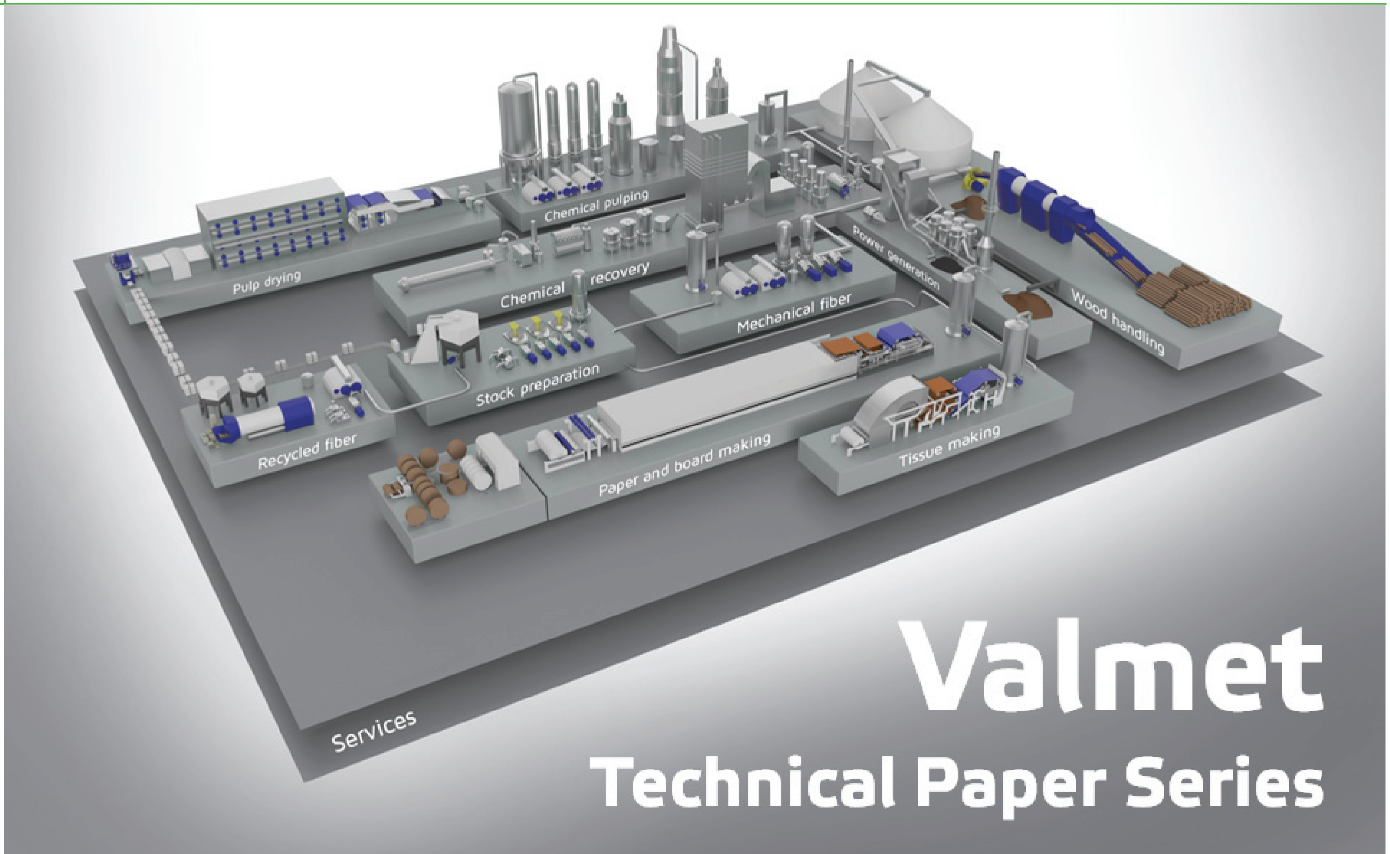

Valmet Fabrics – an Introduction

Executive Summary

One of Finland's oldest companies, Tamfelt, now Valmet Fabrics, is a major producer of technical and industrial textiles. The company's core product line focuses on producing a full range of paper machine clothing. The company's products include forming fabrics, press felts, shoe press belts, and dryer fabrics.

Valmet's machine clothing products are marketed under several branded lines, including the GapMaster and Citius forming fabrics, and several others for the pressing and drying sections. Valmet Fabrics is known globally as a reliable, innovative, and competent supplier of technical textiles.

This white paper will provide some practical tips on fabric care, review the history of Valmet Fabrics, and introduce Valmet's family of forming fabrics with descriptions and case studies.

First we will look at some practical tips provided by Valmet service engineers with hundreds of in-mill service calls under their belts. Then Valmet's history in fabrics development will be reviewed, followed by case studies and brief descriptions of Valmet's key forming fabrics.

Forming fabric practical tips

Guiding of all types of fabrics follow similar basic rules, guidelines, and set-up procedures. Here are some of the most important ones.

Normal Entry Principle

Web-roller transport dynamics will attempt to displace a web until it enters perpendicularly to the roller's axis. Otherwise known as the "Normal Entry Principle" (**Figure 1**), this means that an ingoing fabric will tend to align itself at 90° to the downstream guide roll. Whether normal entry is achieved at the steady-state condition is dependent on traction forces overcoming web span stiffness.

For low wrap angles, the normal entry principle means the fabric will steer to the side it contacts first. For high wrap angles, such as stretch rolls, the fabric will steer to the slack side.

Only the guide roll misalignment should be controlled. All other fabric rolls are aligned square to machine and should not affect guiding.

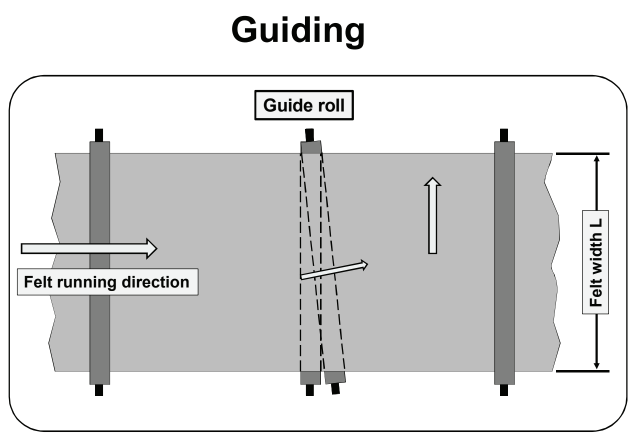

Figure 1. Normal entry rule

If the auto guide roll end is working hard to steer a fabric, other rolls may be affecting guiding. These rolls should be aligned square to the machine and leveled.

Some mills have found that cocking the stretch roll a little is required to run a straight trade line. In this case, tighten the side where the trade line is running ahead. This increases the length the fabric has to travel on that end, allowing the trade line to straighten out.

Wrap angle and lengths

Proper wrap angle of the guide roll is normally between 20-30 degrees. Adequate incoming to outgoing sheet run lengths are necessary, with the ingoing/outgoing length ratio approximately 1:1 to 2:1.

Only the ingoing fabric sees the effects of the guide roll misalignment and moves accordingly. The downstream roller locks in the effect of the guide roll.

Total in-to-out length around the guide roll should be greater than the fabric width, especially for stiff dryer fabrics.

Fabric set-up tips

After a new fabric has been installed, stretch the fabric to remove sags, but not too tightly.

Make sure the guide paddle is not caught on top of the fabric, and is set close to the proper position to center the fabric on the machine.

Crawl the fabric under low tension to remove any wrinkles and straighten the trade line. If too much tension is applied before the fabric has had a chance to straighten out, it will cause the fabric to wrinkle permanently.

Tighten the fabric to manufacturing supplier recommended settings.

Monitor the auto guide roll position (paddle controlled end). Adjust the manual guide end to get the automatic guide end centered. Don't worry if the felt is not exactly where you want it for now (unless the fabric is running off the rolls).

Once the fabric auto guide end is running in the center of its stroke, adjust the guide paddle to wherever you want to run the fabric in the machine.

Increase the fabric speed while monitoring the guiding of the fabric. Adjust the manual guide end to keep the auto guide end centered.

Adjust the paddle arm height if the fabric is oscillating too rapidly or slowly. The closer the paddle is to the fabric, the greater the response rate will be to changes in fabric position and vice versa.

Forming fabric ridging

Forming fabrics need to possess uniform rigid dimensional stability to lay flat and maintain open area for good drainage properties. If there are any distortions in the fabric, especially bottom side fabrics, basis weight profiles will suffer.

Valmet engineers have seen several instances of a problem called "ridging" of the forming fabric on LWC machines. In one instance, a ridge occurred over a small cross direction, about 1" wide, which was present all the way around the fabric. At the ridge, the basis weight was light as the stock slurry rolled off the ridge into nearby lanes on a flat fourdrinier machine. It was easily seen on the dry end of the machine, for example before the dry end calender and at the rereeler unwind.

What to watch for

When the ridge gets high enough and the light streak worsens, the fabric needs to be replaced. In at least four occurrences an engineer noticed the ridge problem developing in a new forming fabric at the same mill shortly after installation.

When looking at the fabric with a microscope, it was clear that the bottom polymer strands were damaged. When these strands broke, the ability to keep the fabric flat was lost and the machine direction ridge was formed.

In each case all wire return rolls were checked in the ridge area to see if there was any debris or defect in the roll covers. Nothing was found. However, the roll over the pulper, the spreader roll, was not initially inspected due to its location.

Later, this roll was removed with a crane to check the cover. After close inspection, the problem was found to be a small spec of rust that was embedded into the spreader roll's rubber cover. The size of the rust was very small, around 1/16". After removing the rust particles from the covers, no more problems were seen with fabric ridging.

The reason the spreader roll cover rust particle caused the forming fabric to wear is due to the relative speed difference between the rust particle and the fabric. As the particle sticks out, its tip speed is greater than the spreader roll cover and fabric speed. This speed difference, along with the high rpm of the smaller spreader roll, created a buzz saw effect that caused enough damage to large filament wear side strands that they could no longer maintain the dimensional stability of the fabric and created the ridge.

It's amazing what unforeseen operational costs a tiny piece of debris can produce when it's located in just the wrong place. Hopefully this problem will never happen on your machine - but if it does, you know where to look for the possible problem.

History of Valmet machine clothing production

Valmet's involvement with paper machine clothing had its beginnings in the 18th century in Finland. Manufacturing in Scandinavia in the 18th century was undeveloped, with goods being produced by guild craftsmen. Weaving machines, invented in England near the end of the 18th century, powered by steam engines resulted in the development of modern manufacturing techniques – helping to bring about the Industrial Revolution of the 19th century.

Thus in the late 18th century and early 19th century, a new type of manufacturer came to be. He was not a craftsman, but the owner of a manufacturing mill – possibly not even directly involved in the production process. In Finland at that time, several manufacturing groups grew rapidly, including well-known names such as Fiskars and Hackman.

The beginning – a water-driven woolen textile mill in 1797

A sheep estate owner, Ernst Gustaf von Willebrand, set up a water-driven textile mill in 1797 in Jokioinen. Using the wool from his existing large sheep herd he wanted to produce woolen textiles using the new English machinery. Willebrand installed two weaving looms and a few years later a carding machine. The mill produced textiles for about a decade until Willebrand's death in 1809.

The mill was restarted in 1838 by Axel Wilhelm Wahren, who later became a well-known Finnish industrialist. By the mid-19th century, the mill was one of the largest in Finland. Water supply became an issue and Wahren left to start a cotton mill elsewhere.

Tampere, the ideal location

Operation of the mill transferred to Axel Israel Frietsch, who began looking for a solution to the mill's water shortage problem. The town of Tampere had become an important Finnish industrial center with rapids running through the city, offering a good supply of water power. Tampere was also exempt from import duties under the then-Swedish rule. Frietsch built a new mill in Tampere, which opened in 1859.

In the mid-19th century, the United States was the world's premier supplier of cotton. When the American Civil War severely disrupted cotton imports, cotton prices increased dramatically. Supply was restricted to Egyptian and Indian cotton, and thus was mostly unavailable to the Finnish market. In 1863, with no raw cotton to weave, Frietsch declared bankruptcy. In 1869, a group of Finnish industrialists, including Axel Wilhelm Wahren and Carl Zuhr bought the mill.

Zuhr was the mill manager, and the company was called the Tampere Woolen and Worsted Mill, and grew to be a prominent wool and textile mill. Around the same time, another important industry was rapidly developing – papermaking.

Shifting toward machine clothing production

Development of the first papermaking machinery, using wood instead of cotton or cotton rags, meant that Finland's large forests were perfect for paper production. The town of Tampere had had a modern paper mill since the 1840s, using the convenient water power of the nearby rapids. Increasingly sophisticated papermaking machinery, running at faster and faster speeds, created a need for better sheet support. Felts were developed, as a protective layer between the paper and the machinery, and as means of dewatering the sheet.

In the late 1870s the Tampere Woolen and Worsted Mill started to reorient its production to support the growing paper industry by making machine clothing also known as technical felts. In 1887, the technical felts division was born, called Tammerfors Klädesfabrik.

Difficult times ahead

Production at the turn of the 20th century was anything but easy. As reported in Tamfelt's 2000 Annual Report, "The new product line, in itself one of the toughest within the weaving industry, was the source of great trouble for many years. Products that turned out badly, claims and heavy damages were incurred before even a satisfactory manufacturing skill was achieved. In spite of many hardships [the company director] continued to develop the product with admirable energy. He took advantage of the experiences gained, and by investigating the way foreign mills made their felts he enhanced his own knowledge and the skill of the workers. Thus the machine felts of the company started slowly to gain foothold in the domestic market."

Things didn't get easier as the decades rolled on. A mill-destroying fire in 1888, a damaging flood in 1889, followed by World War I. After WWI, during the Soviet civil war, the final battle between the White and Red armies was at Tampere, destroying the company's warehouse.

Wool, yarn, and fabric production sustained the company into the mid-20th century. Machine clothing production grew steadily, requiring a new, dedicated plant built in 1936. Just in time for World War II. The company was once again hit hard, with bombing raids causing heavy damage to its plants and raw material shortages reducing production.

Competition drives production in mid-20th century

After World War II, the company had new foreign competitors, producing cheaper wools and new textiles. The Finnish paper industry was growing well, which helped make up for dwindling wool sales. Demand for technical felts and other textiles increased through the 1950s.

Other geographic regions were also increasing their demand for paper. In the mid-1950s the company started to export technical textiles into Europe and elsewhere in the world.

By the early 1960s, felts were clearly the company's main product, outselling wool and consumer textiles. The original felt mill was enlarged and in 1965 the company began producing filter fabrics. Within a decade the company had outgrown its original location and started construction on a new mill.

The tail wags the dog – machine clothing production surpasses textiles

In 1981, all technical textiles machinery and employees moved to the new, large manufacturing plant. The wool production branch stayed at the old mill. The new company name, in light of the strong focus on paper machine clothing was changed to Tamfelt.

Figure 2. By the 1960s machine clothing was the major product development area, thus the new name "Tamfelt" was chosen in the early 1980s.

The new Tamfelt now began an operational expansion phase by acquiring a forming fabrics company, Viira in 1984. The next purchase was Draper Felt Company, based in Canton, Massachusetts in 1986. This provided a new felt production facility and the ability to better support the U.S. market. In 1989, U.S. production expanded to include forming fabrics with the construction of a greenfield plant - Formtec - in Peachtree, Georgia.

Tamfelt expanded in Europe in 1990 by purchasing majority share of Fanafel of Portugal. This not only increased the company's technical textiles capacity, but also introduced laundry felt production. In 1998 the company opened a Brazilian branch, Tamfelt Tecnologia em Filtraçao, to supply filtration fabrics for the Brazilian mining industry.

In 1999, in a joint venture with Tianjin Paper Net in Tianjin, China the Tamfelt-GMCC Paper Machine Clothing Company was created, with production beginning in 2000. This allowed Tamfelt to produce machine clothing locally for the fast-growing Chinese paper industry.

Tamfelt becomes Valmet Fabrics

In 2010 Metso acquired all of Tamfelt shares, and the company name was changed to Metso Fabrics Inc. Metso Fabrics Inc. was established as the Fabrics business line within Metso´s Paper and Fiber Technology segment. (Metso's pulp, paper and power group became Valmet in 2014.)

Today, Valmet's one of the world's leading manufacturers of technical textiles. The PMC (Paper Machine Clothing) products include paper and board machine clothing, whereas filter fabrics are delivered to the pulp and paper, mining, chemical, power and construction industries. In paper and board manufacturing, clothing is used to remove water and to transport the web of paper through the process. Filter fabrics are used to separate liquid and solids in wet filtration applications. Dry filtration products are used to separate solids from gases. Ironers use special felts (ironer felts).

Case study - new fabric change system improves work safety

Paper mills put a lot of emphasis on work safety. A safety audit at one mill revealed that the fabric change on a particular machine involved many difficult stages, and thereby lowered work safety. To fix this, the mill and Valmet came up with an idea for a new type of fabric change system.

The new system consists of fabric change equipment and covers, and a new way of packing the fabrics, all developed by Valmet. The package includes all fixed and telescopic poles needed during the fabric change. The mill's hands-on experience of fabric change problems was invaluable in finalizing the system design.

Smoother and faster

The installation of the new system took two days under Valmet's guidance. During the first change of the bottom and top fabrics, both paper machine and fabric experts from Valmet were present. Everything went smoothly, and the fabric change was over an hour faster compared with the old way.

"The project went very well. It was punctually planned and implemented by us together with Valmet. The combination of our hands-on experience in changing the fabric and Valmet's machine and fabric know-how led to a successful end result," says one of the mill's managers.

Savings and a short payback period

The system has now been in operation for a year and has shown its capabilities. With the bottom fabric, the change time has shortened by about 2-2.5 hours, and with the top fabric, by 1-1.5 hours. The new system makes it possible to install the long bottom fabric into the machine so that there is no creasing, which could cause paper quality problems or, in the worst case, lead to a premature fabric change.

Thanks to less creasing during the fabric change, fewer fabrics are needed, bringing savings of over 132,000 USD (100,000 EUR) annually (**Figure 3**). And what's more, faster and fewer fabric changes enable the machine to run for nearly 50 additional production hours per year. The investment has been profitable, and the payback period has been short. "Of course, financial savings are important. However, the most important thing for us was to improve work safety," points out the machine's production manager.

The new equipment and packaging adds to work safety in itself. Also, thanks to good instructions and guidance on the various work phases during the fabric change, every member of the staff now knows his or her task, which speeds up the work and further improves safety.

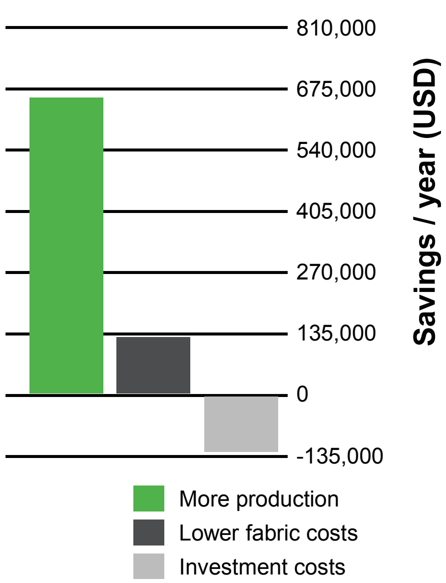

Figure 3. Savings gained by installing forming fabrics using the new method

Lower environmental impact

In the new system, the packing boxes and poles of the fabrics are recycled and reused after inspection. Earlier they were left at the mill. "The new and the old way cost about the same, but through recycling, we are able to lower our environmental impact," adds Pekka Kortelainen, Product Technology Manager, Forming Fabrics, Valmet.

"In cooperation projects, the supplier's expertise is important. However, equally important is the ability to listen to the customer and, above all, understand the customer's needs, as took place in this project. We are very satisfied with the implementation of the project and the operation of the system," the production manager concludes.

Valmet's GapMaster forming fabric - Adaptable for all demands

The growing demand for GapMaster, a leading SSB forming fabric on the market, has turned Valmet into a specialist in this field. Today, SSB fabrics account for 80% of the Valmet's forming fabric production.

In 2001, when this sophisticated weaving pattern was first developed, it was a turning point in Valmet's forming fabric development and also began the era of the most versatile forming fabric weave structure at that time.

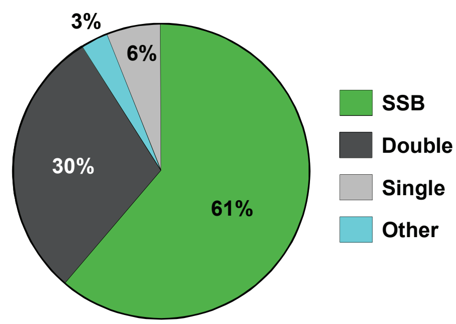

Figure 4. Forming fabric deliveries by style to paper and board machines in 2009. SSB far exceeds all other types.

The SSB forming fabric weave structure was developed in the late 90s. Within a few years, all manufacturers introduced their own modifications of it. The SSB fabrics soon found their way to paper machines, which produced demanding printing paper grades, and gradually became an industry standard.

The SSB fabric weave structure incorporates two major requirements for a high-quality forming fabric: its very fine sheet side supports fibers and the high yarn material amount on the wear side ensures a long life. The structure also offers good weave stability; when tensioned in a paper machine, it provides a rigid mesh plane upon which an excellent paper sheet can be formed.

The lowest possible caliper with the highest fiber support

However, a high amount of yarns in a complicated weave structure requires more space than earlier structures (**Figure 5a**). Thickness, the caliper of the fabric, became higher than with 2- or 2.5-layer structures. Even though thinner yarns can be used, the structure is thicker.

The GapMaster weave structure provided a welcome solution for improving the SSB structure further. Valmet's R&D experts in Juankoski invented a unique patented solution soon after the company's first 'conventional' designs were running on paper machines. The target of their project was to find the lowest possible weave caliper with the highest fiber support with as thick yarns as possible.

Figure 5b shows how the GapMaster pattern allows yarn positions to take less space than a conventional pattern. A more compact structure means a lower void volume, which is a key factor in reaching higher sheet consistency after the forming section. It is also considered important for clean running with a lower fiber and water carry effect.

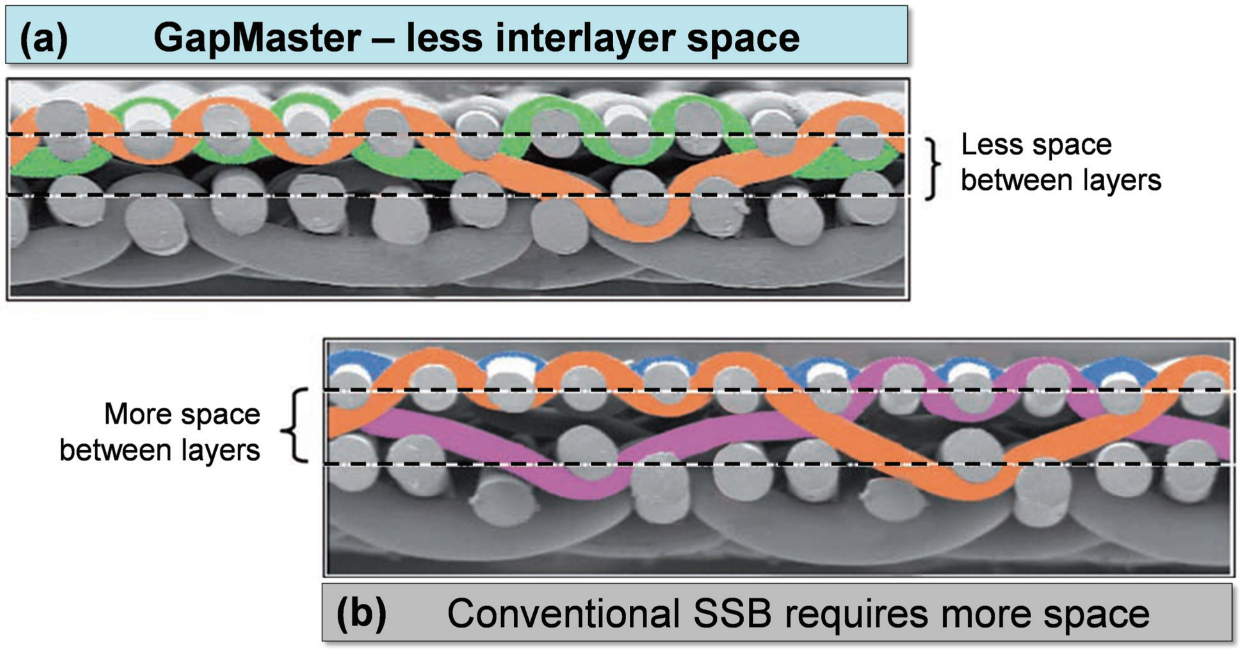

Figure 5. GapMaster (a) vs. Conventional SSB (b) weave structures. GapMaster has no CD yarn contact at the crossing point, giving a more compact structure. Conventional SSB has contacting CD yarns at the crossing point require more space between the layers.

A benefit that came along with the new pattern was its flexibility for various CD yarn (weft, shute) combinations. The GapMaster pattern is adaptable to different weft ratios with excellent yarn evenness.

A forming fabric specification is always a careful balance between paper side and wear side demands. On one hand, the highest possible fiber support requires as thin yarns as possible but, on the other hand, a long life calls for thick yarns. GapMaster offers the widest range of solutions in which specific demands for a forming fabric specification can be met with fewer compromises.

For all printing paper and board grades

"Valmet has invested in state-of-the-art technology. Our mill in China utilizes the GapMaster weaving know-how in its new weaving loom," comments Mr. Ahti Marin, Product Manager, Forming Fabrics. "At present GapMaster is a very versatile forming fabric family. It offers unique specification to all printing paper grades and all plies in board grades. Each weave pattern can be utilized either in a fine GapMaster or very fine GapMaster PRO version."

The excellent references and the ever-growing demand prove how much Valmet's customers appreciate the fabric. During the past few years GapMaster deliveries have increased rapidly.

"Our wide and diversified experiences make up an excellent basis for further development and even more accurate specifications. All this justifies calling GapMaster an ingenious SSB solution that is adaptable for all demands," concludes Ahti Marin.

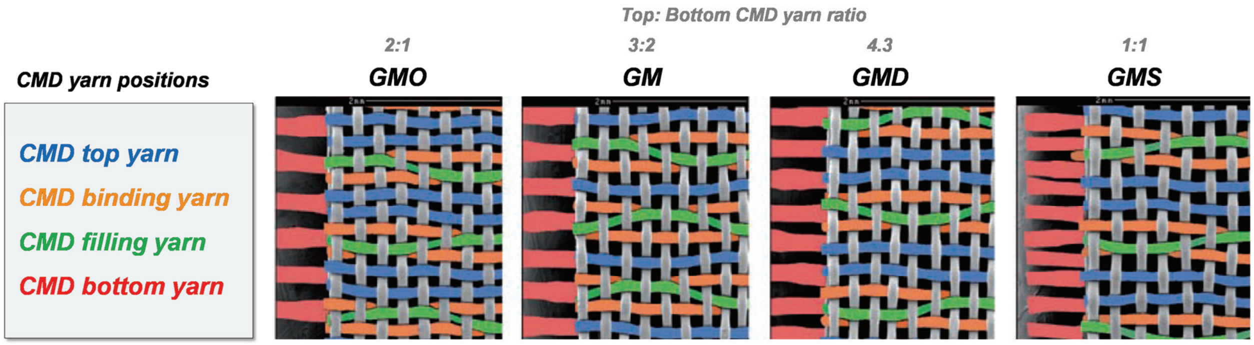

Figure 6. Four GapMaster weave patterns

GapMaster's success in North America

The forming section is vital in determining the final properties of the paper sheet, and the sheet structure in turn provides the runnability and printability of the paper. This is why papermakers strive to find a balance in forming fabrics that allows for better retention, higher density, and improved smoothness.

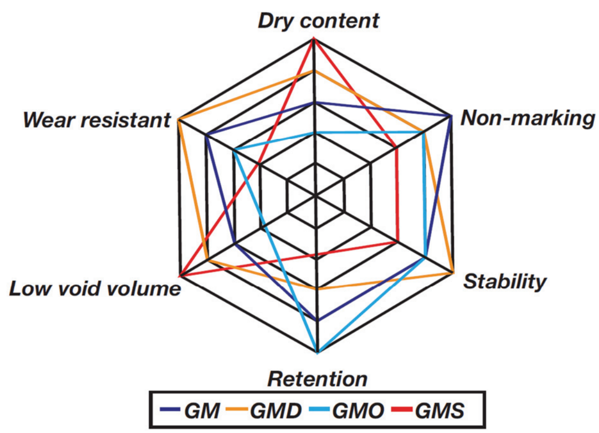

Figure 7: Schematic quality star of GapMaster weave patterns

Papermakers undergo several trials of forming fabrics to determine the equilibrium between having the highest possible fiber support that requires as thin yarns as possible but, on the other hand, a long life that calls for thick yarns.

A study was carried out in North America on a LWC machine operating a hybrid former running 30-38 lbs/3000 ft^2 at 4100 fpm (50-62 g/m^2 at 1250 m/min).

For the top fabric position, the customer installed the GapMaster GM, which is the most common GapMaster structure. With its very fine surface combined with a wear resistant bottom, the customer found that it had less "power ridges" after the top fabric drive roll than other designs. The GapMaster GM's record life time, in this position, was over 220 days.

Since the trials, there have been 16 fabrics ordered.

For the bottom fabric position, the customer's standard fabric was the GapMaster GMO. This design offers lower power consumption than competitive designs and can start-up with higher speed than with other designs. Again, the customer found that this fabric offered flat edges and noticed that the fabric did not stretch throughout its life, unlike some competitors' products.

Although the customer has tested the GapMaster PRO, which reported higher retention, the customer is loyal to the GapMaster GMO and Valmet.

GapMaster GM – the original

The first and most common GapMaster structure, GM (3/2 ratio) has shown its capabilities in many demanding positions. Its' very fine surface combined with a wear resistant bottom contributes to its non-marking performance and to its stability. Customers have praised its superior runnability, long running time, high retention, clean running excellent stability, and non-marking performance, among other qualities.

GapMaster GMD for wear-prone positions

GMD (4/3 ratio) offers even better wear resistance than GM, a fact especially well appreciated by fine paper machines using ground calcium carbonate. This structure offers about the same wear margin as GM, but with more bottom side CD yarns, it features higher wear potential.

"In some cases, the GMD fabric life has been double that of conventional DL fabrics. Other pluses include excellent profiles due to more stability, and lower retention aid usage due to better mechanical retention," explains Mr. Timo Pälä, Product Group Manager, Forming Fabrics.

GMO for improved retention

Fast paper machines with online coating need a fabric that reduces the number of pinholes in the sheet (lower paper porosity). GMO (2/1 ratio) provides a very fine top surface, allowing higher retention and a denser sheet. Its coarse bottom layer contributes to lower power consumption (less drag load), which has in some cases led to high machine speeds.

GMS for high-speed machines

Today, paper machines run faster than ever. These high-speed machines need a fabric that allows high off-wire solids and a clean run. The GMS fabric (1/1 ratio) has given superior results on fast machines.

"With higher speeds, the drainage time is shorter and the fabric caliper greatly affects the final solids after the wire section," Mr. Pälä points out.

GMS is nearly as thin as a standard double-layer fabric, which has very often been the design for the highest solids. In some trials, GMS has reached about the same solids as a DL fabric. Actually, in some cases, even higher solids have been reported.

New special polymer yarn decreases energy consumption

Major savings can be reached through lower drive roll loads and better fabric guiding. The secret lies in a new special polymer used in forming fabrics.

A twin-fourdrinier machine that makes testliner and fluting eliminated its problems of poor guiding of the bottom fabric and a high drive roll load, by installing Valmet's new special yarn PackMaster fabric. The energy consumption of the drive rolls, initially 65% of the maximum level, was quickly reduced to 60%. With normal yarn fabrics, the level is 75-80%. On an annual level, the lower figures result in savings of over 132,000 USD (100,000 EUR).

In another case, a fine paper machine with a gap former had problems due to high loads and fabric slipping on the drive rolls. The slipping caused sudden power load peaks that led to machine stoppages.

The top fabric position, in particular, was sensitive to slipping, and there were often several stoppages after fabric installation.

After the mill installed a special yarn GapMaster inner fabric, the drive roll load dropped from 78% to 68% of the maximum level, and the slipping problems ceased. Three weeks later, a special yarn GapMaster outer fabric was installed, too. The loads were low on this fabric as well, and there was no slipping. Thanks to the lower power loads on the drive rolls, annual energy savings of over 92,000 USD (70,000 EUR) were gained compared to normal yarn fabrics. More savings resulted from the elimination of stoppages caused by slipping on the drive rolls.

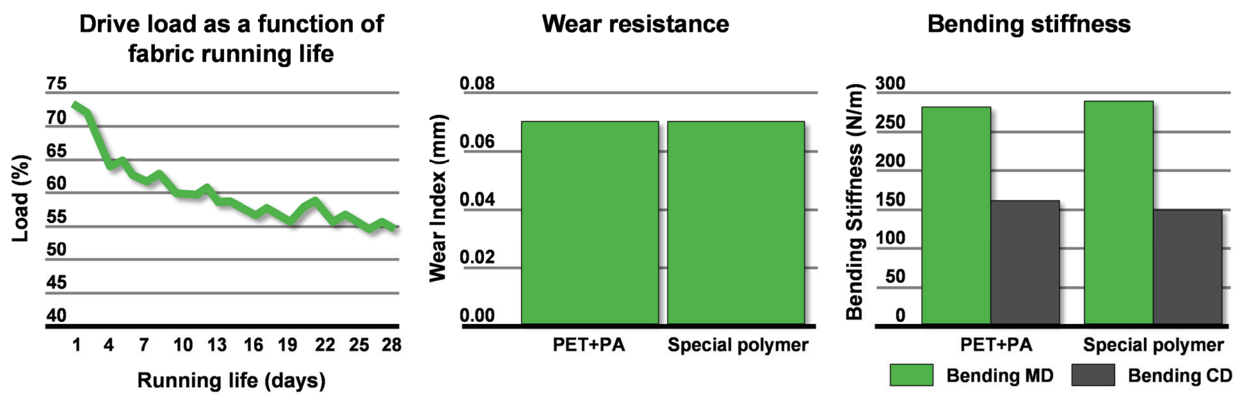

Figure 8. Load on the fabric drive roll as a function of fabric running life (left). Fabric wear resistance (center). Fabric bending stiffness (right).

Polyamide changes its dimensions

Forming fabrics have traditionally been made of polyester (PET, polyethylene- tereftalate) and polyamide (PA). Polyester's most important property for fabrics is its stability. It absorbs very little water and keeps its dimensional stability, even in wet conditions. The most important feature of polyamide is its wear resistance. On the negative side, it absorbs a lot of water, which weakens dimensional stability.

Forming section drives use a lot of energy. For example, on a modern high-speed newsprint machine, over 6% of total energy consumption is caused by forming section drive loads.

The drive roll loads often follow the pattern shown in **Figure 8**. At the beginning of the running life, the loads are high, but tend to fall with time. In part, this is due to the dimensional change of polyamide. When wet, polyamide swells and protrudes somewhat from the fabric structure, reducing the contact area between the fabric and the drive roll. There may be some slipping between the fabric and the roll. This slipping increases drive roll load, causing sudden load peaks, which may even stop the whole forming section.

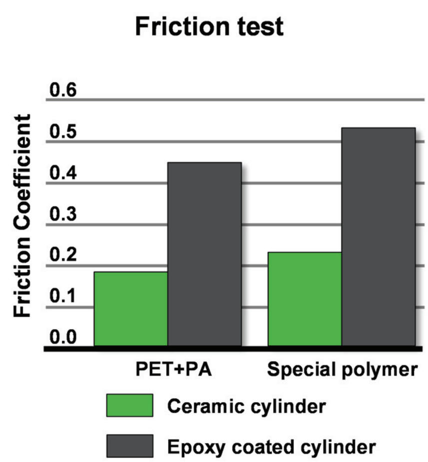

Figure 9. The friction coefficient has been measured using laboratory equipment which defines the friction coefficient between the fabric and the moving roll in wet conditions. The friction coefficient of the special yarn fabric, both on a ceramic and an epoxy-coated roll, was about 20% higher than that of a normal fabric.

New polymer yarn improves dimensional stability

Valmet has solved the problem by using a special polymer yarn in its forming fabrics. Laboratory tests show that both dimensional stability and wear resistance are similar to fabrics with PA+PET 1:1 on the wear side (**Figure 8**). The excellent results reached on paper machines prove that the solution works.

Citius forming fabrics improve solids and cleanliness

"Why do you only develop Sheet Support Binder fabrics (SSB) and no longer double layer fabrics (DL)?" This question asked by a production manager of a fast LWC gap former machine a few years ago was the starting point for the development of the new Citius forming fabric.

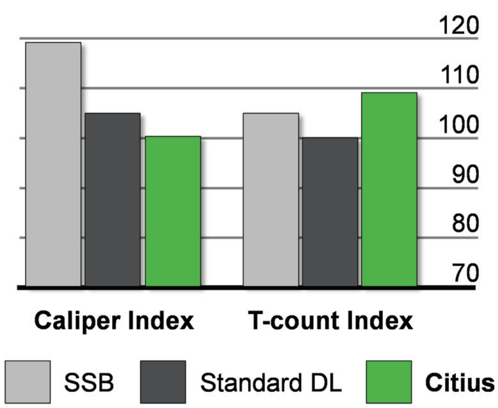

Figure 10. With Citius, lower caliper = less water and water carry; and higher T-count = good fiber support and stable structure.

In papermaking, DL fabrics have provided benefits that SSB fabrics have not been able to do, not even after ten years of development work. These include, for example, high solids, low fiber and water carry-back, and reduced water misting on fast paper machines. The SSB fabrics, in turn, have indisputable advantages compared with the traditional DL fabrics, such as stability, wear resistance and higher mechanical retention.

"The Citius fabric combines the best advantages of the traditional DL fabrics and the SSB fabrics. This has been achieved with thin machine-direction yarns, high yarn densities and a new-type nine-shed structure," explains Pekka Kortelainen, Product Technology Manager, Forming Fabrics, Valmet.

Improved formation and dewatering

"Citius is, in fact, somewhat thinner than the thinnest DL fabrics so far. This contributes to a small void volume in the fabric and a low fiber and water carry effect," Kortelainen continues (**Figure 10**). "The best solids are typically reached with a thin fabric, and the need for high vacuum in dewatering elements is eliminated, which saves energy."

Very positive experiences at mills

The Citius fabrics have been run on both gap and hybrid former machines producing newsprint, LWC and fine paper grades. Experience at mills has proven the above claims to be true.

Newsprint case: Fewer web breaks, less porosity

A hybrid former machine producing newsprint was using a traditional DL fabric as standard. The problem was that fine fiber and water mist drifted on the top of the headbox, causing fiber build-up.

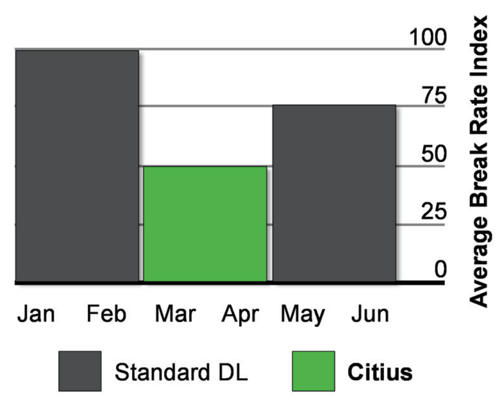

Figure 11. Average web breaks were significantly decreased with Citius.

As this fiber dirt fell on the headbox jet, it caused defects on the paper web and, in the worst case, web breaks.

When the machine was run with a Citius top position fabric, there were 50% fewer web breaks compared with a traditional DL fabric (**Figure 11**). When a traditional DL fabric, which was left in the storage, was run on the machine, the number of web breaks increased again.

Another benefit with Citius was improved paper quality. The most significant quality improvement was 30% lower paper porosity, which decreased print-through significantly. Today, Citius is the standard fabric in this position with a 100% market share.

Newsprint case: Higher solids and better cleanliness

A vertical gap former (SpeedFormer HS) that produces newsprint at a speed of 5580 fpm (1,700 m/min) had run both DL and SSB fabrics in its outer position. With the DL fabrics, the machine had reached high solids but the fabrics' inner loop had become dirty, leading to an increased washing need and web breaks. With the SSB fabrics, the fabrics' inner loop stayed clean but solids in the forming section were over one solids percent lower compared with the DL fabric. Low solids had caused problems in the press section, and it had not been possible to run at maximum speed.

With the Citius fabric, solids have been even higher than with the traditional DL fabric. However, an even better improvement is visible in the cleanliness of the fabrics' inner loop. Citius is now the standard fabric in this position with a 100% share. The two figures show that Citius is wear resistant and has given long running time.

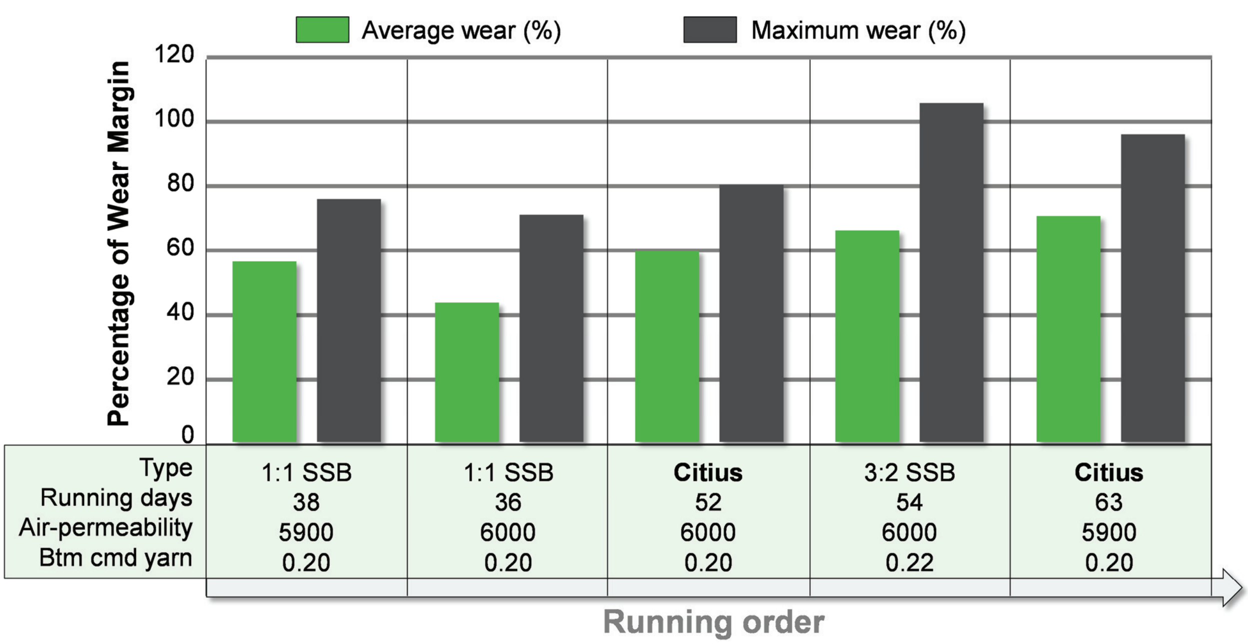

Figure 12: Fabric wear – Citius vs. SSB, percentage of wear margin (newsprint horizontal gap former case)

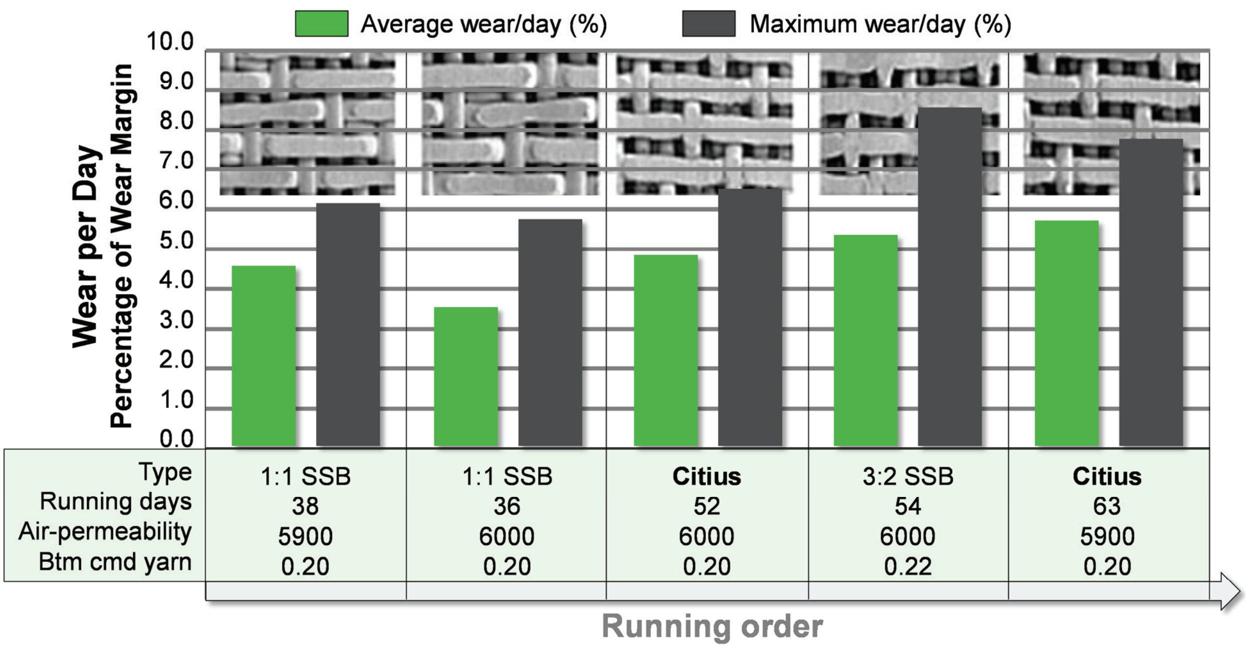

Figure 13: Fabric wear – Citius vs. SSB, wear per day, percentage of wear margin (newsprint horizontal gap former case)

Newsprint case: Higher dry content and good runnability

An OptiFormer LB that produces newsprint at a speed of 1,700 m/min had run many years with SSB fabrics in its outer position. Because of good results on many news print machines they decided to make a Citius trial in the outer position. A 0.5–1.5% higher dry content was reported (**Figure 14**).

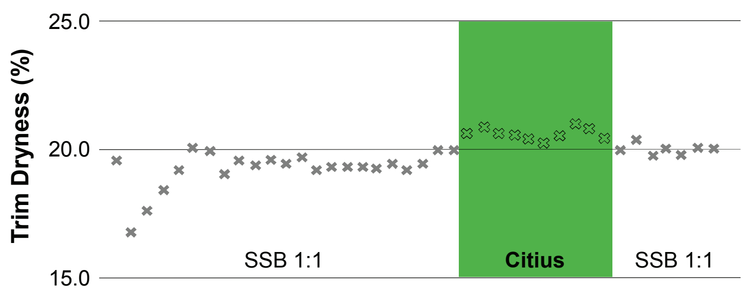

Figure 14. Effect of outer fabric on trim tryness. With Citius there was 0.5 – 1.5% higher dry content (newsprint OptiFormer LB case).

Totally 5 Citius outer fabrics have been ordered with 100 % market share. A Citius trial in the inner position will be discussed next.

LWC cases: Higher solids and better cleanliness

An LWC horizontal gap former was running a DL fabric in both positions as standard. The mill had tested different SSB fabrics but solids remained lower than with the DL fabrics. The Citius fabric was first tested in the bottom position. This resulted in high solids and a cleaner forming section, which both improved runnability. A significant improvement in coating machine runnability was also achieved.

As base paper porosity decreased significantly, much less coating drifted through the paper and there was much less coating build-up on the backing roll. This reduced the need to wash the coating machine. Today, Citius is the standard fabric in both positions with a market share of over 80%.

Summary

Valmet Fabrics has a long history of machine clothing development, with origins dating back to the 18th century. Valmet service engineers provide practical tips on fabric care and setup, using decades of experience in hundreds of mills. Valmet's premier forming fabrics, GapMaster and Citius, have enjoyed success worldwide in reducing power consumption, breaks and porosity while increasing solids, wear resistance and cleanliness.

This white paper combines technical information obtained from Valmet personnel and published Valmet articles and papers.

Valmet provides competitive technologies and services to the pulp, energy and paper industries. Valmet's pulp, paper and power professionals specialize in processes, machinery, equipment, services, paper machine clothing and filter fabrics. Our offering and experience cover the entire process life cycle including new production lines, rebuilds and services.

We are committed to moving our customers' performance forward.