New Tissue Fabric, Felt, and Roll Cover Technology

Improved products help tissue machines run faster, with better quality and reduced energy

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On modern tissue machines, the barrier to increased production and improved sheet quality is often the forming zone; its ability to rapidly drain water while simultaneously controlling fiber orientation and fiber distribution in the tissue sheet, can dictate the amount and quality of tons produced. A critical component of the tissue forming zone is the forming fabric which has three major requirements:

High fiber support (FSI) and uniform Cross Machine Direction (CMD) oriented paper side. Very low basis weights and higher operating speeds require high fiber retention, uniform fiber distribution and improved sheet transfer. To achieve these objectives, the forming fabric surface must have a fine CMD oriented surface to support—and form—the mainly MD-oriented fibers.

Straight-through drainage for rapid water removal and no water carry. As production rates increase, drainage times decrease. The sheet side of the forming fabric should determine the amount and the orientation of drainage resistance, while the machine side should be open to allow water to exit easily during sheet formation, and to minimize shower water flow resistance on the return run.

Structural stability and wear resistance. Although the paper side of a tissue forming fabric contributes to the structural stability, the machine side of the fabric is primarily responsible for fabric stability and useful life. The goal is to deliver the above-mentioned properties, while increasing the forming fabric's economic life.

Forming fabric design must balance the need for fiber retention, drainage and life which inspired Xerium developers to create Formsoft, a new concept tissue forming fabric specifically engineered to provide high-speed drainage over a short forming length, while retaining exceptionally high fiber support. It features a symmetrically woven design that ensures dimensional stability and uniformity for the life of the fabric. The top side improves tensile strength, formation and hand feel, while the bottom structure provides extended life capacity (Figure 1).

Compared to existing triple layer designs, Formsoft provides significantly higher FSI (+6 percent @ the same Perm), and up to 10 percent lower fabric caliper. It also provides measurable improvements in production rates, CD basis weight profile, tensile strength (MD and CMD), softness, and formation. After installation, one customer reported a savings of $320,000.

TISSUE FELT TECHNOLOGY

Due to the rapid adoption of Crescent-former machines in recent years (where the tissue sheet is formed between the forming fabric and the tissue felt), demands on tissue felt technology have increased significantly. Modern tissue felts require very high fiber anchorage with uniform surface characteristics. In addition, the modern tissue felt can play an enormous role in overall machine productivity and energy consumption.

Impact TS (Figure 2) meets the demands of the latest machine concepts by utilizing a highly hydrophilic yarn technology providing immediate felt saturation. In order to reach maximum dewatering performance in "flow controlled" tissue press nips, it is necessary to reach full saturation in the press zone such that the water flow from the tissue sheet flows through the felt to the open void volume in the press roll cover.

The heart of the tissue machine is the suction press (Figure 3) where machine performance is crucial. Low-vacuum suction zones in the suction press before the high-vacuum press zones, are required in order to introduce a proper sheet transfer to the press nip between the Yankee and suction press roll. A so-called "pre dewatering" in that suction zone is beneficial but can also be a downside if too much water is removed

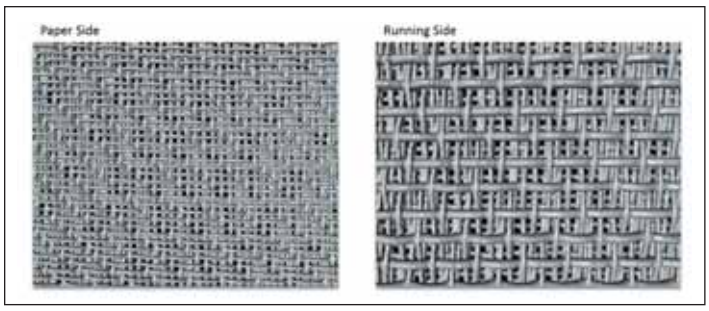

Figure 1. Formsoft's symmetrically woven design ensures dimensional stability and uniformity.

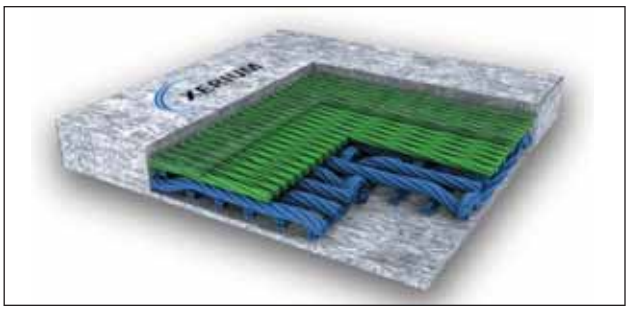

Figure 2. Impact TS utilizes a highly hydrophilic yarn technology providing immediate felt saturation.

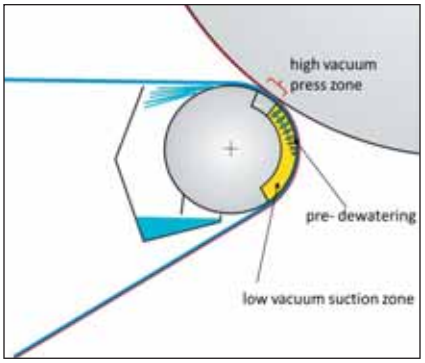

Figure 3. Low-vacuum suction zones in the suction press before the high-vacuum press zones are required in order to introduce a proper sheet transfer to the press nip between the Yankee and suction press roll.

from the roll side of the tissue felt, whereby the saturation in the press nip is insufficient.

Impact TS increases water retention ensuring saturation in the press nip. The effect of suction zones has been simulated at dynamic trials on pilot presses and confirms the higher water retention properties compared to conventional tissue felts. Results of customer field trials of Impact TS include:

- Improved start up time (i.e., full machine speed within one day on an 1850 mpm Crescent-former)
- Increased average machine speeds up to 3 percent
- High machine efficiency due to increased press dryness and therefore reduced breaks
- Production increase up to 5 percent
- Energy savings up to 5 percent
- Less use of HP shower cleaning due to improved self-cleaning effect on the suction press

One Impact TS customer reported saving more than $600,000.

ROLL COVER TECHNOLOGY

Improved mechanical pressing efficiency and increased tissue post pressure roll consistency will decrease the required drying energy per ton of tissue produced.

Figure 4. Electronic sensors monitor nip conditions in real time.

Historically, plain or drilled rubber pressure roll covers were able to withstand the temperature and pressure in the nip, but would wear quickly and were prone to hardening and cracking. Grooving rubber covers was not possible due to extreme wear and unsatisfactory performance, and polyurethane covers were not feasible due to bond integrity and poor resistance to tissue machine chemistry. Introduction of Rebel polyurethane technology in 2007, resulted in a positive step change in tissue pressing performance.

Rebel covers utilize an industry-unique polyurethane technology that overcomes the challenges of Yankee pressure roll application by providing benefits such as:

- Fusion bonding system enables operation at the higher temperatures and nip cycles of the tissue suction, blind drilled, and plain pressure roll positions
- The extremely low hysteresis (power loss through heat generation), allows the covers to run cooler, even in high speed non-water-cooled blind drilled positions
- High wear resistance and material strength allow the cover to run with both drilled and grooved venting, while maintaining cover integrity and providing run times longer than prior rubber covers
- The polyurethane chemistry creates a cover that will not harden like rubber covers, providing sustained optimal performance in hardness sensitive applications

Maximum machine efficiency and sheet uniformity rely upon a uniform CMD Yankee-to-pressure roll nip pressure. Rebel pressure roll covers have built-in SMART Technology electronic pressure sensors to deliver real time nip information, allowing the operator to improve machine performance and run his machine more effectively (Figure 4). Non-uniform CMD loading profiles from faulty loading systems, thermal crowning, and Yankee profile concerns have all been detected in real time, with the corrections leading to record machine production. Specially-designed SMART systems have also been utilized to diagnose improper compound crown fits. In addition, SMART Technology data is used to measure and monitor MD variability.

The most efficient drying of a tissue sheet occurs when water is removed at the Yankee/pressure roll nip. The addition of grooves to the Rebel pressure roll cover (Figure 5), has the following effects, all leading to reduced energy use in the dryer hoods:

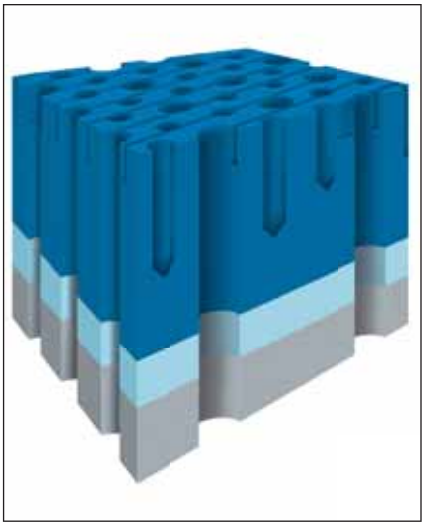

Figure 5. Adding grooves to the Rebel pressure roll cover saves energy use in the dryer.

- Increases surface open area and improves distribution of vacuum or blind drilled venting behind the felt
- Increases roll cover void volume allowing more water to flow from the felt into the roll cover surface
- Increases the vacuum or non-vacuum vented surface area behind the felt, which retards sheet rewet at the exit of the nip

A single customer reported a $1.1 million in overall savings since installing Rebel.

Managing water velocity and flow direction as well as the volume of water, is necessary to minimize hydraulic wear on the roll cover and felt. The most effective drilling and grooving patterns are engineered to complement felt design and the desired method of sheet water removal. Although the holes and grooves are in the roll cover, decisions on the venting patterns should be made within felt design discussions—the roll cover itself only provides the capability to apply the final venting design.

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