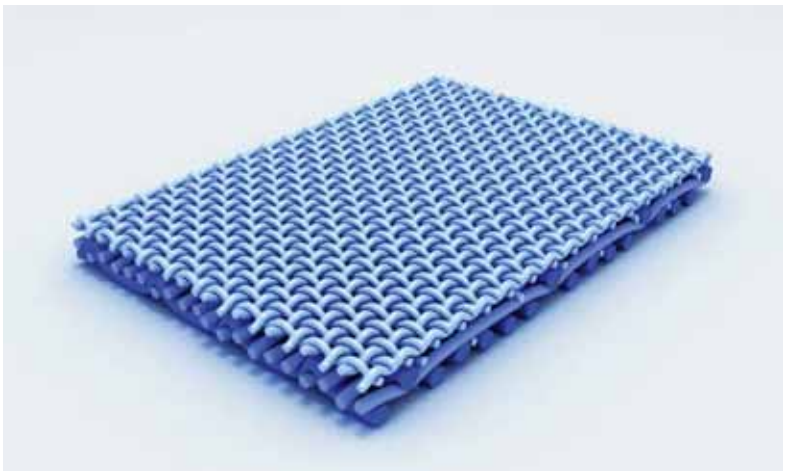
Targeting Quality at High Speed

How can the continuously increasing demands for paper quality be met? Where is there potential for optimization? Paper manufacturers and forming fabric producers are working to provide answers to these questions

By Thomas Rühl and Matthias Höhsl



Reducing the raw material and operating costs as well as maximizing machine speeds and efficiency continue to be prime goals for today's papermakers, and quality demands are increasing steadily.

The forming process is an area that poses immense challenges for both machine builder and fabric producer and there are a variety of factors that contribute to this. Shearing forces and degree of turbulence must be controlled just as precisely as the filtration and thickening processes. The retention of solids must remain stable and at adequate levels to limit the consumption of chemicals. In addition, drainage control is targeted to prevent sheet sealing or hydraulic sheet forming defects.

For the ideal formation and control of two-sidedness in the counter blade of the former, the condition of the outer layers of the sheet as well as the remaining fluid core have to be adjusted carefully.

The magnitude of this challenge becomes clear when considering the time required to form the sheet. In the case of a modern, high speed paper machine, 75-80% of the stock volume is already dehydrated, more specifically, the water is separated from the fibers after approximately 20 milliseconds. After another 40 milliseconds, the sheet has already reached the point of immobility, meaning that the fibers have reached their final position in the sheet. The main properties of the paper, with the exception of the outermost surface layers, have now been formed.

Dewatering through the forming fabrics produces a fiber mat on the paper side of the woven surfaces—step one of sheet formation. Here, the screen design plays an important role in the sheet forming process.

WHAT REQUIREMENTS DOES THE FORMING FABRIC HAVE TO MEET?

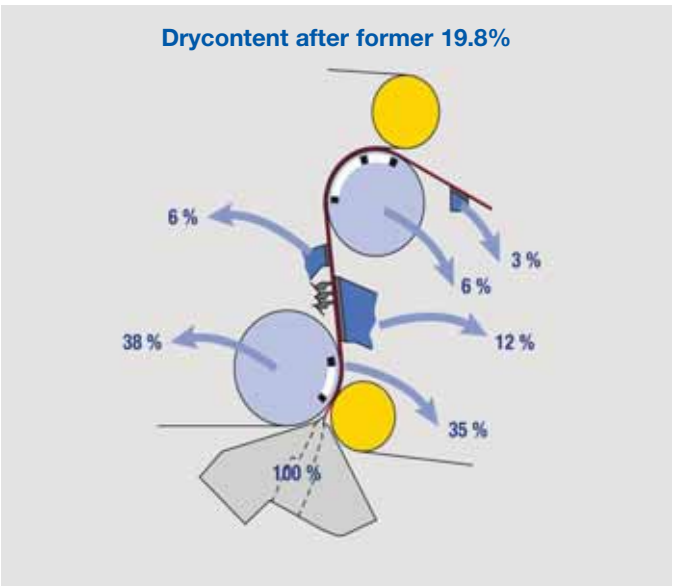
Forming fabrics must contribute to improved paper quality under the extreme conditions of the paper machine. For publication grades such as newsprint or LWC, a high percentage of waste furnishes are used:

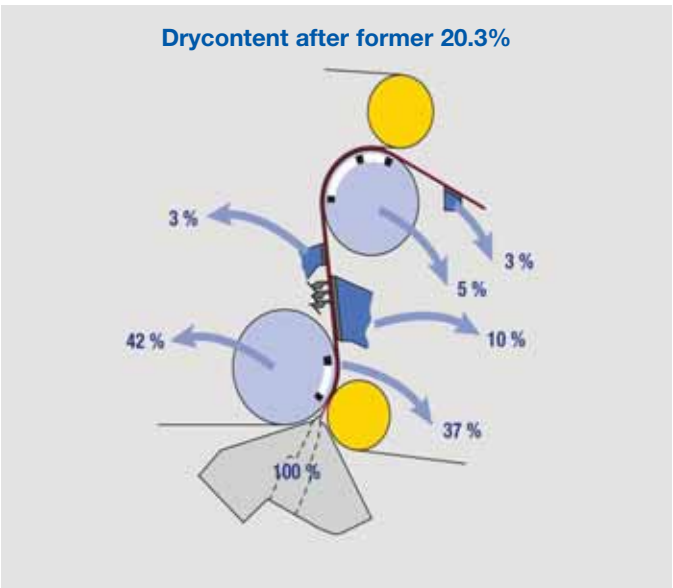
- Improved dye absorption or color penetration, an important quality criterion of printed paper, requires a highly symmetrical and densified sheet structure with a low porosity.
- Improved surface topography of the fabric is necessary to enhance the surface roughness and visual properties of the sheet.

Both of these quality criteria must also be considered in combination with other machine sections, which also have

significant effects on the sheet.

The basic requirements for a consistent sheet structure, good formation, minimal marking by the forming fabrics must be met in terms of sheet quality. The speed-specific requirements include the lowest possible water transport by the forming fabric and adequate lifetime. Too much water transport by the forming fabrics at high machine speeds would result in a heavy discharge of water and soiling of the machine, which can seriously affect runnability efficiency.





A DEVELOPED SOLUTION

The achievement of high paper quality at higher paper machine speeds was the goal for Voith Paper Fabrics in the development of a new type of forming fabric called PrintForm HS. With a Fiber Support Index (FSI) of up to 235 and over 1,800 support points per cm², it is not only the finest fabric, but with a caliper down to 0.58 mm it is also thinner than most two-ply fabrics.

PrintForm HS, which is used in the TQv former on both inner and outer positions, should make a considerable contribution to solving the aforementioned problems, but can only be proven by practical testing. Voith Paper Fabrics tests its machine clothing on test paper machines such as the Paper Technology Center (PTC) in Heidenheim before the first deployment to a customer's machine, in order to assess a large number of operating and quality parameters.

These include, on the one hand, the direct properties of the forming fabrics, such as CD and MD dimensional stability, or the water transport and associated cleanliness of the machine. While on the other hand, process behaviors such as dewatering and retention, as well as the actual paper quality attributes of formation, porosity, sheet structure, surface and strength properties.

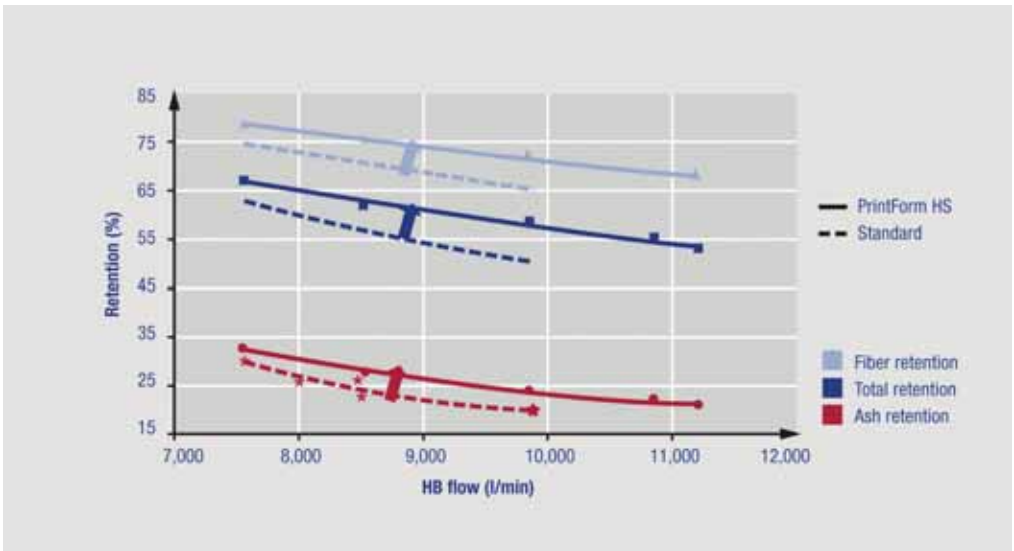
PrintForm HS was tested producing newsprint under different trial conditions at the PTC using 100% waste paper base. The test series was carried out on the DuoFormer TQv, where conventional forming fabrics were used as a benchmark for the PrintForm HS. In order to test the fabrics in the entire production window of the paper machine, the trial plan included multiple testing points with different settings of vacuum, blade pressures and jet-stock speeds.

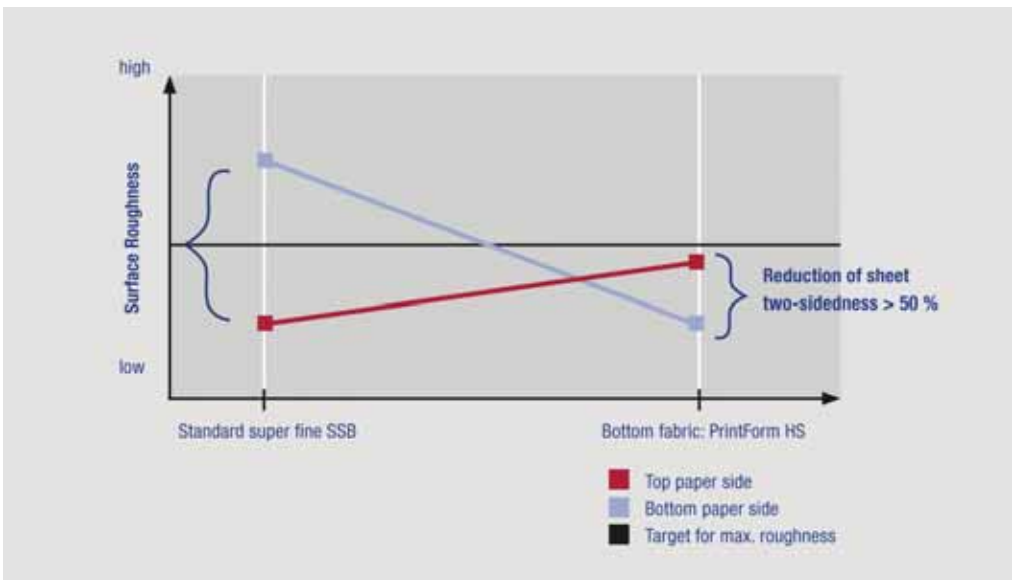
NEWSPRINT PAPER TRIAL

The machine speed was 1720 m/min on the former. The PrintForm HS and reference fabrics had identical permeability and were run through all trial points.

PrintForm HS trials produced considerably better mechanical retention behavior. The retention of both fiber and ash are shown in the retention diagram below indicating potential savings in the retention chemistry, a significant advantage to the papermaker.

One of the key development targets for the PrintForm HS was its ability to perform at high speed. The PTC trials





included a test that involved producing newsprint at up to 2,500 m/min. Even at this very high speed, the dewatering behavior remained stable, the dry content after the former remained just as high and there was minimal water transport or discharge. This outcome and other results for other material qualities provided the basis for the field experiments.

MILL TRIAL

Building on the experiences gained at the PTC, the application team reviewed the PrintForm HS ahead of its first test on a customer's machine. The target was to reduce the sheet two-sidedness on a fast-running gravure paper machine.

The customer traditionally ran very fine weft-bound SSB fabrics, though the paper roughness was still above the required value on the bottom side of the sheet. PrintForm HS with a 30% higher number of support points, compared with the standard fabric in this position, was the key criterion for the fabric trial. No design changes were made to the top fabric. A considerable improvement in the roughness on the bottom fabric side of the paper allowed the two-sidedness to be reduced by approximately 50%, which achieved the goal set by the papermaker.

CONCLUSION

The close cooperation between papermakers, paper mill suppliers and clothing manufacturers allowed for an ideal definition of the target requirements for this forming fabric. In the PTC, the PrintForm HS was able to achieve the stated goals to improve paper quality and increase machine efficiency—and this at machine speeds of up to 2,500 m/min.

The application of the PrintForm HS to the customer offered impressive proof that the trial results from the PTC are transferable to full production machines.

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