Small Process Changes Can Produce Big Results

Executive summary

What if you could create a major positive outcome for your mill by making a relatively minor change in your process? Not all game changing results require a massive rebuild. Sometimes a pinpoint focus on a particular problem, and the assistance of a qualified and skilled solution provider such as Valmet, can bring about significant benefits for your production line.

This white paper presents several examples of small upgrades that have produced significant positive changes in productivity, efficiency and profitability at mills around the world.

The process changes analyzed in this paper are in three main areas: roll service, roll covers and fabrics. In the area of roll service, Infinikote thermal spraying and DryOnyx H coating are reviewed. The CoteCondor and CalLeopard roll covers for coater backing rolls and calender rolls are also discussed. In the area of fabrics, we present the WavStar filter bags and OptiProof forming fabrics. In each case study, the targets and results achieved are analyzed.
Yankee dryer regrinding lessened with thermal spraying

SCA Ortmann in Austria faced a frequent problem with chatter marks on the Yankee on their PM 4. Even though the Yankee dryer was only eight years old, the problems became so serious that it required regrinding – twice a year. After several years of regrinding, the situation finally became untenable and demanded a permanent solution once and for all. As SCA Ortmann had applied thermal spraying on their PM 9 earlier, with good results, they decided to spray the PM 4 Yankee dryer too, with Infinikote from Valmet (Figure 1).

"Today we have nearly no Yankee wear. Both machines have been running trouble-free for more than twelve years without regrinding. We are very satisfied with the result and so is our machine operator who handles the Yankee dryer with care and makes sure the creping operation is well center-lined," says Josef Berger, Operation Manager, SCA Hygiene Products GmbH.

SCA Ortmann is located in Pernitz, a one-hour drive from Vienna. The mill has two tissue machines producing bathroom tissue, napkins and hankies. PM 4 is the widest tissue machine in Europe with a sheet width at the reel of 6.92 meters. Consequently, it also has the largest Yankee dryer. The machine is running 100% recycled pulp at 1,870 m/min and it produces 91,000 tonnes per year.

Eight Yankee experts performed the task using Valmet's renowned Farros MZA grinding machine and six spray guns to apply the Infinikote. The result was what you can expect from a high-class process like Infinikote. The papermaking surface is excellent and the Infinikote coating has greatly extended the life of the dryer and the continuous run time of the machine. The problem with chatter marks is now just a distant memory.

Dryer cylinder anti-stick coating improves product quality

Daily maintenance of dryer cylinders is crucial for any paper manufacturer striving for excellence. Valmet’s mill improvement expert team reduced IP Sun’s dryer cleaning time, furthering their ambition to become one of China’s leading producers of liquid packaging board. Following the on-site maintenance, the adaptability and stability of their end products was better than ever.

Board machine dryers are vital to enhancing the strength and smoothness of sheets and to improving paper moisture. It is no surprise that dryers are considered one of the most important parts of the dehydration process, after the press section. Nevertheless, dryer cylinders create a variety of operational challenges due to their large size and considerable weight, coupled with their price and the time required for installation and unloading.

High demands on end product quality

IP Sun places a great deal of emphasis on continuously improving their paper quality and fully satisfying the needs of their customers, while simultaneously expanding their market share, especially in the
growing liquid package market. Securing end product quality demands a strict focus on strengthening the maintenance of dryers, preventing corrosion, and extending their service life.

The mill therefore needed rapid assistance when some sticking and corrosion problems emerged on the surface of the dryer cylinder of their PM 22 in May of 2013. Due to poor surface release properties, fluff and break times had increased alarmingly and the sheet moisture had abruptly deviated. Eventually, this resulted in quality problems in the end product.

**An economic yet efficient solution**

Valmet’s mill improvement team recommended the DryOnyx H anti-sticking coating service (Figure 2), designed for efficient on-site application. DryOnyx H’s excellent suitability for onsite work meant that time-consuming heating with gas-based equipment was not needed. This allowed the mill to save time and avoid any negative effects of heating, such as possible changes to dryer dimensions.

Moreover, due to its innovative nanopolymer release material, DryOnyx H has unparalleled surface performance. The coating maintains its hardness even at the high temperatures found in the dryer section. This leads to reduced wear, improved release properties and a longer service life. Due to the special chemical additive in the polymer, the coefficient of friction is 80% lower than in previous materials, which means better doctorability and reduced drive power consumption.

**Professional service in the shortest possible time**

After receiving the call from Sun Paper, Valmet’s mill improvement experts quickly arrived at the mill site. First, the team identified the location and size of all the corroded areas, and then proposed the optimal solution based on the customer’s preferred break time. Valmet swiftly assigned two recoating teams and two sets of equipment to work simultaneously on the dryer cylinders of PM 22. Both teams applied the DryOnyx H anti-stick coating and completed the repair on-site in the shortest possible time (Figure 2).

**A profitable partnership**

The success of the project was highly regarded by the management teams of IP Sun and Sun Paper. Between June and November 2013, Valmet’s expert service team successively applied the DryOnyx H anti-stick coating to no less than 25 dryer cylinders on four different machines. In addition to dryer cylinder DryOnyx H coatings, three suction roll shells were also serviced by the Valmet team. The expectations of brief downtime and minimal customer losses were met through successful cooperation.

"Valmet’s service personnel were very professional and I was greatly satisfied with the coating results. Since minimizing downtime is very precious to us, it was crucial that the break times were reduced and the release properties significantly improved. Valmet saved lots of valuable time for us with their efficient and professional service," says Mr. Li, Mill Manager of PM 17 at IP Sun.
"We can now see a significant decrease in fluff and the surface of the dryer cylinder is very clean. Before the service was carried out, the dryer cylinder needed to be cleaned three or four times every shift. Now we only need to clean it once in every shift. Valmet helped us save lots of cleaning time," says Mr. Ma, Vice Mill Manager of PM 22 at IP Sun.

About the Mill
International Paper & Sun Cartonboard Co., Ltd., located in Yanzhou in China's Shangdong province, is boldly taking up the challenge of answering to the country's increased demand for liquid packaging board production. A joint venture between the American firm International Paper and China's Sun Paper, the mill's annual output is more than 1.4 million tonnes of liquid packaging board, folding boxboard and solid bleached board. With its newest cooperation, IP Sun plans to deliver 300,000 tonnes of sterile liquid package board in the near future.

Roll cover extends roll change intervals on coating stations
Blade coating demands much from the backing roll cover. It needs to be very homogeneous to achieve a flawless coated paper surface. The cover has to be evenly hard and rough across the entire roll width. It also needs to be easy to clean and wear-resistant in order to maintain good coating profiles during long operating cycles. Usually, backing rolls must be changed when the coating profiles of the blade coating station no longer meet the set paper quality requirements.

Today, hard-coated coater blades are mostly used on blade coating stations, with the advantages of better runnability, better paper profiles, and a longer useful life. The downside is wear of the backing roll cover. Problems usually appear at the edges where the roll cover and the blade meet.

This happened at Stora Enso Veitsiluoto PM 1 in Finland, a paper machine producing 180,000 tonnes of coated printing paper per year. The line includes an offline coater with four blade coating stations.

"The backing roll change interval was quite short, no more than 4–6 weeks on the blade coating stations due to wear at the cover edges," says Markku Åman, Production Manager.

The hard-coated coater blades wore the cover edge very quickly. The situation varied between stations and was worst on the first and fourth stations.

A solution was sought using Valmet's new CoteCondor polyurethane cover, designed for all blade coating stations. It is particularly well suited for coaters that use hard-coated coater blades. Valmet is the first cover manufacturer to supply a polyurethane cover for this application.

Wear- and marking-resistant
With the new polyurethane material and mixture, the CoteCondor cover resists wear and marking much better than conventional roll covers. As a result, it can be used on the machine much longer, considerably reducing the need for roll changes. With online coating in particular, the difference is significant as roll changes can be scheduled according to other shutdown needs on the line.

During web breaks, covers are often locally subjected to strong forces that may cause dents in them. The CoteCondor polyurethane material has excellent strength properties, enabling it to resist even heavy local
impacts without any marking. The amount of material removed during grinding is also reduced, extending the overall useful life of the cover.

**Excellent results led to a second order**

At Stora Enso Veitsiluoto PM 1, the first experiences of the new CoteCondor cover have been excellent (Figure 3). For the first operating cycle, continuous operation for 15 weeks was set as the objective for the fourth station. During this time, the cover was hardly worn at all, so the cycle was extended to 24 weeks. Runnability and coating profiles remained good for the whole period.

During grinding, only 0.4 millimeters of material was removed from the diameter, which is considerably less than normal. During the second operating cycle, the cover has been in use on the first station for 20 weeks already. The Veitsiluoto mill has been very satisfied with the results.

"The roll change interval on the most problematic stations has been extended from the initial situation without any detrimental impact on runnability or profiles," says Janne Harjuniemi, Operations Manager. "Within a year, we have managed to eliminate about five roll changes and grindings, which has led us to acquire a second CoteCondor cover for the line."

**Great experience also from a board mill**

The Metsä Board Husum mill in Sweden is another mill producing coated printing paper, which had similar problems with wear at backing roll edges as Stora Enso Veitsiluoto did. The line includes an offline coater with four blade coating stations. The backing roll wear problem was most severe on the first and second stations, for which the rubber-covered backing rolls had to be changed every 240-430 hours operating time.

CoteCondor was first installed on the second station, where it was operated for 1,530 hours, which is four times longer than the normal operating cycle of the rubber-covered backing roll. Even then, the cover was not significantly worn during the operation. During grinding, only 0.3 millimeters of the diameter was removed, which was much less than usual. Runnability and coating profiles remained good throughout the operating cycle.

The customer was impressed by CoteCondor and has already ordered a second cover for their stations. "Since the CoteCondor was taken into use, we haven't had to worry about how long the rolls will last. This has made it much easier to plan roll changes in a controlled manner," note Andreas Zakrisson, Operating Technician, and Thomas Bolén, Roll Manager, Husum (Figure 4).
Doubling calender roll runtime with new roll cover

After the long journey that the pulp makes through all the papermaking phases, calendering represents the final chance to improve the quality of paper before it is rolled up and shipped. Great demands are therefore placed on calender roll covers, which are often required to perform under challenging conditions. A long, uninterrupted run that produces consistent paper quality requires excellent wear and barring resistance, as well as high nip load durability even at high speeds.

Save costs with long, reliable runs

Valmet has developed CalLeopard, a new composite cover for calender rolls uniquely designed to meet these tough calendering requirements. It is the first calender roll cover to utilize both a new polymer and fiber reinforcement, with a special focus on combining durability with a homogeneous micro-structure, resulting in a very smooth surface.

These factors combine to give CalLeopard extremely high wear and barring resistance, allowing extended running times. This nanotechnology newcomer is another step towards trouble-free papermaking and significant cost savings.

Excellent roll cover durability

Wear resistance is important for all rotating rolls in the paper machine, but perhaps nowhere as much as in the calender. The dry, abrasive paper is in direct contact with the elastic composite cover under high loads and often at very high speeds. Doctoring for paper grades such as SC or DIP-based paper also means special requirements for the wear resistance of covers.

Cover wear is often non-uniform, which affects the cover profile – primarily in the cross direction, but also in the roundness of the cover. When cover profiles deviate enough from the specified values, paper quality and runnability suffer. Excessive local wear may even put the cover itself at risk. With CalLeopard, the wear on the cover is minimal (Figure 5); reducing maintenance costs through longer grinding intervals and fewer cover changes.

130 days and still running

CalLeopard’s extended running times are clear, including in a multi-nip calender at a North American SC paper mill, where CalLeopard has achieved a running time of 130 days at speeds of 1,170 m/min and a loading of 328 kN/m, and still continued running. This has been the longest run in this position without profile problems, according to the mill.

Longer running times under vibration

The design of CalLeopard also pays special attention to barring resistance. This is partly achieved by the high wear resistance, but another key factor is the resistance of the cover surface to deformation while absorbing the flexing in the nip. The advanced cover materials and cover structure of CalLeopard resist
the barring deformation of its circumference into the infamous star shape, permitting longer running times under vibration.

**Doubled running times at SC paper mill**

At Stora Enso Kvarnsveden’s PM 12 in Sweden, high quality SC paper is produced with a modern 5 + 5 TwinLine multi-nip calender. After already achieving running times of about 800 hours with CalJaguar H, the new CalLeopard has nearly doubled that time, to almost 1,600 hours. The surface has remained very smooth throughout, even up to a Ra of 0.17 μm. CalLeopard has managed this level of performance under harsh conditions: pressures of more than 400 kN/m and speeds of 1,130 m/min, while being doctored.

Anita Nordenström, Technician of the PM 12 TwinLine states: "With CalLeopard, we can run much longer without vibration." Longer running times have also given Maintenance Manager Håkan Kinnunen (Figure 6) more flexibility in planning roll changes.

**New filter bags increase capacity**

"The poor capacity of our disc filters was causing us major problems. They were a truly troublesome bottleneck and the entire process was negatively affected – finding the right solution was a must," says Patrik Jansson (Figure 7), Operations Engineer at Holmen’s mill in Hallsta, Sweden.

"We were initially skeptical that a corrugated filter bag could be the solution, but because the idea of investing in new, costly disc filters was not all that attractive, we decided to give Valmet’s WavStar filter bags a try. The alternative, with sectors in corrugated steel instead of filter bags, was not an alternative for us either. The references we looked at showed that it was difficult to achieve the promised capacity, and even if the service life of plates is longer than for filter bags, the cost of investment is high.

"Using corrugated filter bags was a new thing for us, and we wondered how long the filter bags would last. But because Valmet promised a service life of at least three years, we felt secure in moving forward with our decision, despite a few misgivings."

**Stable capacity increase**

"Now that we’ve evaluated the results after the filters have been running for more than two years, we can see the benefits and we know that the major benefit is in the increased capacity, which means we don’t have to invest in more filters," says Patrik Jansson. "The corrugated fabric significantly increases the sector's surface area, which explains why dewatering is now so much more effective."
"The numbers send a clear message. Since the installation, we've been able to increase capacity from 1,000 to 1,200 tonnes per day – a 20 percent rise – that has been stable throughout the time we've been using the filter bags. Part of the increase is due to us changing the cleaning and cake discharge shower system and getting a bit better at caring for our disc filters. However, the main reason is the new filter bags."

**Speed fundamental**

"Another positive effect is that the nozzles do not get clogged," Patrik Jansson continues. "At the high speeds we were running at before, this was a big problem. High speeds also produce poor, thin pulp cakes. Contrary to what one might believe, it's an advantage to be able to run at a lower speed, because it is difficult to get the pulp to form a good cake at higher speeds. We've been able to reduce the speed from 1.8 to 1 rpm, which is ideal – the filtering is good and the fibers have time to build up into a cake with the right moisture content and thickness. Since the cake is thicker than before, the filters are also cleaner.

"Valmet installed the first filter as part of the comprehensive service, but since then we've replaced them ourselves. One difference from before is that we now change all sectors and fabrics at the same time. Before, we constantly had bad fabrics that had to be frequently replaced. Determining which sectors had to be replaced was time-consuming when you consider that we had 360 sectors to monitor."

**Analysis – an aid in service**

"General disc filter maintenance is performed during the autumn," says Patrik Jansson. "One sector is taken down and samples are sent to Valmet for analysis. This tells us how much strength remains in the weave and can even indicate the expected service life, which is handy. The analysis also includes technical operation discussions. We really appreciate the technical support we receive from Antti Mäkinen at Valmet. Both maintenance and service have become much easier."

**Bottleneck eliminated**

"With WavStar filter bags, the bottleneck was eliminated," Patrik Jansson concludes. "Dewatering for the disc filters is now properly dimensioned, the process is optimized and the filter bags work really well – we're extremely pleased with the results!"

**Improvements in packaging grades with correct choice of forming fabrics**

The right forming fabric can bring about huge improvements in boardmaking. The OptiProof forming fabrics improve machine efficiency and paper quality as well as provide major cost savings – all benefits warmly welcomed by packaging grade producers.

The production efficiency and cost-saving requirements of packaging grades – liner and fluting – are continuously growing. One such need is to make packaging paper and board grades as light as possible, yet with the same strength properties as heavier grades. "To achieve this in both the cross- and machine directions throughout the web, formation has to be good and fines must be bound on the web. It is also important to have even basis weight profiles as well as good printability properties on liner," says Pekka Kortelainen, Product Technology Manager for Forming Fabrics at Valmet.
Another requirement is to save energy since energy plays a significant role in production costs. The forming section is responsible for approximately 19% of the energy consumption of a packaging paper machine. The sectional drives make up the largest single user of energy in the forming section at 42% (Figure 8).

A third requirement is to increase machine speeds in order to produce packaging paper more quickly and without web breaks. The fastest gap former machines today run at over 1,600 m/min, and the 24-hour world speed record is currently 1,704 m/min.

**More demands on forming fabrics, too**

All these requirements place more demands on forming fabrics, too. "In addition to featuring a long lifetime and effective dewatering, the fabrics must have a good retention capability, minimal fiber and water carry, high dimensional and diagonal stability, as well as good fiber support," Kortelainen points out.

The OptiProof fabric provides 25% better fiber support and 15% higher CMD stiffness than traditional SSB fabrics. Although the fabric is thinner and has a void volume almost 10% lower, its wear resistance is almost 20% better than that of a traditional SSB fabric. The seam is also 50% stronger (Figure 9), mainly due to the lock binding.

Valmet developed its OptiProof forming fabric based on the fine-surface fabrics originally made for printing paper machines. The fine warps, 10-shed structure and lock binding (Figure 10) of these fabrics are known to contribute to a fine paper side and a wear-resistant roll side.
According to Kortelainen, experience gained on production machines has demonstrated that OptiProof fabrics are suitable for both slow Fourdrinier machines and for the world's fastest gap former packaging board machines.

**Best ever profiles and annual savings on a gap former machine**

A gap former machine producing testliner and fluting at over 1,600 m/min in a basis range of 70–120 g/m² was having an issue with uneven basis weight profiles. Despite numerous trials with many PMC suppliers’ products, it was only possible to achieve sufficiently good profiles with one supplier’s fabrics.

In the spring of 2013, a pair of OptiProof fabrics was installed in the machine, resulting in its best ever profiles. Sheet formation was more homogeneous, and the strength properties (CMT, SCT and burst) improved compared with the standard fabric. There was also a significant reduction in the use of polymer/retention aid, a high dry content after the forming section and a record-long fabric lifetime.

A huge financial benefit came from significantly lower power consumption, resulting in annual savings worth approximately EUR 200,000.

**Excellent fabric performance on a Fourdrinier machine**

A customer running a Fourdrinier machine that produces corrugated medium (fluting) in a basis weight range of 90–170 g/m² at speeds of 600–800 m/min wanted to extend the lifetime of their forming fabric.

A trial with OptiProof resulted in a longer lifetime than standard fabric. Many other major advantages over other designs were also realized, such as improved dewatering, reduced waste, excellent runnability and higher production.

**Summary**

Faced with increasingly tough competition, papermakers are actively seeking to optimize profitability and efficiency in their operations. Whatever the maintenance or production need, Valmet provides optimal solutions and services for it.

Rapid results can be obtained with relatively small changes in roll surface treatment, roll cover modifications, and fabric choices. Valmet's in-depth know-how and comprehensive understanding of the many processes on modern pulp, board, paper and tissue making machines result in solutions that, for minimal investment, make large changes in your mill’s bottom line.

*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.*