TRENDS in press felt technology

Supplier survey gives insight on advancements and qualities.

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Drainage rates, total drainage, and release properties are all a function of press felt properties. Machine clothing is designed for specific paper grades and even for specific machines. A press felt must also be able to carry stock through the press section without compro mising sheet structure.

The past few years have seen advances in press felt technology. Innovations in design and raw materials have significantly improved durability and efficiency.

Tappi Journal asked North American suppliers of press felts to share their insights on what's expected of press felts, what's new in materials and design, and steps papermakers can take to enhance press felt performance. Participants included Frank J. Cunnane, VP, Product Technologies, Asten Press Fabrics, Clinton, SC; John Conley, Technical Director, Press Felts, Weavexx, Wake Forest, NC; Robert L. Crook Jr., VP, Design/ Manufacturing, Scapa Press Fabrics, Wilson, NC; William M. McCarthy, VP, Marketing, Albany International Corp., Rensselaer, NY; Frank Norris, VP, Engineering, Orr Felt Co., Piqua, OH; Shelly Sybeldon, Technical Marketing Coordinator, Appleton Mills, Appleton, WI; Bob Burke, Applications Manager, JWI Group, Atlanta Felt, Jonesboro, GA; and Ian K. Booth, VP, Marketing, Tamfelt Inc., Canton, MA. We wish to thank each respondent for his time in participating in the roundtable survey.

TJ What are the ideal (or most important) characteristics of a press felt?

SYBELDON: Generally, the characteristics vary according to the requirements of the grade, position, and machine. Several areas are considered important when addressing the development of a fabric for a particular position. They are water removal, sheet quality, sheet handling ability, the openness or void volume of the felt, ease of installation, and life. Beyond these basic characteristics, runnability and repeatability are

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necessary for the successful clothing of a paper machine. Because of the customized nature of the press fabric development, the felt's design and composition address the specific needs of that machine.

CONLEY: A felt must have the capacity to handle the water load and, ideally, work as well at the beginning of its running life as when it is taken off the machine. To attain this ideal, the felt must be engineered to resist compaction and filling. At the same time, the surface and base structure of the felt must meet the sheet finish requirements for the grade being produced. Other considerations are stability, resistance to chemicals, and wear.

MCCARTHY: A press fabric should provide steady-state performance. Steady-state performance is demonstrated by a press fabric that provides optimum operating levels from startup until removal. The press fabric demonstrates this by very little change in caliper, vacuum levels, and physical characteristics throughout life. This translates to consistent machine speeds, efficiencies, and paper production.

CUNNANE: All makers of press felts strive for consistency of product and performance. The ability to produce press felts with minimal variation in specification and properties is fundamental to providing papermakers solutions to concerns or enhancements to performance and quality. Papermakers ex-

pect that once the application recipe has been refined, they can depend on the felt to provide consistency of performance felt after felt.

TJ What are the greatest challenges in reaching that ideal?

SYBELDON: Reaching the ideal felt is challenging since many of these characteristics contradict one another. For instance, a high-void-volume felt may be difficult to install or may not present the best finish. In order to meet these challenges, suppliers must understand the needs of the paper machine and address the special felt requirements to create the most appropriate design. Clothing suppliers have also faced adjustment to the technological advancements of the paper industry. Machines are now running at faster speeds with wider sheets. There is also an increased usage of chemicals, fillers, and recycled fiber. These types of developments continue to force felt suppliers to rethink their design applications.

BOB BURKE
JWI GROUP, ATLANTA
FELT, JONESBORO, GA.

BURKE: In the past few years, the curve depicting the improvement in product uniformity and felt life has been asymptotic. That is, we are getting better and closer to our goals, but will never reach them. This is because our sights are always being set higher for even more life and better uniformity. It will probably take a major change in the product, through R&D efforts, to make an integral change in felt life from current levels. Currently, time appears to be the major challenge in developing new products. The recent industry downturn has caused many clothing suppliers to focus less on R&D and more on manufacturing efficiency to offset pricing concessions made to hard-pressed customers. The hope is that this will not have a lasting effect on the amount of R&D that felt producers can afford.

BOOTH: The ability to provide optimum dewatering has been affected in recent years by the increase of secondary fiber and subsequent filling problems that this change brings and the ever-increasing demand to run the machinery at higher and higher speed. We, therefore, must have clothing that resists contamination or at least conditions well, at high-speed running must vent water well at the nip, and must give up the remaining water readily at the uhle boxes. The enhancement of sheet finishing has been optimized by major innovations in base fabric design with a move away from the normal woven two- and three-layer fabrics to complex laminated structures which allow for a smoother pressing base cloth surface and rigid high-void-volume sublayers to enhance compaction-resistance and allow for the movement of larger volumes of water from the press. Higher press loadings on both hard nip and flow-controlled nips and longer contact dwell times in shoe press application are all placing high demands on the felt designer to ensure there is no detraction from sheet-surface quality.

TJ How do felt performance demands differ based on paper machine press position and on the grade of paper being produced?

CONLEY: Felts for printing and writing grades, for example, must be designed to face high speed and high PSI (pounds per square inch) where concerns are flow or pressure control, smoothness, blowing, sheet transfer, and vibration. Felts designed for kraft paper grades must withstand high PLI (pounds per linear inch) loads and high water loads while draining freely, resisting compaction, imparting finish, and transferring the sheet. There are almost as many press section designs as there are grades of paper. Press section geometry, loading, roll covers, and mechanical condition can all affect the runnability of the felt. A great pickup felt may be quite different from a felt designed to run on a last-press position. The pickup felt must have excellent void volume retention and water handling capacity while allowing smooth sheet transfer. The pickup is the workhorse of felts. The last press works harder to get the water out of the sheet; therefore, the felt has to withstand high loads while not causing vibration or sheet marking.

JOHN CONLEY
WEAVEXX, WAKE FOREST, NC.

NORRIS: Generally, performance demands are dictated by the requirements of the application. For example, on flow-limited high impulse presses the felt must be able to maintain adequate void capacity for a hydraulic-pressure gradient to exist. The magnitude of this gradient determines the rate of flow from the sheet. In the other extreme, the most important characteristic of a felt for a tissue machine is its ability to not rewet the sheet after the pressure roll. The seemingly small amount of water involved in rewet represents a significant percentage of the sheet's basis weight. Maintaining a smooth, dense batt structure on the surface of the felt is the primary key to drying performance on a tissue machine.

CROOK: Successful sheet transfer, water handling, and felt impact on sheet quality are constants for all applications. However, parameters and qualities that define successful performance cannot be easily summarized, since almost infinite combinations exist. This is why press felt clothing remains an engineered product and not a commodity.

TJ What recent innovations in materials have helped increse the efficiency of press felts?

CUNNANE: In recent years, a lot of R&D has centered on improvement of the batt fiber material. Higher-molecular-weight polymers with chemical additives to enhance resistance to chemical and mechanical degradation have significantly improved the durability of felts on paper machines. With the increase in recycled stock and the use of oxidative biocides, the environment that felts operate in has become harsher. Felts are required to withstand the rigors of chemical cleaning and exposure to oxidative agents.

FRANK CUNNANE
ASTEN PRESS FABRICS, CLINTON, SC.

CONLEY: Today's monofilament-based fabrics enable us to engineer fabrics with precise control of size and drainage characteristics. Batt fibers of high molecular weight for wear resistance and chemical resistance are recent innovations of our suppliers. Yarn suppliers have also added polymer to enhance chemical resistance, and some new materials including elastomers to dampen vibration have been tried. We can also apply new surface treatments for finish and bonding as well as enhance the felt's resistance to chemicals, compaction, and contamination. Carefully chosen combinations of fiber and surface treatments can have a synergistic effect that greatly improves the final product. Our fiber suppliers are pushing the limits of what can be done with current fibers, and the next generation will likely be a totally new material.

NORRIS: Recent improvements in raw material, both batting and base fabric yarns, have created a higher standard of performance in press fabrics. The single most important characteristic of a batt fiber is its ability to resist wear. The introduction of high-molecular-weight nylons has made a significant improvement in felt durability. Dimensional stability has been enhanced by new types of nylons being used in base fabrics. These materials are much less sensitive to temperature variations in the press section.

BOOTH: Modifications in polymers for both monofilament and batt fiber manufacture have given numerous improvements in the area of chemical degradation resistance, friction or wear resistance, and the ability to resist some stickies. These changes, together with in-house production modifications, have shown increased running times, improvements in the retention of caliper and subsequent residual permeabilities, and less contaminant plugging in the base cloth. Several new treatments to ensure ease of installation on noncantilevered machines and products to give a more rapid felt startup are being enhanced continually.

TJ What recent innovations in design have helped increase the efficiency of press felts?

CUNNANE: Major improvements have already been made and new developments are on the horizon for seam products that will perform on the full range of paper grades. Seam felts have reduced the downtime for installation significantly. This has improved the efficiency not only in minimizing downtime but by allowing design structures that could not be installed in endless form to be used to enhance the water removal process.

CONLEY: We have been producing laminated base fabrics of two and three layers for some time, and we're moving to four and maybe five layers for maximum design flexibility. Laminated felts are by far the greatest offering to control press efficiency. A variety of base fabrics can be combined to provide a uniform pressing surface, predictable drainage control, and finish requirements.

BURKE: The customization of composite-base designs to meet the demands of specific applications have maximized felt life and increased sheet solids exiting the press section. This has facilitated the increasing production rates in both the kraft and fine-paper segments. The partnerships forged with the suppliers to the wet-felt industry have also led to improved performance of standard single- and double-layer designs. Specifically, the modification of needle design/technique along with advances in fiber technology has resulted in sheet-side surfaces that are more uniform and wear resistant.

ROBERT L. CROOK Jr.
SCAPA PRESS FABRICS, WILSON, NC.

BOOTH: Without doubt, the modern-day laminated base structures have totally changed the designing of press clothing tremendously. With the use of woven, nonwoven, and formed

components, the applications engineer now has enormous flexibility in fitting together the parts to match the requirements of the individual press position. Although the laminated structures have been around since the later 1970s, it is only in the past couple of years that major strides have taken place to the point where now two-, three-, and four-layer engineered base cloths can be applied to the majority of press positions and have shown optimized efficiency and paper sheet characteristics. Seamed felt applications continue to grow in all paper grade segments of the industry. Installation and safety factors are still the driving force. Major innovations in the seamed designs with differing base cloth types will promote even further these unique products.

TJ What common mistakes made at mills are most likely to diminish felt perfomance?

CROOK: Improper or marginal felt cleaning/conditioning, or both, combined with poor maintenance of the cleaning/conditioning equipment.

NORRIS: In most cases, modern felt constructions are designed to carry the water out of the press nip to the uhle box. To take advantage of this characteristic, paper machines require adequate vacuum and shower systems. Deficiencies in this area also lead to reduced press performance as a result of filling, compaction, or wear.

BURKE: Perhaps the most common mistake is the premature removal of a press felt. Felts should be removed when they are compacted, filled to the point where water removal is diminished, or both. But often felts are removed because of poor sheet-moisture profiles that are indirectly related to press felts themselves. Poor conditioning, uneven press loading, or sheet condition entering the press are often at the root of the problem.

WILLIAM M. McCARTHY
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MCCARTHY: Poor communication between papermaker and clothing supplier is a major contribution to diminishing press fabric performance. The communication links must establish a good understanding of the customer/paper machine requirements and provide a continuous flow of data from both parties. If the communication between both is working at all levels, the day-to-day details that can detract from press fabric performance (operating conditions) are addressed efficiently and corrected.

TJ What steps can a mill take to ensure the felts they receive the best performance possible?

NORRIS: Establishing good methods of measuring press fabric performance is the key to optimizing a fabric design for a specific application. For example, metering uhle box separator flow and press pan flow provide an objective measure of press fabric performance. Other measures, such as drying performance, can be useful, but these are typically affected by many more variables.

FRANK NORRIS
ORR FELT CO., PIQUA, OH.

CUNNANE: To ensure the best possible performance, it is essential to have an effective conditioning system and an active felt performance evaluation program. The conditioning system should be designed to provide the necessary cleaning and dewatering without inducing excessive felt wear or degradation. It is also important to have an evaluation program that evaluates key measures that influence the performance and quality of the papermaking process

SYBELDON: Mills that have optimal press fabric performance have a close and open relationship with their suppliers. Suppliers and mill production crews should have an open line of communication relating to the machine variables and the felt characteristics necessary for the machine to reach high performance levels. Technical service inspection and testing should be regularly performed on the felts to provide a bench mark and history for suppliers to better understand the overall performance of a machine.

BURKE: The mill and supplier should conduct a comprehensive review of the machine and identify key machine parameters along with clothing performance expectations. A program should be set up to monitor and evaluate these items on a continuous basis. Over time, analysis of these parameters can serve as an excellent troubleshooting tool.

BOOTH: Proper care of press felts must begin right at installation, ensuring a complete and thorough wetup to diminish the chance of creases or wrinkles. Felts are manufactured to run at predetermined tension or length, and these criteria should be met. Regular and well-maintained conditioning equipment is probably the single most important thing the papermaker can do. Plugged shower nozzles, incorrect oscillations, worn uhle box strips, and ill-set or nonexistent slot deckles can and do contribute to diminished performance. If large quantities of secondary fiber are being supplied in the furnish, a reputable chemical wash can be a tremendous asset. And last but not least, whether it be the modern technology or a papermaker's intuition that says a felt is at the end of its productive life, don't try to squeeze another week. Your machine performance will surely diminish and you will have us poor felt guys starving to death.

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