Improving Tissue Machine Performance with Fabric, Felt, and Roll Cover Technology

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Xerium Technologies, Inc.

- Stowe, Mount Hope, Weavexx, Huyck Wangner
- Key Businesses
  - Machine Clothing
  - Roll Covers & Mechanical Services
  - SMART® Machine Automation
- 26 plants, 2 new plants under construction
- ~3,050 employees, 20 countries
- 406 patents, 101 new patents in process
- ~$540 million sales
- NYSE small cap stock - ~$240 million equity value
Xerium Products Link Directly to Common Consumer Products

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<th>Xerium Products</th>
<th>Paper, Paperboard, Tissue, Pulp Machines</th>
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Topics

- Advancing design and development methods into a “virtual” world
- Quality and Efficiency starts on the former
- System Engineering of felts, roll covers and venting design for high pressing efficiency
- SMART Machine Automation provides real-time information on the impact to the tissue sheet from the Yankee / Pressure Roll nip
Looking inside the black box

...... before trials are installed on the paper machine
Nondestructive 3D material microscopy

CT-Images

Data Export to GeoDict
3D-Reconstruction

Specimen moves to change mag.
Source-Detector distance is adjustable.
GeoDict Analysis

- Structure
- Pressure and flow analysis
- Void, flow channel, pore size
- Surface topography
- Contamination
- Felt base / cover venting interaction

Poor Size & Distribution
High speed drainage with superior sheet structure, formation, softness and strength
Engineering Drainage Channels for Uniform Velocity

Sheet Structure Formation
Preparing for the Press
Uniform High Fiber Support Surface with Open Base Structure for Fast Uniform Drainage

Acceptable

Best

Tensile Strength Correlations

Increasing float length and pick count can increase CD tensile
Designing Fabrics Around Sheet Structure Modal Depth

A low Modal Depth – the most frequently occurring depth – predicts a softer sheet or improved Handfeel.
Understanding Float Length and Crepe Frequency

There may be potential to improve crepe and softness consistency over time with forming fabric design

Before blade change

After blade change
Optimization of the Press
Tissue Nip Dewatering
With Complimentary Roll Cover and Press Felt Designs

Roll Covers
Engineer roll covers to manage water drainage velocity through optimum nip intensity and width

Press Felts
Design felts for quick saturation, drainage, pressing uniformity, sheet smoothness, and reducing rewet

Venting
Engineer effective void volume to compliment felt design, evacuate water, and reduce rewet
Suction Roll Nip Dewatering

1. Vacuum begins drawing water to roll surface

Estimated 150 to 450 gsm total into holes prior to nip, 10 to 25 gsm from sheet

Example
17 gsm bath
1266 gsm H₂O total

2. Nip compresses sheet and felt to saturation

3. Water is pressed into roll surface

4. Past peak pressure, sheet and felt expand and sheet rewet begins

5. Water film is split and final sheet dryness is set

6. Vacuum holds water in roll surface past nip

23 gsm H₂O with sheet

7. Water film splits and water is discharged

764 gsm H₂O with felt

479 gsm H₂O into Pan / Roll

Estimated 150 to 450 gsm total into holes prior to nip, 10 to 25 gsm from sheet

Example
17 gsm bath
1266 gsm H₂O total
Setting the Correct Nip Pressure

- Nip pressure is a compromise
  - Sheet bulk
  - Sheet dewatering
  - Yankee fit / CD profile issues

- Cover design
  - Flexible enough to fit Yankee shape
  - Able to support venting design and tolerate nip abuse
  - Hardness / thickness specs for 250 to 500 psi, 1.72 – 3.44 MPa nip pressure

- Felt design and cover venting must compliment nip pressure – avoid excessive flow velocity and lateral flow direction.

The cover is the primary controller of the Impulse Curve shape.
Choosing the Best Cover Material

**Rebel** Blind Drilled Polyurethane
Non-Water-Cooled Pressure Roll

**Quantum** Blind Drilled Polyurethane
Non-Water-Cooled Pressure Roll

- 64°C Bond Line
- 79°C Bond Line
Press Felt and Roll Cover Design
Quick Felt Saturation, Free Flow, Reduce Rewet

- Sheet compression increases dryness, but reduces bulk
- Re-wet is the limiting factor to increased post pressure roll consistency
- As nip pressure recedes and sheet expands, felt and cover designs must force the water film to split closer to the felt surface to reduce re-wet

Best design concept
- Smooth, tight felt cap-batt surface
  - Reduce rewet flow
  - Highest sheet to Yankee contact
- Open sub-batt structure
  - Minimize restriction for fast drainage
  - Felt is cleaned in the nip
- Open hydrophilic felt base
  - Fast saturation
  - Reduces re-wet
- High open area cover surface with engineered void volume to remove water and reduce re-wet
QS Hydrophilic Base Technology

... Holds the Water
QS Base Technology Reduces Rewet

Standard Woven Press Felt

Minimal water released at felt surface = reduced re-wet

Press Felt equipped with QS Technology

Significant water spray from felt surface
Pressure Roll Venting

- Not all venting designs provide equal performance – evaluate your patterns and engineer venting to compliment press felt design
- Maximizing vacuum surface open area improves water handling and reduces re-wet
- Groove geometry matters for best sustained performance
- Benefits include increased dryness and speed, but improved crepe coating performance for a softer sheet has also been documented
Use of Suction Roll Double-Drilled Venting

- Potential improvement for some suction rolls
- Allows for optimal vacuum open area
- Coordinating the grooving pattern is important
- Recommend evaluation of vacuum system for best results

Increasing vacuum surface open area
EnerVent Engineered Grooving
for Rebel Polyurethane or Xtreme TS Rubber Pressure Roll Covers

Engineered Effective Void Volume
- Optimized suction through hole venting
- Added grooving for increased efficiency

Conventional groove geometry is not best for soft covers
- High percent of open area reduction in nip
- Can cause felt wear
EnerVent Engineered Grooving
for Rebel Polyurethane or Xtreme TS Rubber Pressure Roll Covers

Engineered Effective Void Volume
► Optimized suction through hole venting
► Added grooving for increased efficiency
➢ Xerium’s EnerVent grooving technology
➢ Geometrically incapable of closing
➢ Greater groove wall stability
➢ Wider groove – less effected by narrowing
➢ Void volume remains effective
Dynamic monitoring for real-time knowledge
The 1\textsuperscript{st} real-time Suction Tissue Pressure Roll nip profile was measured with SMART Technology

Documented benefits from SMART tissue pressure rolls include

- Energy savings through nip pressure monitoring and correction
  - Yankee grind justification
  - Thermal crown evaluation and load adjustment
  - Load and crown adjustments to reduce CD moisture variations and reduce over-drying of high spots
- Increased clothing life
  - As much as 100\% on a TAD machine
Thank You