



Advance



Blown Film



Cast Film



Extrusion Coating  
& Laminating



Liquid Coating  
& Laminating



Pelletizing



Process  
Control



Unwind &  
Winding

## Coefficient of Friction Properties Effect on Winding

The goal of every film manufacturer is to consistently wind quality rolls to insure that their printing and converting customers can produce defect free products. Roll density or hardness is the key factor for consistently producing quality rolls of film materials. The amount of inwound tension or residual stress wound into the roll is obtained by using one of more of the T.N.T. (Tension/Nip/Torque) winding principles. The film's layer to layer coefficient of friction properties have a major effect on the ability to apply the T.N.T. principles to produce the desired roll hardness without roll defects.

In general, films which have a layer to layer coefficient of friction (COF) value of 0.2 to 0.7 will wind well. However, consistently winding defect free rolls of high slip or low slip (low COF or high COF) films usually presents major winding challenges.

**Low Coefficient of Friction Films** High slip films have low layer to layer COF (generally COF < 0.2 ). These films will often have inner web slippage or cinching problems when they are winding and/or in subsequent unwinding operations or will have roll handling problems in between these operations. This inner web slippage can result in defects such as web scratching, dishing, telescoping and/or starring roll defects. Low COF films need to be wound as tight as possible at the core, usually with high torque, and then taper the winding torque to a minimum amount at 3 to 4 times the core OD and build the desired roll hardness using the Nip winding principle. Air is never our friend when winding high slip films! These films always need to be wound with uniform nip loading to prevent air from entering the roll during the winding process.

**High Coefficient of Friction Films** Low slip films have high layer to layer COF (generally COF >0.7). These films will often have blocking and/or wrinkling problems. When surface winding these high COF films, out of round rolls can be expected at low winding speeds and roll bouncing can also be a problem when winding at higher speeds. As explained by well know consultant and columnist Tim Walker of TJWA Inc., “this is due to the fact that the outer layers of a winding roll requires a small amount of sliding action as the layers first enters the winding roll. This sliding action produces inwound tension as the air following the web is ejected from the nip or out the sides. If the full width slides, this is not a problem. But, if one lane or spot sticks and the rest slide, then a local shear stress will develop near the sticking point. This local shear may form a small buckle or soft wrinkle in the top layer. In some products, a small bump or ripple can be wound over and ignored, but in other products (especially optically clear films), the next layer will not smoothly wind over a bump or ripple, but will instead conform over the bump, producing a slightly larger bump or ripple. As additional layers are added, like a rolling snow ball, the defect will often get bigger with each turn.” These defects are commonly called slip knots or slip wrinkles.

High COF films are best gap wound with a minimum gap between the following roll and the winding roll. Spreading needs to be provided as close to the winding point as possible. A FlexSpreader covering on the following roll has proven to be successful on a number of high COF winding applications.

Please refer to the Spreading Tech Tip on the Davis-Standard web site [www.bc-egan.com](http://www.bc-egan.com) under Converting Systems / Company Information and then under the Publications and Technical Documents tab.

For more information on meeting your winding requirements, contact R. Duane Smith, Product Manager-Specialty Winding, Davis-Standard Converting Systems at [smithd@bc-egan.com](mailto:smithd@bc-egan.com) .

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