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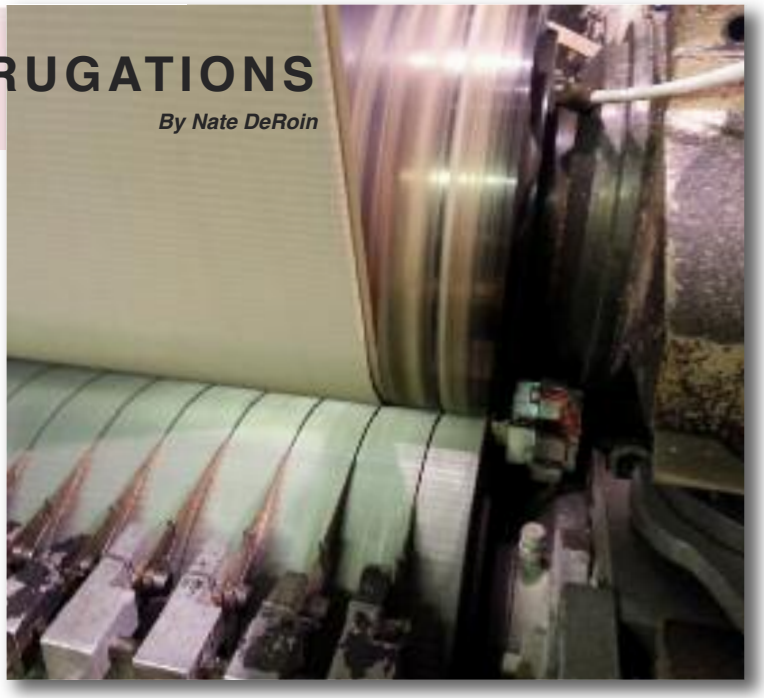
ADVANCED ADHESIVES REPORT

Your corrugating newsletter from Harper/Love Adhesives Corporation

COMBATING LOOSE CORRUGATIONS

By Nate DeRoin



Many consider the singlefacer the heart of the corrugator. Single face web is the primary component of all board combinations (including triple wall) and can even be used by itself as a packing material for furniture. Once the medium is formed or fluted in the corrugating labyrinth (where the corrugating rolls meet) it tries to spring away from the lower corrugating roll and therefore must be held in place. Three methods are commonly used to accomplish this: fingers on older machines and positive pressure or vacuum on modern machines. Singlefacers are commonly identified by this characteristic.

Loose corrugations, also called fluff out or blow out, are the most common defect seen in plants today. They appear as intermittent flutes which are distorted or pulled out of shape as they exit the nip of the pressure roll, forming waves along the edge or v-shaped spots in the middle of the web. Let's look at how to identify and correct the most common causes for this type of defect.

Medium running on or too close to a corrugating roll slot. This defect appears as large V-shape spots of delamination on the edge of the web. On pressure type singlefacers it is caused by high-pressure air blowing the edge of the medium into the slot in the corrugator roll. On vacuum machines, if the edge of the medium is too far away from the slot, the vacuum can't hold the edge of the medium during its transition around the lower corrugating roll. This issue is tricky to diagnose because too much or not enough, pressure/vacuum can also cause loose edge on the singleface web.

Starch build up on the pressure or corrugating roll. Unlike the other defects, this will show up as random loose spots on the edge of the web. The singleface operator will often hear the problem before anyone sees it. Starch build up on the rolls will cause them to bounce, making a loud thumping noise. The two most common causes are: running the single face liner and medium out of alignment, or improperly set glue dams. Housekeeping can also play a major role in this type of defect. The largest contributor to most breakdowns, quality issues and jam ups, is poor housekeeping. Crews not understanding the importance of proper housekeeping and taking shorts cuts to save time, causes a great deal of problems. For example, a dirty glue station can cause poor adhesive transfer and make it very challenging for the operator to set the glue dams.

Improper gap between the lower corrugating roll and glue roll. The singleface web may look fine coming out of the nip of the pressure roll, but can be easily pulled apart at the dry-end of the machine. The gap between each adjustable roll on the machine, should be checked and calibrated at the

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start of every new workweek to ensure the proper settings. The gap between the glue roll and lower corrugating roll must be set to the caliper of the medium that is running on each order. The most common operator mistake when presented with this issue, is to increase the amount of adhesive film on the glue roll. This will result in starch slinging onto the medium, instead of forming a smooth glue line and could cause post warp due to excess starch application. The soak test will show a spotty glue line on both the singleface liner and medium if the glue roll to lower corrugating roll is not set properly.

Not enough pressure roll pressure or an out of parallel pressure roll. Inspection of the combined board reveals good flute formation and glue pattern on the medium, but light or missing pressure lines on the singleface liner. On most machines, this adjustment is made by decreasing the distance between the pressure roll and lower corrugating roll or by increasing the loading pressure on the cylinders. If the board is loose on only one side, the pressure will need to be adjusted until parallel. On some machines, this can be accomplished by just moving one side of the adjustment control. On others, shims are added or removed from the wedge blocks. This adjustment is typically performed by maintenance personnel.

Here are a few steps that are key to the success of a well-run operation and will help combat loose corrugations:

- Training is important, both for the crews and the management team, they must have the ability to consistently do the basics well.
- Strive to keep work areas efficiently organized. Ensure the machine is cleaned properly and is run ready at all times.
- Ensure a good preventive maintenance program is in place. The machine operators and maintenance crews should work hand in hand to deliver the best machine condition.
- Have a detailed pre-flight checklist to guarantee that the adjustable settings are accurate, ensuring the machine will perform at optimum levels.

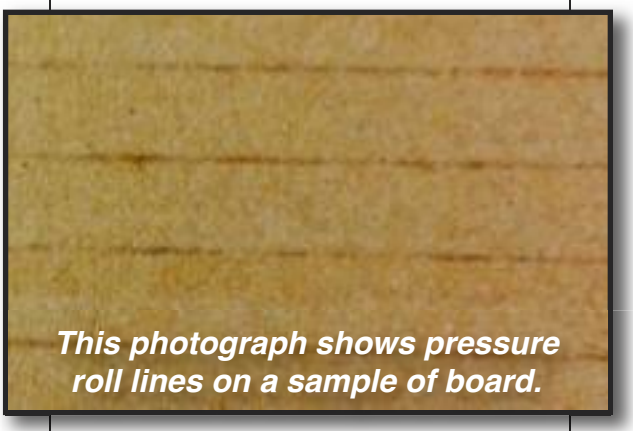
BELTED SINGLEFACERS

By Rex Woodville-Price

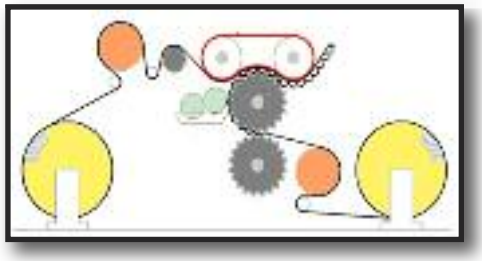
Once their basic design was established some hundred years ago, singlefacers have not undergone major changes in their structure that weren't merely incorporating technological advances in mechanical state of the art. Things like electronic sensors and automated actuation of adjustments have made them easier to operate but have not really changed their inherent function. Developments such as larger unequal diameter rolls have allowed wider, faster running machines with a significant reduction in harmonics and vibrations. However, innovations like fingerless retention of the medium and the replacement of the pressure roll with a band have arguably changed the nature of the singlefacer.

On a banded or belted single facer, the pressure roll is replaced by a metal band which holds the medium and liner in contact while the bond is forming. The difference is contact time and pressure. The pressure roll can only touch a single tooth of the corrugating roll at a time, creating a point nip. This metal on metal single pinch point, can exert enough pressure to literally cut paper. We have seen how too much (pressure roll) pressure can cut through both the liner and medium.

The issue is that this point of contact only lasts an instant. At high speed, the papers are held in contact for less than 5 milliseconds. By using a band that wraps a larger arc of the corrugating roll, the nip is extended. This in turn extends the amount of time that the papers are held in contact, allowing the bond to be formed at less pressure. This simulates the way the bond is formed in the doublefacer.



This photograph shows pressure roll lines on a sample of board.



One of the advantages attributed to this means of forming the bond is that the paper fibers at the bond site are not damaged because less pressure is involved, this can promote improved mechanical resistance of the combined board since the structural integrity of the paper is retained.

One byproduct of this process is that it is more difficult to identify the SF side of the board because there are no pressure lines. The effect is so pronounced that it is much easier to print the SF side of the board with good results. Some detractors claim that these machines are not ideal for running heavyweight papers at speed, though the industry trend is use lighter weight papers and less total fiber.

Singlefacers without pressure rolls have become more commonplace with most of the larger machine manufacturers at least offering it as an option.

MEDIUM FRACTURES

By Bill Nikkel & Rex Woodville-Price

Fractured medium will drastically lower the strength and mechanical properties of the finished board. One cause of fractures can be too much tension on the medium. When the medium enters the nip between the corrugating rolls, it is bent in opposite directions as it is forced against and around, the tips of the teeth of both corrugating rolls. As the "wrap" around the teeth increases and more paper makes contact with the metal, friction will increase because of the relative movement between the paper and flute tip. As friction increases so will tension.

Tension will peak just prior to the nip at the centerline between the two corrugating rolls.

If the tension in this mechanical tug of war exceeds the MD (machine direction) tensile strength of the paper, the flutes will fracture as they are formed. This becomes a real possibility since the medium is usually a lighter weight paper and tends to be made of shorter fibers, so it generally has lower tensile strength than a liner. The problem is aggravated today in part because there is a tendency for mediums to be of lower basis weight and be composed of increased recycled content with shorter fibers. Paper fibers tend to shorten with each cycle of recycling, potentially also getting damaged. This can reduce the tensile strength of the paper.

If flute fracturing is noted, steps must be taken to reduce medium tension. Ensure that the system which controls medium tension is properly communicating with the roll stand brakes.

Web tension is affected by roll diameter. As the paper is peeled off the roll, it generates a torque which will change in proportion to a change in the roll radius. This torque is counteracted by the roll stand brake. As the radius of the roll becomes smaller, so does the torque and if the same web tension is to be maintained, the braking force will have to be reduced. In addition, a larger roll, weighs more and therefore has more rotating inertia, consequently it requires more braking force to control tension. As the roll runs out, it obviously gets smaller and has less mass. A smaller roll will require less brake to maintain the same paper tension as it did when it was full. Therefore it is important to reduce the brake progressively as the roll runs out. Modern splicers in good working order will do this automatically. If the web tension control is not functioning properly, it will be necessary to make these adjustments manually until the unit is repaired.

A driven capstan roll helps alleviate this problem as it will turn slightly faster than paper speed to reduce excessive tension and friction as the paper goes over the heated vessel (the pre-conditioner in this case). It is worth noting that the medium speed relative to corrugating roll RPM, changes with flute type due to differences in take up factor. So machines have an adjustment for different flutes.

Proper pre-conditioning of the medium is important because as the fibers are moistened and heated, they become more pliable. Moist flexible fibers will be less damaged by the violence of the fluting process. On the contrary, overheating the medium will quickly drive off its moisture and make it weaker and more brittle. Keep in mind that today's denser papers tend to transfer heat more quickly and will readily exceed optimum temperature.

Controlling medium tension at the singlefacer is conducive to producing quality singleface and combined board. Tension related defects will negatively impact board strength.

Medium Fractures

Leaders in the science of making good adhesives better™

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