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Corrugated caliper: why is it so important?

Scope

Corrugated is a very popular packaging material primarily because it has a high strength-to-weight ratio. What this means is that corrugated is exceptionally strong considering its lightweight. In fact, the primary job of a corrugated box is to protect its contents (i.e., our customers' products). As such, corrugated should be considered to be an engineering material.

Safety precautions

There are no safety precautions.

Content

It is amazing that we can take several flexible pieces of paper and combine them into something very rigid. A 20×20 200-lb test C-flute corrugated box can withstand almost 900 lb of weight before failing and yet it weighs only 2.5 lb. How can corrugated be that strong? There are two reasons.

One reason corrugated is so strong is that the fluted medium separates the two liners and when stood on end, the flutes act as columns. We all know that columns have been used for structural support for centuries. We know that a large diameter column of concrete is stronger than a small diameter column of concrete. So, the further apart the two liners can be held by the medium columns, the stronger the corrugated structure will be for a given combination of liners and mediums. In order to maintain the greatest possible strength, we must maintain the greatest possible thickness. In our industry, we refer to thickness as caliper.

Box compression or stacking strength is a key characteristic of corrugated boxes. As we can see from the discussions in the preceding paragraph, excellence in caliper control equals superior stacking strength. In fact, caliper is an important part of the McKee formula for predicting box compression (Ref. TIP 0304-09).

Caliper, then, is an indirect measure of the compression stacking of corrugated boxes. Low caliper is usually the result of poorly formed flutes or crushed flutes and often results in poor corrugated box performance.

Each grade of corrugated has a caliper target based on the depth of the flutes in the corrugated rolls and on the thickness of the liners and medium used. Whenever the caliper of a given grade of board is less than the target value, we have failed to achieve the maximum strength potential of the materials we are processing. There are only two things we can do to maximize caliper: form the flutes to the maximum potential of the corrugated rolls, and not to crush the flutes after we have formed them.

There are lots of opportunities to crush flutes in a box plant. Anytime corrugated board passes through a nip between two rolls we have the opportunity for crushing. Nip points occur at many places on a corrugator and on box finishing equipment. Examples are the glue machine rider roll, double backer ballast rolls, printing press feed rolls, printing plate/impression cylinder, etc.

Caliper control may be the most important quality control function in a box plant. Everyone who operates a piece of equipment in a box plant needs to be fully aware of what the equipment is (or is not) doing to caliper at all times.

Caliper of board coming off the corrugator should be measured. Caliper should also be measured before and after feeding at finishing equipment to insure that crush is not occurring at these machines.

We want corrugated to remain an effective packaging material. If it is to remain effective, we must deliver that high strength-to-weight ratio all the time.

Good caliper control is a very important key to successful box performance.

Keywords

Compression, Thickness, Stacking, Compression strength

Additional information

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