LAYFLAT OF PLASTIC FILM: DEFINITIONS AND CAUSES

One of the most difficult parameters to measure and understand in plastic film is the concept of layflat. Layflat is a major reason for poor quality and rejected product. End users of plastic film, such as printers and laminators, have often encountered rolls of plastic with baggy centers or baggy ends, or both. This nonuniform profile does not "lay flat" when stretched out onto a table or floor. Poor layflat can result in poor registration and distortion during printing or lamination. It is easy for the end user to identify poor layflat but not to quantify the problem.

Layflat is typically observed in a manufacturing process such as calendering or extrusion by laying a ten or twenty foot sample out onto the floor or table. Observations can be made on a finished roll such as baggy in the center or baggy on the ends. Attempts have been made to quantify these baggy areas by measuring the bag height above the table with feeler gauges. This is difficult at best. It is also of little use since most end users
willingly accept little, if any, poor layflat.

What complicates layflat measurements is that there are really two causes: 1) layflat as it occurs during the calendering/extrusion process, and 2) layflat that occurs after the plastic has been wound onto a roll and allowed to cool. Most manufacturers try to measure and control the former but struggle with the latter.

Both types of layflat readings are adversely affected by thickness profile across the width. Having uniform thickness across the width of the film is by far the most critical parameter. High ends, a low center, oxbow, or too high a center all lead to poor layflat. Often, the layflat taken immediately after winding will look very good, but once wound up and allowed to cool, the film shrinks onto itself stretching the film and causing poor layflat. "Die lines" in extrusion or the "pull line" (release line on the fourth calender roll) in calendering, coupled with film shrinkage and neckdown, can adversely affect layflat. In fact, any distortion while the film is in its thermo-elastic temperature range can hurt layflat. There are literally dozens of causes, but thickness control is by far the most important.

In the paper industry, layflat is also a concern. When a jumbo roll of paper is removed from the winder, a number of circumference readings are taken across the roll. The goal is to have a near perfect circumference, i.e., a flat roll. The operator will use a mallet to hit the roll every six to twelve inches across the roll listening for a uniform sound. If any soft spots are found, adjustments are made to the thickness profile. The same is true for plastic film. A uniform circumference that has no soft or hard spots will usually result in a flat sheet. It is common practice to have a very slight crown at the center of the roll for optimum results.

Once a good thickness profile is obtained, the operator must be sure that other factors such as excessive tape on the core, a burr from a dull trimmer knife blade, or bad packaging does not adversely affect layflat. It is best to set aside a roll for evaluation a day or so later.

This report would not be complete without recommending the addition of a tempering section to any printer or laminator. With the addition of heat and stretch, then cooling prior to printing or laminating, much of the layflat can be removed.

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