Paper Machine Clothing Trends in Today’s American Market

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Trends 2010 - A Review

• Forming – Triple layer progression continues

• Pressing - moving seams into final segments of the industry, extending the move to non-woven components and structures

• Drying - Spiral fabrics appearing in all applications
2011 – A Year of Recovery and Stability

- Many manufacturing companies had to reshape themselves following the financial crash that bottomed in early 2009
  - Assets were rationalized, product offerings streamlined, supply chains “leaned out”, business practices optimized
  - Many traditional suppliers to the paper machine clothing industry also “leaned out” their businesses
  - Clothing companies will push toward manufacturing flexibility to deliver new products quickly and to adjust to the changing material supply base
Three Manufacturing Platforms

• Fabrics woven with wide looms

• Fabrics woven with narrow looms

• Fabrics that require no looms
Fabrics woven with wide looms

- Slow to weave, long changeovers – major impact on delivery time
- Lots of material behind looms – difficult to switch to new product options
- Order set at the first pick - inventory is inflexible, pegged to a specific position
- Looms have to be as wide as paper machines (flat woven) or half as long as paper machine positions (endless woven) and range from 8 to 30 meters wide
Fabrics made with Narrow Looms

- Fast weaving – 3 to 10 times faster than wide weaving
- Less material behind looms – product cycles out in weeks, not months
- Inventory is flexible – customer ordered size does not fix where output goes
- Must bond material longitudinally to achieve paper machine width
Fabric made with narrow weaving looms

Web Structure

Narrow loom bottom base

Narrow loom top base

Longitudinal bonds needed to “build” paper machine width
Fabrics made with no looms

- No Weaving – A major unit operation bypassed
- Stock rolls either internally manufactured or purchased
- Inventory is flexible – ordered size does not limit where material goes

- Must bond material longitudinally to achieve paper machine width
Fabric made with a Wide Loom Base and a Non-Woven Base

Wide loom Bottom Base

Non-Woven Top Base
Fabric made with No Weave Looms – All Non-Woven Bases
Many Options – Not All Woven

<table>
<thead>
<tr>
<th>Non-woven components</th>
<th>Single layer</th>
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<tbody>
<tr>
<td></td>
<td>Double layer</td>
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<td>Double layer with seam</td>
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<td>Laminated (2-3 separate bases)</td>
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<td>Composite materials</td>
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<td>Non woven</td>
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Wide to Narrow to No Loom

- Will be determined by MD bond quality
- Will also be determined by seam quality
- Both will determine the manufacturing “flexibility” of the supplier
Wide to Narrow to No Loom

- **Forming** – No commercial offerings in the narrow loom or non-woven class. Sheet quality and fabric stability requirements are too select to allow anything but wide woven fabrics.

- **Pressing** – Narrow loom fabrics and hybrid woven – non-woven combo fabrics are well established, pure non-woven emerging in many markets. Needling helps to mask bonding impact.

- **Drying** – Spiral fabrics (non-woven) do not require MD bonding and seam quality limitations are few.
Spiral Dryer Fabrics – No Looms

- Smaller machines allow for flexible manufacture
- Changing from one material to another takes minutes not days
- Need only to replace a single spool of mono – a wide loom involves up to 100,000 monofilament strands
- The last coil is the seam
- No bonding requirement
Toward “Flexible” Manufacturing

• Pressing and Drying have multiple product offerings, Forming not commercialized

• Paper Machine Clothing material supply chain rationalized and tightened, the need for flexible manufacture more critical since financial events of 2008-09

• Flexible manufacture leads to
  - Easier and Faster New Product Introduction
  - Better Standard Delivery
  - Faster Emergency or Trial Delivery