anvil wears, the variable speed control kicks in and keeps the board speed at the same rate. In the MicroGrind, it provides a consistent blanket size because every 10,000 revolutions 0.001" (0.025 mm) of the surface is removed from the anvil blanket while the machine is running. The anvil speed is automatically adjusted to compensate for the reduced anvil diameter. This assures that the anvil speed is always correct and that the blank size will be consistent throughout the run.

As diemakers, we need to understand that if we have an error in the cutting die for one reason or another and we are using a VSA to compensate for that, we could be putting severe lateral torque on our axial knives, causing them to lean over. We don't want the VSA to disguise diemaking errors. VSAs are great to tweak in for the purpose of the anvil wear, but we can't use them to disguise diemaking errors from some of the circumstances that I'm going to show in a minute.

Diagram 13 shows a 50" long die with a big end cap for a pallet. As you can see from the inset, the corrugation is running from the top of the slide to the bottom. If I use the same shrink factor on this die and the same on the second one (with the corrugation going horizontally), I will get two drastically different dimensions.

So, here's what I did. I made this cutting die with slugs, as you see from Diagram 14. A single die was made with an insertable section; therefore the perimeter cutting die was exactly the same for both diecuts, through corrugation and cross corrugation. We used a brand new Martin press and ran the exact same paper, some with a slug and some without the slug. I ran a range of papers from C flute to double wall. I ran cross corrugation, through corrugation. I ran some that had a big scrap section in the die; some had perf and some had a blank middle with scores.

The results are in Diagram 15. Notice the two samples highlighted in yellow. This shows that cutting BC double wall with a 50" by 50" (1270 mm by 1270 mm) die can yield an 0.433" (11 mm) difference in dimension of the diecut part, based on a heavy rule concentration of scrap knives and different flute penetration. There was no impression change, no speed change, nothing. Flute orientation, scrap concentration and rule concentration drastically affect dimensional

See TROUBLESHOOTING page 14

Continued from page 12

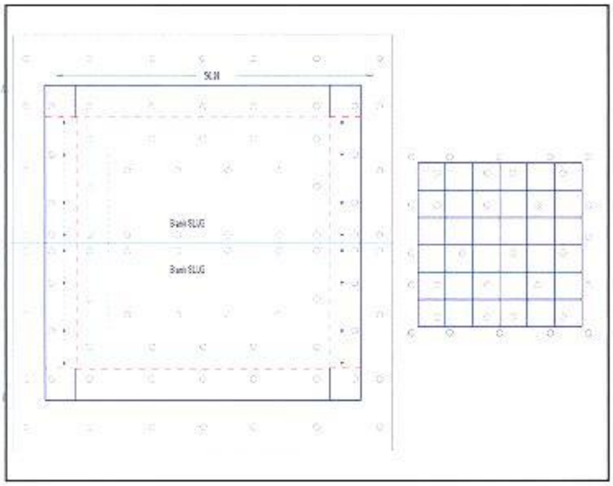


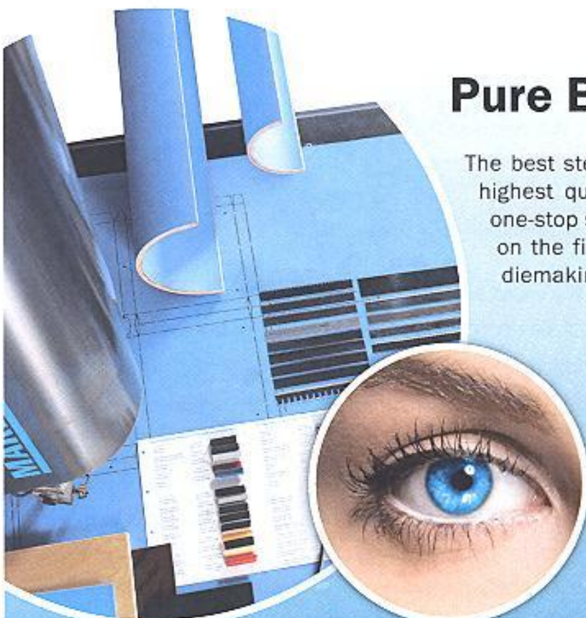
Diagram 14

accuracy, and we can't use the VSAs to disguise the problem. We must make adjustments in our shrink factor calculations when we are making the cutting die, in this case almost 1 percent.

Avoid getting the shaft

The third of the Seven Habits is to avoid getting the shaft. This has to do with machine configurations. Some machines have a set of shafts after the diecut section (see Diagrams 16-18). When there are scoring shafts after the diecutter, they leave very little room for scrap to fall through. Scrap can bounce around and ride over the top of these shafts, ending up between the diecut sheets. For example, if you're running a 55" (1397 mm) long sheet on a 66" (1676.4 mm) diecutter, you only have 11" (279.4 mm) between each sheet. Say you are running 6,000-7,000 sheets per hour; the scrap that is bouncing around only has that 11" (279.4 mm) void to fall into. You've got to be careful because there is so little room.

Often we will get the complaint that the die is not stripping, and our first thought might be to add more rubber and that will fix it. But often what they really mean when they say the die is not stripping is that they have scrap in



the load. After looking at high speed videos of the press in action, we've found that one of the reasons they have scrap in the load may be because the trim knives on the outside were damaged, so they weren't cutting the perimeter trim into 4" or 5" (101.6 or 127 mm) pieces. Instead, the trim came through as a ribbon rather than falling through. Sometimes the trim breakers don't trim because they get damaged on the racks. A lot of people don't worry about that, because they think they aren't really part of the job, but they are. They aren't part of the finished job, but they are very functional, and they can get dinged up and damaged, or even disappear, causing the scrap to hang on.

Diagram 19 shows the exact same machine with the scoring shafts removed; the whole section is taken out. The layboy is a series of transfer belts that deliver product from the diecutter to the stacker (see Diagram 20). If you remove the shafts, you can get your layboy section right tight up against the cover. There are no shafts to carry waste, so I can pull the layboy away and give the scrap room to fall without bouncing around and falling on the next sheet. And if your sheet is shorter, say 30" (762 mm), you now have an extra split second for that scrap, and that could be the difference between it hanging up or not. So many people will run the machine with the layboy jammed up tight, and they leave it there for every job. It needs to be adjustable so for larger sheets you can move it back and give more room for the scrap to fall.

As an aside, I also recommend that you document more information about your press than just saying something like, "It's a 66" by 100" (1676.4 by 2450 mm) Ward." In today's age of digital photography, you can take a photograph of the machine and add it to your specs.

We often look at results from afar, noticing that monthly production is down or monthly labor costs are a little high.

This Die was 50" (1270MM) and varied 11MM from Flute orientation and rule concentration

TARGET DIMENSION 50.0 — 1270 Target

Sample #	Board	Flute direction	Die Design	
1	C Flute	Thru	heavy scrap / Scores	1273
2	C Flute	Cross	heavy scrap / Scores	1273
3	BC Flute	Thru	heavy scrap / Scores	1268
4	BC Flute	Cross	heavy scrap / Scores	1278
5	BC Flute	Thru	heavy scrap / Perf	1272
6	BC Flute	Cross	heavy scrap / Perf	1278
7	C Flute	Thru	heavy scrap / Perf	1273
8	C Flute	Cross	heavy scrap / Perf	1273
9	C Flute	Thru	Blank Center / Perf	1272
10	C Flute	Cross	Blank Center / Perf	1273
13	BC Flute	Thru	Blank Center / Scores	1267
15	C Flute	Thru	Blank Center / Scores	1268
16	C Flute	Cross	Blank Center / Scores	1273

Diagram 15

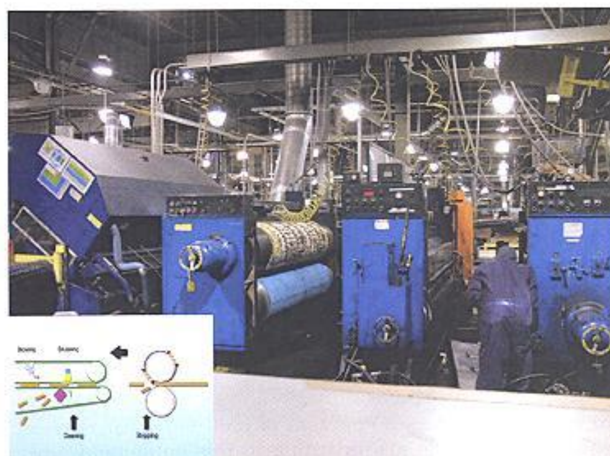


Diagram 16

Diagram 17

Diagram 18

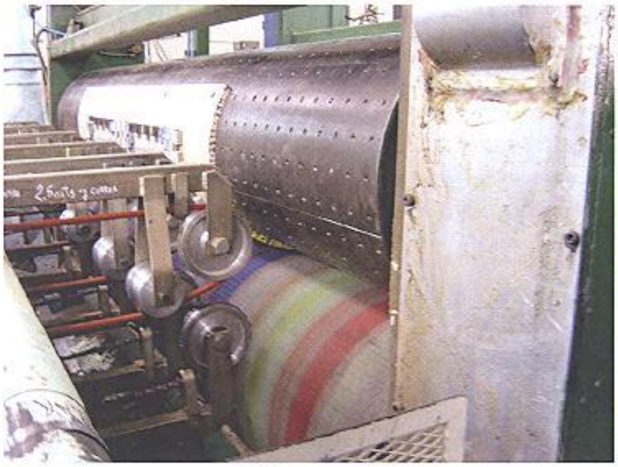


Diagram 19

Diagram 20

But we never really take a closer look. So instead of looking at it from 30,000 feet (9,144 meters), we are going to look closer at about 30 magnifications. Diagram 21 is a chart from TAPPI Technical Association of the Pulp and Paper Industry) that compares pieces per hour on different size rotary diecutters. These are 66" up to 115" (1676.4 up to 2921 mm), so the middle red bar would represent a 1624 diecutter. Keep in mind a machine that size can run 10,800 sheets per hour, and some of the new ones will run 12,000. So you are talking 10,000-12,000 sheets per hour capability.

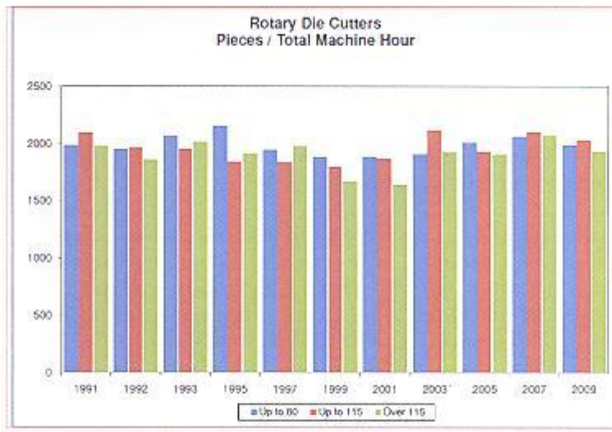


Diagram 21

Now look at the numbers for 20 years. They've gone nowhere in 20 years! For 20 years these rotary diecutters are running less than 25 percent of their capacity. What's happening is people are investing in this equipment and they are squeezing diemakers for price, not understanding why their $2 million USD investment hasn't given them the ROI they expected. Since 1991 when that graph started, there has been the advent of the rotary laser, processors, water jets, etc. (see Diagram 22), so our tooling manufacturing capabilities have gotten better ... but it hasn't equated to the production on the rotary diecutter. We have to ask ourselves why that is.

Diagram 22

Part 2 of this article, which will appear in the October issue, will explore why production hasn't changed in 20 years, along with the other four Habits of Highly Effective Diecutting.

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