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How to minimize rolling scores on lightweight and high-performance liners in diecutting operations

Introduction

Over the last several years, the corrugating industry has moved steadily into high performance liners in both lightweight and heavyweight (high ring crush) grades to meet their customers' ongoing requirements. These changes have required plants to change many of their past operating procedures on their corrugators to retain the necessary moisture in the combined board for efficient scoring and finishing in downstream diecutting and flexo folder gluer operations.

High performance liners will give up moisture at a faster rate than a typical virgin liner produced with similar moisture content. High performance liners will release moisture more readily and heat up more quickly due to sheet densification (less air is trapped). The levels of preheater wrap typically used in the past will not work on high performance liners. The starch solids typically run are the 23- 25-28% range to help improve bond in the high performance material to facilitate and insure efficient downstream operations without quality problems.

Scope

This Technical Information Paper includes recommended operating procedures to minimize incidents of rolling scores on lightweight and high performance liners in both rotary and flat bed diecutting operations.

The ideal score must:

- (1) crush the paper to produce a crease about which the board will fold or hinge
- (2) produce relief for corrugated board or paper adjacent to the fold crease
- (3) control the corrugated board deformation in the vicinity of the score to limit tension or shear in the paper.

The resultant score should be accomplished without cutting or cracking the paper of the combined board and should fold squarely along the centralized crease line. In order to achieve this, the die cutting machine must be in good mechanical condition. This includes the following:

- Correct rolls, scores, and anvil diameters with correct total indicated runouts.
- Proper diameter of female anvil and correct OEM specified score width and height requirements.

Safety precautions

There are no safety precautions.

TIP Category: Automatically Periodically Reviewed (Ten-year review)



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Rotary die cutting

The most common scoring method utilizes a steel scoring rule. The steel scoring rule simply crushes the paper against a urethane anvil to form a crease about which the board will hinge or fold. Rubber is generally applied adjacent to steel scores in rotary diecutting. The rubber helps control the sheet through the diecutter as well as providing some, but limited, relief to the corrugated board or paper adjacent to the fold. This method produces acceptable results for the majority of corrugated diecutting operations. Soft anvil diecutters are designed to insure that the cutting rule does not cut at the same location on the anvil revolution after revolution. Doing so would quickly destroy the urethane anvil surface. Therefore, in most cases it is not possible to take advantage of creasing counter systems that are used in flat diecutting. However, there are systems available that offer a score that consists of a scoring bead and shoulder that works in conjunction with the soft anvil to score the paper in an embossing manner which compresses the corrugated board with minimum tension and shearing stresses. The shoulder bead and profile can be custom designed to achieve the desired results in different grades of high performance liners. Your die manufacturer can recommend systems by which the score profile can be easily and quickly changed on press to compensate for varying process conditions.

A recent development on the market is a die for high speed rotary diecutters such as the new DRO rotary, called a “matrix die”. This die is a combination of a creasing die in conjunction with a fixed-position companion receiver.

Flat bed diecutting

Two of the most important physical parameters are creasing rule selection, both width and height, and establishing a proper female counter or creasing matrix.

In selection of the proper creasing rule, there are two major considerations, and both relate to the female counter. First, the female counter, or matrix, should be approximately twice the board caliper plus the width of the creasing rule. Second, the female counter should have a width of $3\frac{1}{2}$ to 4 times the board caliper, although this value may vary for machine direction scores because of the increased elastic properties and the need to create a sharper angle to achieve equivalent deformation of the board. Here, rule height becomes very important and machine direction creases may require slightly more rule penetration to form the proper bead. Your die maker should be able to recommend the proper rule height for varying board combinations.

Remember that in order for the board to fold properly, there must be a proper crease. A proper crease requires delamination and deformation of the combined board. In order to do this, you must establish the correct relationship between board caliper, rule thickness, and the height and width of the female channel. By establishing this relationship, your equipment will produce a crease that will fold properly with minimal crushing on either side of the crease. It is excessive crush at the crease that is the main cause of rolling scores.

Keywords

Scores, Die cutters, Liners

Additional information

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