Energy-Cured Coatings

Coefficient of Friction v25.1

Energy-Cured Coatings – Coefficient of Friction	
Scope	- The coefficient of friction for Energy-Cured coatings can be influenced by the following: • Environmental conditions – temperature & relative humidity • Application, process-related variables/conditions • Consumables/materials • Contamination - This document outlines some of the more common variables that can influence COF results using Energy-Cured coatings and is meant as a general guideline – influences may contribute singularly or collectively to variations in COF results.

Energy-Cured Coatings – Coefficient of Friction Testing Information	
Coefficient of Friction (COF) Testing	- Coefficient of friction (COF), as it relates to Energy-Cured coated surfaces, is the measurable frictional force resistance between two surfaces when in direct contact. - Measured results are achieved using specialized lab testing equipment along with industry accepted testing conditions/methods/procedures.
Relevant Testing Methods	- Relevant COF testing methods: • **Tappi 402:** Conditioning of test specimens • **Tappi 549:** Coefficient of static/kinetic friction – horizontal plane method • **Tappi 815:** Coefficient of static friction – incline plane method (Slide Angle – AOS)
Relevant Testing Equipment	- **TMI 32-76:** Coefficient of friction – horizontal/flat plane tester - **Thwing Albert 225:** Coefficient of friction – horizontal/flat plane tester - **TMI 32-25:** Coefficient of friction – incline plane tester

Energy-Cured Coatings – General COF Influences	
Ambient Conditions	- Temperature and humidity will directly impact on the COF result/performance of Energy-Cured coated samples: • Temperature can impact the softness/hardness of the cured coating-film. • The humidity of laminate air that is trapped between coated surfaces when put into a stack. • The ambient humidity in the processing area for coated materials. • Temperature/humidity of the COF testing area – controlled testing conditions are recommended (Tappi 402). • Fluctuations in temperature/humidity of storage/processing areas for coated materials.
Age of Samples	- The amount of time that a coated sample has been off press can have a direct impact on the COF result – samples should be aged/conditioned >72 hours to realize a stabilized COF result. - Samples should be aged/conditioned (Tappi 402) prior to qualitative testing.
Degree of Coating Film-Cure	- Proper Energy-Cured coating film-cure can ensure that the desired/formulated COF result is achieved. - Inadequate film-cure creating over-cure/under-cure can have a direct impact on the COF result – recommended qualitative testing methods for monitoring film-cure (control parameters for each test are coating product specific): • $KMnO_4$ UV Stain Test • MEK Chemical Resistance Test • Acetone Chemical Resistance Test
Coating Pre-mixing	- Pre-mixing the coating material into a homogenous condition prior to use will aid in producing a consistent COF result throughout a press run. - Lack of pre-mixing can directly/negatively impact the COF result and overall consistency.

Coating Contamination	- Contamination of the coating container by an outside chemical or alternate coating product that has different formulated slip agents/characteristics. - Good housekeeping and changeover procedures are necessary to ensure consistent and compliant COF results.
Coat-weight Variation	- Changes/variations in applied dry coat-weight, whether job-to-job or throughout a single press run, can directly impact the COF result.
Ink-Type	- Ink-type – Conventional, Energy-Cured, Digital formulations - Wax, silicone contained in ink layers that can migrate to the surface - Condition of ink layers for dry/cure - Hold-out/absorbency of ink layers
Surface Contamination	**Agents/Additives** - Surface contamination by any agents contained in inks and/or fountain solution that is contained underneath the coating-film that migrates and populates the coating surface: • Ink slip additives such as waxes/silicones • Slow evaporating ink solvents • Slow evaporating wetting-aids contained in fountain solution mixtures - Surface contamination may be a slow process taking place over a period of time and may not be immediately evident after coating application – COF can change as sheets age if agents slowly migrate/populate the surface. - Retesting for COF as sheets age can indicate whether a slow migrating contaminant is contributing to COF variance over time. **Moisture** - Latent water/fountain solution trapped beneath the coating-film that can permeate and populate the surface or become trapped between coated surfaces in a stack. - Condensation on the coating-film surface due to extreme changes/swings in atmospheric conditions for temperature/ humidity. **Debris** - Coating surface contamination with debris such as spray powder, dust, paper-fibers, lubricants and other foreign materials.
Coating Film/ Smoothness	- The quality of the coating-film for smoothness/regularity as it relates to face-face or face-back surface area contact.
Substrate	- Substrate smoothness/regularity as it relates to face-face or face-back surface area contact. - Substrate hold-out/absorbency as it relates to the coating-film thickness that resides on the substrate surface.