MAKING YOUR LEGACY COATER/LAMINATOR WORK

Getting the Most for Your Process Investment

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Where to Begin?

- What are the processing parameters required for producing the “new” product?
- What was the legacy machine designed to produce and at what rates?
- What process limitations did the existing equipment have with its original products?
- What are the economics involved with a “successful” transformation?
What Does the New Product Need?

- Thorough Understanding of Process Requirements
  - If Knowledge Base is Limited within the Company, Seek Help from Industry Experts, i.e. Consultants or Vendors
  - Decisions Based Upon Naïve Process Understanding can be very Costly or Even Fatal to the Overall Project.

- Process Requirement for Coaters and Laminators Vary Dramatically
  - Laminating a Heavy Gauge Kraft Paper to an Adhesive Coated Liner is Relatively Easy Compared Producing an Optically Clear Laminated Construction
  - Each Type of Coating Method Requires Its Own Type of Coating Station and Its Own Level of Precision.
Laminating Considerations

- Many Older Machines Were Not Designed to Handle the Modern, Highly Sought After Laminates
  - The Machine was Built to Operate at 150 - 500 fpm
  - The Machine was designed to laminate Heavy Face Stocks to Adhesive Coated Release Liners
  - Requirement: Join Two Easily Handled Webs

- Popular Laminated Product Requirements:
  - Thin gauge films \( \leq 0.001" \) thick
  - Transparent Construction (Optically Clear – No Defects)
  - High Rate of Production \( \geq 1000 \text{ fpm} \)
HAZE is one of the Most Common Defects Found in Optically Clear Constructions

- Defect Appears As a Translucent or “Hazy” Region in a Transparent Construction

- Haze Caused by Microscopic Bubbles Grouped Together in the Inner Layer of the Laminate
Eliminating Haze

- First Instinct is to Increase the Loading on the Laminator Nip.

- Increased Loading on a Soft Rubber Cover Increases Nip Footprint.

- Larger Footprint → Larger Nip Area → Lower Unit Force (psi) → Harder to Stop Boundary Air
Eliminating Haze

*HAZE* is eliminated when air is prevented from getting into the lamination

- Increase Durometer of Cover to Between 80 – 90 Shore A
- Increased Hardness of Rubber Cover Decreases Nip Footprint For Same Loading
- Smaller Footprint → Smaller Nip Area → Higher Unit Force (psi) → Easier to Stop Boundary Layer Air
Hard Durometer Laminating Rolls

When Utilized Properly, Hard Durometer Rolls (80 - 100 Shore A) Produce Superior Clear Laminations

Considerations When Using Hard Rubber Covers

• Harder Covers Plastically Deform (Dent) Easier Than Softer Covers
  - A Splice-Bump System Should be Utilized
  - Roll Handling is Critical
  - Should Be Treated Like the Most Delicate Component in the Machine

• Roll Geometry is Critical!
  - Harder Covers do not Displace As Easily and Therefore Highlight Geometry Mis-matches
  - Roll Bending Due to Loading Is Immediately Evident in the Product
  - Roll Must be Crowned to Match Bending
Roll Geometry Related Defects

- Regions of Haze in Transparent Laminations
- Wrinkles / Creases / Bags
- Web Curling – MD/CD
Slot Die Coating Requirements

Slot Dies Work Well for Thin Coatings As Long As Critical Parameters are Addressed

• Die Geometry
  - Feed Gap Variation ≤ 0.001”
  - Lip Step Variation ≤ 0.001”

• Accurate Die Positioning to the Backup Roll
  - Repeatable and Controllable Die-to-Backup Roll Gap
  - Coating Angle of Attack Rotation About the Feed Gap

• Precision Backup Roll
  - Concentricity ≤ 0.0005”
  - Cylindricity ≤ 0.001”
Die – to – Roll Positioning

Die-To-Roll Positioning Must Always Be Evaluated Whenever Considering Die Coating Capabilities
A Coating Process Has a Variance of ± 2 GSM and a target coat weight of 20 GSM so that 18 GSM can be maintained (18 + 2 = 20).

• Coating Thickness is Controlled by \( H \).
  Final Coated Film Thickness \( h = \frac{1}{2} \times H \)

• Reducing the variation in \( H \) directly reduces the process variation.

• Process variation reduced to ± 0.5 GSM allows coat weight target to go to 18.5 GSM (18 + 0.5 = 18.5) Resulting in an almost 10% reduction in adhesive cost with same functionality.
Die Coating Requires Precision

The Thickness of a Die Coated Film is Directly Proportional the Distance Between the Die and the Backup Roll

• Roll Run Out → MD Coat Weight Variation
  - Bearing / Bearing Housing Redesign
    For Repeatable Accuracy
  - Concentricity ≤ 0.0005”
  - Quick Change Backup Rolls

• Diameter Variation → CD Coat Weight Variation
  - Cylindricity ≤ 0.001”
  - Measured Accurately via Non-Contact Methods
What Process Limitations Already Exist?

Consider the Case of the “Magic” Process Roll

- Only Roll in the Inventory that Successfully Produces the Desired Product
  - Roll #1 & #2 Have a Working Face of 90.0” and a Core O.D. of 8.00”
  - Both Rolls Have a Bearing Centerline of 100.0”
  - Both Roll Bodies are Made out of Steel
  - Both Rolls are Covered in 80 Durometer Shore A Nitrile
  - Both Rolls see a Loading of 20 PLI in the Laminator and have a Parabolic Crown of 0.015”

- Roll #1 is Successful and Roll #2 Produces Haze in the Center

  - Roll #1 has a Core Wall of 1.0” & Roll #2 a Core Wall of 0.375”
  - Roll #1 has a radial Defection of 0.0075” & #2 a deflection of 0.015”
  - Parabola Crown of 0.015” Matches Roll #1 NOT Roll #2
How Much is Management Willing to Spend?

Relatively Inexpensive Improvements Can Be Made to Existing Lines Which Can Expand their Capabilities

• Machine Alignment
• Mechanical Improvements to Laminating Stations
• Process Roller Evaluation
• Process Roller Cover Selection and Refurbishment
• Bearing/Bearing Housing Redesign and Replacement
• Die Station Mechanical Evaluation and Overhaul

As the Machine Becomes More Useful through Less Expensive Modular Improvements, The Legacy Machine Evolves into an Effective Tool for Processing Modern Products.
Conclusion

- Current Economic Times Have Forced Companies to do More with Fewer Resources

- New Products Have Process Demands that Legacy Equipment Wasn’t Designed to Meet

- Knowledgeable People in the Industry Can Help Identify the Process Needs for Your Product

- Relatively Inexpensive Modular Improvements Can Help Your Legacy Equipment Produce Modern Sought After Products