Economical Modernization Solutions for Existing Paper Machines

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INTRODUCTION

Paper Finishing Concepts

Economical Modernization Solutions for Existing paper machines.
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Achieving maximum machine availab--ility with optimum paper quality-despite frequent changes in product, larger paper roll sizes and higher operating speeds-is a challenge for any papermaker. With so many different factors affecting the production process and paper quality, it is essential to find the right solution to each problem in order to remain competitive and profitable in today's market. Responding to this need, Voith Paper has established numerous economical modernization concepts for upgrading existing machinery utilizing the latest technology and processes. Our objective is to maximize your machine productivity while reducing your operating costs.

This paper presents a number of field proven upgrade and calenders, winders and machine threading systems. It explains how to retrofit the latest advances in technology to modernize and update existing equipment or processes, to achieve improved paper quality, manpower allocation and machine efficiency. All of the concepts presented in this paper have been well proven in mills throughout the world.

Expert Services

The first step for any optimization project is to identify current problems or "gaps" in your current machine condition or processes that are costing you time, profits, or quality in the finished product. A condition and/or process audit identifies existing or probable future problems, details recommended improvements or actions, quantifies potential for improvement, providing the mill with an ROI or feasibility report, and provides a schedule of recommended maintenance, spares etc. In addition, during each audit, the equipment is maintenanced and adjusted, so that the mill immediately realizes the effects from this servicing and optimization of the equipment.

Calender Upgrades

Machine calenders are an indispensable part of the finishing process for most paper and board grades. However, after years of service, heavy loading etc., weak points often show up. In addition, steadily increasing quality demands, working widths and operating speeds require market oriented technologies which guarantee maximum quality and production reliability. The Voith calender upgrade concepts presented here demonstrate how old calenders can be brought up to date with the latest technology for today's product requirements.

There are a number of things which influence the finished quality of the paper after the calender. Mechanical influences include the number of nips, the compressive stress, the temperature of the thermo rolls, the dwell time of the paper in the nip (i.e. speed of the paper web), cover hardness and the surface of the rolls. Paper properties which influence the calendering result include the furnish, sheet structure (i.e. formation, ash distribution, twosidedness, coating formula), and paper moisture. In general when we are looking at improving quality issues (smoothness, CD profile, gloss, twosidedness), with a calender rebuild, we will be looking at the mechanical influences.

Deflection Compensation Rolls.

One of the most cost effective, easily retrofittable technologies for upgrading existing calenders are the various deflection compensation rolls. In the production process of paper and board grades, the unavoidable caliper variations in the paper web are a well-known challenge, especially the differences in the CD profile of the web. These variations have to be kept as low as possible to guarantee a consistently high quality of the paper further processing (winding) and sale.

The *Econip roll* is a swimming roll designed to provide control over the level of deflection of its crown. Through this crown control it is possible to maintain a uniform linear nip pressure over the full sheet width under a wide range of machine loading conditions. It has a very simple design for easy integration into existing installations. Although this technology has been in use for over 40 years, more recent improvements in the basic Econip technology provide better results for the papermaker. A double pass oil circulation systems ensures uniform CD temperature, and the new extended bearing design gives a more even line load distribution throughout the entire sheet width.

Econip Roll Principle of Operation: Control of the Econip Roll's crown or camber is achieved through variable hydraulic pressure acting between the centre shaft and the outer shell. This results in these components bending or deflecting, thus allowing the roll's profile to be matched to that of its mating roll. The annular space between the centre shaft and the outer shell is divided into two chambers by the longitudinal seal assemblies mounted along the length of the shaft body. This effectively transforms the roll into two semi-circular "tubes". Hydraulic oil is pumped from an auxiliary hydraulic unit into the roll's end port. The oil passes from this feed port, through the internal drilling in the centre shaft and into the pressure chamber through an entry aperture within the top surface of the shaft. In operation the full flow capacity of oil from the hydraulic unit is admitted through the feed port, completely filling the top chamber. The resulting hydraulic pressure in the top chamber exerts a force between the centre shaft and the outer shell causing them to deflect. The level of deflection is proportional to hydraulic pressure acting between the shaft and the shell in

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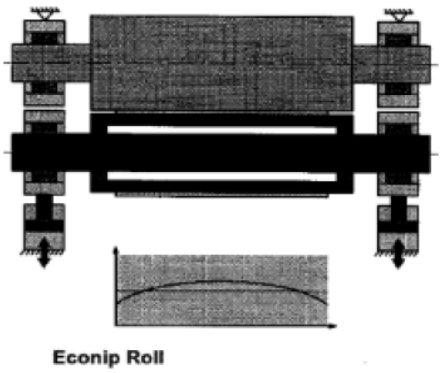
the top chamber. This pressure can be adjusted by the operator in order to fine tune the profile of the Econip roll in relation to its mating roll. The result is uniform linear nip pressure under all loading conditions.

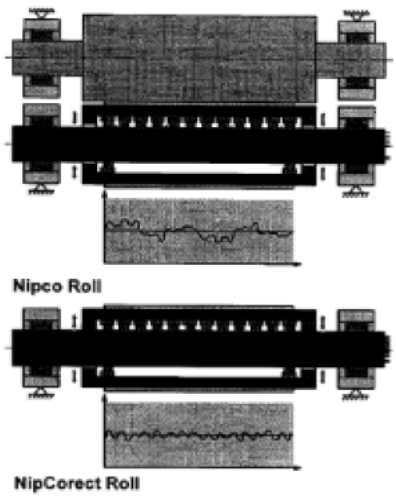
Nipco/Nipcorect Rolls

For More precise profiling, Nipco technology was developed. The 1st Nipco roll installed in 1974 and is still in use today. There are infact over 10,000 Nipco rolls delivered worldwide. The modular design offers roll systems for widths over 10 meters, speeds up to 2,500 mpm, and line loads up to 550N/mm. There are 3 main elements distinguishing a Nipco roll: the fixed shaft, the roll shell and the hydrostatic supporting elements. These are built into the shaft and support the rotating roll shell on its inner side against the exterior load. In the classic Nipco roll the supporting elements are controlled in zones. Due to this, reliable individual line load curves can be realized over the entire width of the nip-even with extremely low line loads. In the Nipcorect roll the supporting elements are controlled individually providing maximum correction potential of the web's CD profile.

Profiling rolls equipped with Nipco technology have been developed to precisely correct long wave or short wave CD profile differences. Zone controlled Nipco rolls-up to 16 zones depending on the design-can correct in the long wave range of about 1,500mm. Short wave CD profile disturbances are best corrected by Nipcorect rolls. Since the supporting elements in the shaft are controlled individually, profile corrections can be carried out in the range of 150mm. In combination with the Profilmatic control software used to determine the optimal set value changes, excellent CD profile can be realized. With the use of Nipco profiling rolls a remarkable improvement of the caliper profile can be achieved. Voith's recommended solution for optimal CD profile regulation is a combination of Nipcorect roll, Profile controls software and Module therm. This combination can achieve 2-Sigma values in the range of 0.28 and 0.18 um measured in a calender finishing copy paper-a result never achieved with any other control strategy.



Econip Roll



Nipco Roll

NipCorect Roll

Flexitherm Heated Rolls:

The Voith Flexitherm rolls are designed to provide the appropriate amount of heat in a uniform CD temperature profile to achieve the target smoothness. using a Duopass system heated oil is run through the roll to provide even heating across the roll width. Depending on the heat source (oil, electrical, or steam temperatures of 160°-260°C can be achieved.

These rolls are simple to retrofit into existing calenders to provide improved smoothness and paper finished quality.

Voith Roll Cleaner

Throughout the production process, the paper product is continuously in contact with various roll surfaces. To ensure troublefree production and faultless paper quality, roll surface cleanliness is critical. However, it is almost impossible to avoid deposits such as stickies, fibers, fillers, resins, coating colour etc. These deposits can cause marking, gloss reduction, surface flaws or even preformations and web tears. To overcome this problem, Voith developed the Roll Cleaner, Which removes surface deposits with a foamed felt cleaning wheel. The cleaning wheel is power driven and rotates in the opposite direction to the roll. Hard deposits are brushed off without any surface damage. During operation the cleaning wheel is pneumatically pressed against the roll surface by a pneumatic cylinder, and continuously traversed on a guide carriage along the roll. Cleaning can take place continuously, or only intermittently. Rolls can be cleaned over the entire working area, or only over specific partial areas. Dirt removed from the roll is permanently extracted via a vacuum system so no dust is produced due to cleaning.

Compared with a doctor, the Roll Cleaner provides a better cleaning effect, the roll surface temperature is not influenced by cleaning, cover damage is reduced (so cover life is increased), and there is less increase in roughness.

The Roll Cleaner is suitable for both chilled iron and polymer rolls. Use of the Roll Cleaner reduces the risk of "hot spots" and extends the useful life of the roll.

Winder Rebuilds:

The market demand for winder performance is simple: production of perfect reels. However paper qualities differ as much as there are different winding systems available. Different paper specific parameters, production requirements and machine design all influence the winding process, and therefore the numerous options available to improve the quality and efficiency of your current winder.

Dollars are lost at the winder for only two basic reasons: when the winder is making rolls, it is not making as many as desired, or it is not producing the necessary quality, or the winder spends too much time at zero speed (i.e. downtime is excessive). In planning improvements at the winder it is important to recognize in which of these two categories solutions need to be applied-uptime, downtime or quality.

Voith has developed a number of modular winder rebuild upgrades which combine cost effective and previously successful solutions without compromising mill specific requirements. For two-drum winders,

filed proven rebuild packages are available for increasing winder capacity and reducing manpower by automating many time consuming processes. In this paper we will look at the automation of the set change, an easily retrofittable option. To improve winding quality, there are packages available for process optimization, the new technology soft covers for winder drums and rider rolls, and the optimization of the web run, including installation of new spreading equipment. We will look in detail at the new Elacovers, In addition, most older winders today must seriously look at a complete controls systems upgrade, especially with the obsolesence of the Siemens S5 system. Voith is able to provide this service for most existing winders.

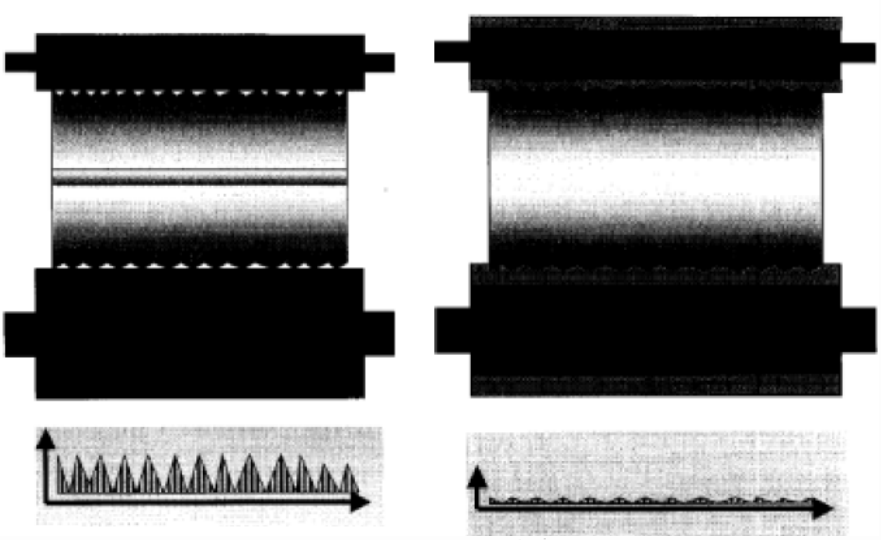
Automatic set Change

The highest level of winder conversion is upgrading to the fully automatic set change. It typically includes
-a web severaing knife and core loading system. The knife cuts the sheet as the roll set is removed from the drums. Core handling positions the cores to start the next roll set.
-adhesive application: executed either onto the cores or directly on the web for finished roll closure and/or core gluing.
-lateral automatic core transport: from outside the winder feeds cores form a core storage table. There are various ways to bring the cores to the drum valley.

Because the set change occurs on every set, it usually is the biggest contributor to throughput improvement compared to other times. Stop to start time can be as low as 30 seconds, average is 45-60 seconds.

Elacovers

For grades prone to nip-related defects such as Newsprint, LWC, SC grades, Roto, and coated paper and board grades, the soft cover drum conversion from steel drums is probably the most cost effective and common roll quality driven winder upgrade. Demand for increased recycled fiber content combined with increased roll diameters and consequently higher roll weights, have resulted in excessive nip loads exerted on the paper roll surface. Increased nip loads lead to more defects such as crepes, corrugations, bursts etc. Ideally these grades would be wound on single drum winders where nip forces



can be controlled independently of roll weight. however, for many reasons, often mills are using two drum winders for these grades. replacing the steel drums with Elacovers will eliminate these defects up to relatively large roll sizes.

The reason for this is that by simply changing out the drums (and possibly the rider roll) the winding operation remains essentially the same. The installation is relatively easy and there is minimal retraining of operators beyond slight adjustments in roll structure recipes.

Side benefits often include running the winder at higher speeds and reduced web tension. Often dishing problems disapaper. On certain coated grades, an Elacover called ElaLoad (soft covered) rider roll provides for noticeable roll quality improvements. Such rider rolls maintain a more uniform liner contact with the paper rolls, compensating for variations in both core diameters and paper caliper in spite of diameter differences in the paper rolls across the width of the winder.

These Elacovers, Elaload, ElaCare and Elagrip, are elasomer - coatings similar to rubber suitable for high speed winding up to 3000 mpm. These covers eliminate friction between the paper reel and the winder drum, close the nip-even if the paper profile is not as perfect as it could be-, cuts off air and adds additional hardness by nip induced tension. These Elacovers reduce the harmful layer movement inside the reel to a minimum.

Machine Threading Optimization:

One of the major causes of lost machine efficiency and insufficient capacity utilization is threading downtime.

Threading is a key process that can have a major impact-either positive or negative-on both efficiency and availability. 5-7% machine availability gains are achievable through implementation of technical innovations and optimized threading processes alone. In addition, operator safety is significantly improved, and costs due to unnecessary downtime are reduced. Effective break management is a critical element required to achieve optimum threading performance.

Successful break management will reduce the number of breaks, as well as time required for threading. Automated threading is a key element in any such program and there are several critical factors that must be addressed and controlled.

Process Issues Required for Reliable threading

Achieving and sustaining benchmark threading performance requires indepth and specific expertise in all aspects of machine threading, as well as application experience in all types of threading system components. The most successful and sustainable threading process for a particular application will require a combination of technologies, and the ability to combine these technologies into a seamless, effective process.

The crucial success factors to be addressed are :

- Location and condition of the tail (Edge Squirt Tail Cutter systems) and their effect on tail characteristics, threading performance and breaks
- Tail stabilization prior to transfer (doctor, moisture content, furnish) and initial transfer considerations.

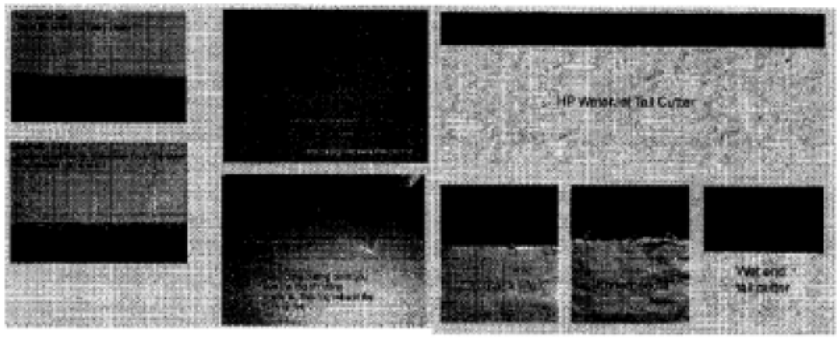


Fig.1 Samples of Edge Squirt Systems

Fig. 2: Samples from various tail cutters

- Elimination of the double tail
- Controlled tail transfer
- Positioning and design of the infeed rope nip/rope system design
- Integration of controls, manpower allocation and integration of balanced system into overall machine operations.

Location and Condition of the Tail

For type of reliable, automated threading system, a good quality tail in a specific known location is required. In addition, for optimum press section threading a tail width of 40 mm is required; for the rest of the open draw transfers a tail width 150mm is required. If the tail width and location are left to operators' discretion, as with many manually adjusted edge trim and tail cutter systems, both the tail widths and tail locations can very widely. This causes downstream threading problems, when the tail is either the wrong width and/or is in the wrong location. Valuable time can be lost while the problem is identified and proper adjustments made to overcome these problems. In addition, a poor cut from the edge squirt system can cause fiber spray and debris which up in the presses and cause sheet breaks.

To solve these problems an automatic positioning edge squirt system is recommended. This is a high pressure waterjet system, with reduced fibre spray which significantly reduces build up and therefore press breaks. (See Figure 1) In addition, the automatic positioning on this system provides exact and consistent tail positioning (+/-0.5mm) for threading, and then accurately adjusts deckle for each grade after threading.

In the dryer sections of the machine (prior to the size press, on line coaters and the end section) two types of tail cutters can be used depending on application requirements. For machine speeds in excess of 1000 mpm, the Waterjet tail cutter is recommended, especially when feeding into a rope system, because a high quality, dust free tail is required for maximum reliability. For machine speeds under 1000 mpm, the Disk Cutter rotary knife tail cutter can be used, unless the threading application requires the movement of the tail towards the inside of the machine during threading (e.g. before on line coaters). In no case, should a stationery knife type cutter be used. This tears (instead of cuts) the tail, damages it and can cause sheet breaks as well as threading problems (due to the damaged tail) See Figure 2.

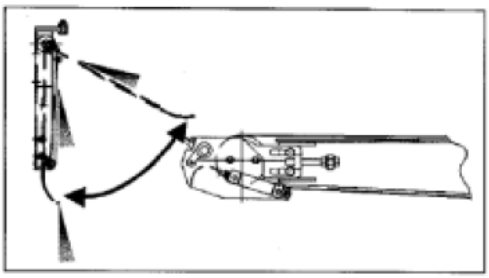
Pre-transfer Tail Stabilization and the Initial transfer

The neat critical success factor is stabilizing, controlling and transferring the tail through the treading path. To stabilize and control the tail prior to transfer, we use suction trays above and below a flip tray (see Figure 3). When the flip tray is activated, it transfers a controlled tail, through a tail ripping device and then directly onto the high vacuum zone of the conveyor.

Eliminating the Double tail

Critical to success in this initial transfer is the double tail. This is the tail that is pulled out of the broke during threading, and follows the "threading tail" down the machine. It can catch on machine frames, etc. and cause a threading failure. As it breaks up, it also leaves debris throughout the machine, which can cause sheet breaks or threading failures. For board and packaging grades, the rotary ripper is used to eliminate this double tail. (See Figure 4). The patented rotary ripper is located on the infeed end of the first conveyor in a VTT system. The rotary ripper blades, which sever the double tail, are driven by air motors at approximately 12,000rpm.

1 Fliptray
2 Pivot Cylinder (pneum.)
3 Transport Jet (ARTX)
4 Stabilisation / Suction Tray
5 Dryer Can Doctor



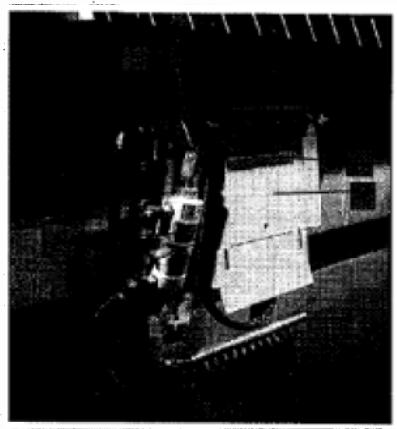
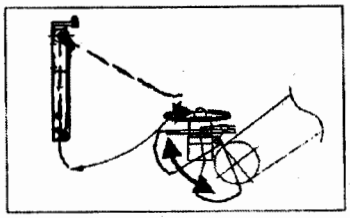


Figure 3. - Flip Tray with stabilization

1 Conveyor
2 Pivot Cylinder (pneum.)
3 Guard
4 rotary ripper blades
5 air motor
6 safety guard (park position)



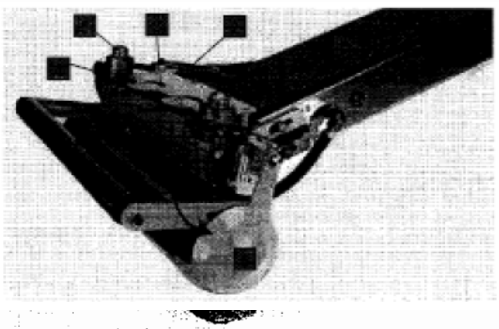


Figure 4. The Rotary Ripper

Controlled Tail Transfer

The most effective way to transfer a tail through open draw sections of a machine, or into a rope nip is with a VTT (vacuum Tail Transfer) Conveyor. This system uses a spinning conveyor belt over a vacuum box to stabilize and support the tail as it is transferred. This belt runs faster than machine speed to minimize slack, and maintains control of the tail throughout the transfer. It automatically adjusts for changes in machine speed and basis weight so that no operator adjustments are required. this allows the mill to adopt standardized threading procedu --res for all grades and speeds. Specialized deflectors and shoes on the infeed and outfeed end of the conveyor, and application designed belt runners, enhance performance. As a total system, the VTT conveyor ensures sustainable optimum threading performance.

Rope System Design Consider--ations

There are many critical rope system design criteria that need to be addressed during the planning stages of a project. These include proper specifications for drives and stretcher, location of drives and stretchers in relation to each other and the rope system they control, appropriate size and type of sheaves throughout the rope system, placement of sheaves and distance between support, roll groove profiles, rope to rope transfers, avoidance of interferen--ces in the rope path etc.

Integrating the Threading Process into Overall Machine Operations

Threading is a critical machine *process* with a significant impact on machine availability-not a collection of individual equipment components. Each component in your threading system must be optimized, balanced and adjusted to work in conjunction with all other threading components as well as with all other machine systems, resulting in a reliable sustainable total machine threading process. This threading process (all systems, components and controls) must be integrated into overall machine operations.

Threading process optimization is an essential part of effective break management. It includes both technology and processes to minimize the number of breaks, and downtime during a break. The optimum design includes the technology and processes which minimize wherever possible paper breaks. An automated threading process ensures that the paper web is established as quickly as possible after a paper break, and provides consistent threading performance regardless of grade, speed or crew experience.