New Forming Fabric Technologies Reduce Cost-In-Use For Paper Mills

Today's fabrics must maximize overall machine efficiency, runnability, and profitability, while continuing to keep a sharp focus on sheet quality.

By Steve Cole

Historically, forming fabric developments have been focused on improved sheet quality. Although sheet quality improvements will always be a top priority, in recent years some forming fabrics have been successfully engineered and specifically designed to also maximize machine efficiency and profitability.

Reducing chemical and energy costs, while improving overall machine runnability, have become top priorities for today's papermakers, along with premium sheet quality. And since machine clothing usually represents less than 2% of a mill's overall costs per ton of paper produced (see **Figure 1**), it is imperative that clothing design and application be focused on the largest cost drivers.

Functions and Applications

Fundamentally, forming fabrics are expected to provide the following basic functions on a paper machine:

- Form a quality sheet
- Convey the sheet from the headbox to the press section
- Run for an economic life.

However, in addition to the above, forming fabrics are often judged to be successful or unsuccessful in numerous other ways:

- Retention
- Formation
- Drag load (power amps).
- Profile
- Sheet two-sidedness
- Sheet porosity (coating efficiency)
- Filler distribution
- Cleanliness
- Sheet release
- Guiding
- Abrasion resistance
- Ability to drain
- Mechanical stability
- Off-couch sheet solids.

Until recently, traditional fabric styles had rather daunting application limitations.

Double-layer fabrics, for example, have significant tradeoffs. Maximizing fiber support can severely retard drainage by closing the "holes" at high mesh counts. Non-uniform drainage hole sizes and relationships in double-layer designs can mark the sheet, retard release, and cause fiber carry (run dirty).

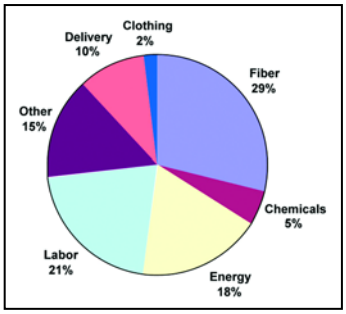

Figure 1. Paper manufacturing costs

Relatively unstable weaves can contribute to unsatisfactory CMD profile, especially on long unsupported runs and gap formers. And relatively low stiffness factors can cause excessive deflection into drainage elements, thereby increasing drag loads.

Similarly, conventional triple-layer fabrics also have their own set of negative attributes. The separate stitch yarn can cause non-uniform drainage velocity, leading to sheet defects ("dimple mark"). Also, having been forced to limit the quantity of stitch yarns due to the aforementioned mark potential, the stitch yarns cannot effectively "bind" the two distinct top and bottom layers. These two layers can become unstable and produce a sheet with poor profile, slowed overall drainage, or can ultimately lead to catastrophic delamination (top and bottom layers completely disintegrate).

Overall, the triple-layer's inability to behave as a uniform, homogenous structure can make it run very dirty by trapping fibers between the layers and in the stitch yarn crossover points. This condition magnifies as the fabric wears and the magnitude of "layer slop" increases when the mechanical and hydraulic pressures begin to break down the integrity of the fabric.

New Multi-Layer Developments

In the mid-to-late 1990s, forming fabric design turned some dramatic developmental corners. For example, during this period Weavexx and Huyck engineers began

developing a new generation multi-layer forming fabric structure that would not have the compromises inherent in traditional double-layer and triple-layer designs.

From that research program, the family of Huytexx products was developed, the first ever to truly provide papermaking qualities, mechanical stability, energy-chemical efficiency, and runnability, in the same structure. **Figures 2 and 3** show the sheet side and machine side of the Huytexx fabric.

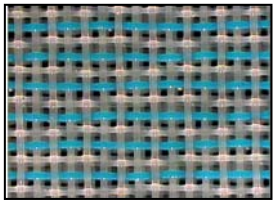

Figure 2. Sheet side of Huytexx fabric

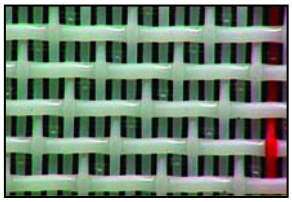

Figure 3. Huytrexx fabric machine side

One of the key features of this fabric is its "support shute binder (SSB) yarn. The SSB yarn serves two functions—it binds all of the yarns together (producing a single homogenous structure), and it maximizes fiber support by spending two-thirds of its time on the surface of the fabric. Simply put, this ensures that the fabric retains the plain weave top surface for optimum sheet quality while providing the rugged machine surface for extended life potential. **Figure 4** shows a typical SSB yarn arrangement.

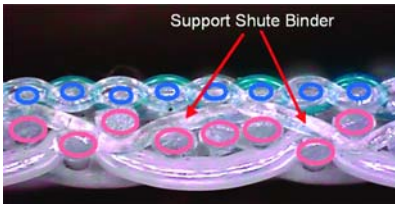

Figure 4. SSB yarn in a multi-layer structure

Mill Results

To date, this new technology is used in more than 500 positions worldwide, almost equally spread between fourdriniers, hybrid formers, and gap formers. **Table 1** summarizes several of these applications, listing mill benefits and how they were obtained.

Continuous Improvement

To achieve true success, it is imperative to couple this kind of new product technology and its application with targeted objectives for each paper machine. Today's culture must be focused on delivering added value managed through the continuous improvement (CI) process.

CI can be defined as the relentless pursuit of perfection by:

- A focus on quality and economic cost drivers as defined by customers and their expectations
- Adding value to products and services with bundled solutions and unique diagnostic tools
- Reduction of waste and non value-added activities
- The study, focus, and prioritization of key performance indicators that impact manufacturing costs and product quality.

In an age of increased financial pressures on paper manufacturers and suppliers, it is critical that mills and suppliers work in harmony to adapt new technology where it can truly add value and provide measurable economic return. The supplier and paper mill must team together to match the proper product technology with the precise objectives of the mill. Even the best technology when misapplied leads to inefficiencies, non-value added activities, and economic loss.

Therefore there must be established guidelines for each project:

- Plan the project—define the objectives
- Know the value—for the project to be valid, it must have economic return
- Action plan—product trial, scientific investigation, measurements
- Document the process—track the data, trap the savings
- Quantify results—calculate and report the value. ■

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Mill / Former	Grade	Benefits	Reason/Technology
Southeast U.S. Hybrid Former	Groundwood	0% Power reduction Cleaner running *$125,000 total annual savings*	Easier draining over vacuum elements, high fiber support, straight-thru draining
Northwest U.S. Hybrid Former	Coated Papers	Reduced coating costs *$600,000 total annual savings*	Improved porosity and formation
Southwest U.S. Gap Former	Newsprint	12% Power reduction, Improved drying, Reduced breaks *$400,000 total annual savings*	Easier draining over vacuum elements, high fiber support, straight-thru draining, cleaner running, higher off couch solids
Southeast U.S. - Fourdrinier	Linerboard	15% Power reduction	Easier draining over vacuum elements
Europe Gap Former	Newsprint	Reduced steam in dryers by 6,000lb/hr *$300,000 total annual savings*	Higher sheet solids off couch, proper match of open area, calliper, CFM
Europe Hybrid Former	Freesheet	Longer life, Reduced retention aid, Lower refining energy *$500,000 total annual savings*	Improved wear resistance, improved mechanical retention, improved formation/retention, high FSI

Table 1. Benefits and reasons/technology at six U.S. and European Mills