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Converting a Mill from Writing & Printing to Packaging Grades- A Case Study



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Abstract

Many Printing and Writing grade producers are faced with contracting markets and hence increased competition / reduced profitability. Their choices are often to shut down or convert a paper machine to a value-added grade. The Heinzel Group was faced with such a challenge at their Laakirchen, Austria mill and they chose OCC and Approach Flow Systems along with a complete paper machine – to- board machine conversion.

Introduction

Over the past 10 years mature Printing & Writing grade markets like Europe and North America have, due to changes in readership and social media patterns, seen numerous paper machine and mill closures. While these market-driven actions have reduced the production of Newsprint, Super-Calendared, and Lightweight Coated grades some companies have opted not to completely idle a valued (paper machine) asset but to, instead, convert it to agrade offering an expanding customer base and increased profitability. In these same markets, due primarily to the growth of e-commerce, a common target for these conversion is Packaging and specifically Containerboard (= Corrugated Medium, Linerboard, Fluting, Test-Liner, etc).

Fig. 1 *shows the relative decline of Newsprint and other Printing & Writing grades globally (more pronounced in mature markets) and, over the same time period, the rapid growth of Packaging grades...making conversions into this market sector a logical target for many Printing & Writing grade producers.*

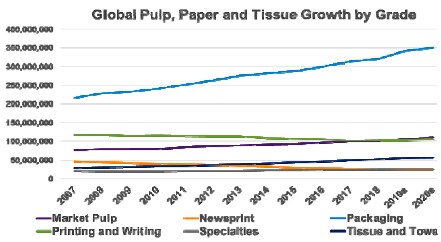

Figure 1: Reference – Fisher International

The Heinzel (Laakirchen, Austria) PM 10 Challenge:

In 2016 the Heinzel Group decided to convert their PM 10 from making graphic paper to 450,000 t/yr of Fluting and Testliner (70-140 g/m2) while still operating their other paper machine (PM 11). This meant converting their existing ground wood mill to OCC, upgrading their Approach Flow System, and a complete conversion of their paper machine, using as much existing as possible, and completing the complete shutdown / conversion in less than 10 weeks! Here is what we did together:

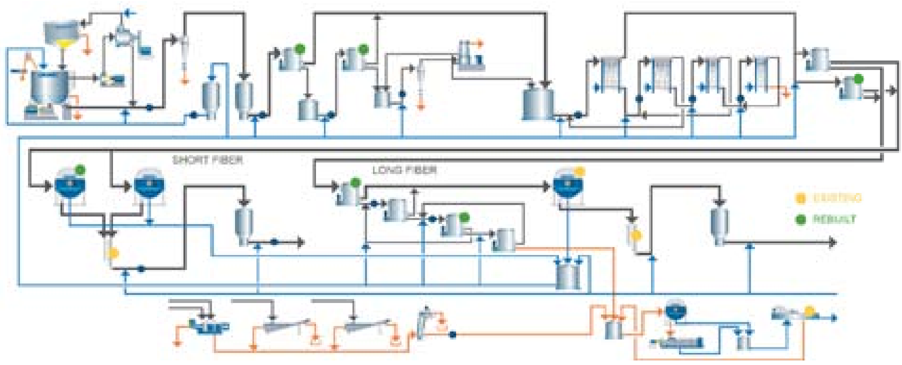

Figure 2 : OCC system flow sheet

A new 500,000 t/yr(1,350 t/d) OCC System, using as much equipment from the ground wood mill as possible, was installed. This included a new Low Consistency FibreSolve™ Pulping System with a single 130m3 Pulper...one of the largest in Europe. To handle the high debris load in the OCC furnish Andritz also supplied two (2) Fiber Guard™ Detrashers along with dedicated FibreWash™ Drums (trommel screens)

Figure 3: The new Andritz FiberSolve™

Low Consistency Pulper includes a Ragger for removing wires and plastics

Following the Pulping System, a High Density Cleaner System was added to remove debris such as staples and other contaminants and to provide protection to downstream equipment. HD Cleaner system accepts, at 3-4% consistency,is sent to the Dump Chest.

From the Dump Chest OCC stock is sent to a 3 stage Coarse Screening System where additional coarse debris is removed. The Coarse Screening system was specifically designed to re-use existing Screens (from the ground wood mill) retrofitted with slotted Rejector™ baskets and low energy / high efficiency Dolphin™ rotors.

The coarse Screening loop: OCC systems have high debris loading .Mills are converting from screen baskets with holes to baskets with slots to increase removal efficiency. Early coarse screen baskets drilled holes 0.070inch (1.8mm) depending on the furnish. These baskets were good for removing large and coarse debris, but poor for removing smaller debris and stickies.Thisincreases the burden of higher debris levels in the incoming feed to downstream equipment ,which is being tasked with achieving excellent removal efficiencies with very little fiber loss. Screen baskets with slot 0.016inch (0.40mm) have been utilized (figure 4).However, these slots typically have the same Wire/Profile shape as those in fine screens ,even though the role of the coarse screen is primarily “barring screening” to protect downstream equipment ,as opposed to the “probability Screening” function of a fine screen.

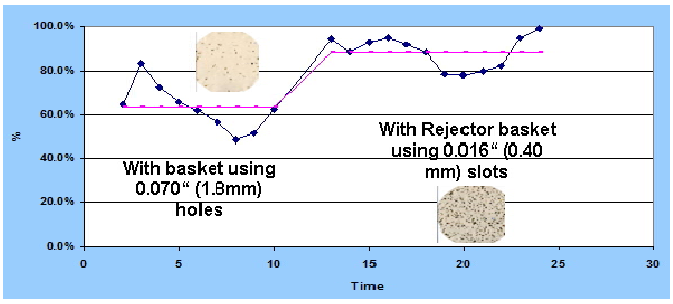

Figure 4: The primary benefit of converting from holes to slots in the coarse screen basket is to increase coarse debris and stickies removal early in the process to take the strain off downstream equipment. This graph illustrates the typical stickies reduction results from a hole to slot

Profile step height has strong influence on screening efficiency. Bar –Tec Rejector basket is the only basket in the market today with a wire profile for the Coarse Screening loop, that too with low energy requirements. (FIGURE 5)

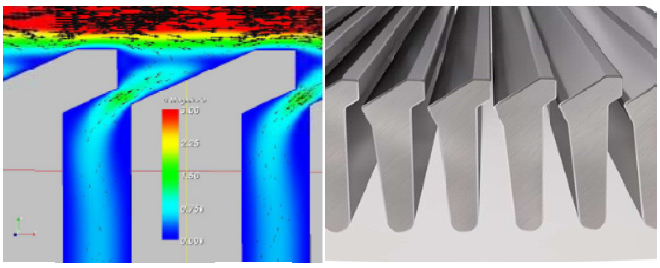

Figure 5: Flow analysis of ANDRITZ Bar-Tec Rejector wire. Cross-cut of a Bar-Tec Rejector profile

Increased angle of repose:Computational Fluid Dynamics (CFD)analyses were performed to optimize the Rejector’s turbulence and passing velocities. Conventional wire profiles require debris to make a 90°turn in order to be accepted. The Rejector requires the debris to make a 120° turn-a more difficult path for the debris to take.There is also a unique channel that greatly improves debris removal and improves basket life.

Reduced energy to clean the slots: Conventional Wire profiles, upon completion of the negative rotor pulse to clean the basket, draw the accepted stock /water back through the basket in a flow that is perpendicular to the feed pulp stream.This increases energy consumption.The back flush flow in the Rejectoris in the direction of the rotor rotation improving the negative pulse effectiveness and minimizing energy consumption.

Increased Area of Chrome:TheRejector wire has significantly more land area (the top of the wire) for the addition of chrome, which increases basket life.

Smaller slots for stickies removal: Although the Coarse Screening loop is typically not the place where stickiesareremoved, the slot size, profile height and angle of repose of the Rejector allow for substantial stickies removal .With fewer stickies in the accept pulp, there will be reduced stickies in the accept pulp, there will be reduced stickies in the feed to the fine screens. (FIGURE 6)

Basket	Drilled baskets 0.051” (1.3mm) holeProfiled	Rejector Slot 0.020” (0.4mm)
Rotor	S Type-3 vanes	LR Drum
Tip speed	23.2 m/s	23.2 m/s
Capacity per screen	~ 227 t/d	~ 417 t/d
Diff. Pressure (psi)	3.5-4.0	2.7
Power Consumption	60-63%	54% on 200HP
Consistencyfeed accept	2.5 % 2.4 %	2.5 % 2.3 %
Debris Removal %	42%	69 %
Screens Required	3	2
Power Savings	NONE	Shut down a 200HP motor~ $ 60,000 / yr
F-A Freeness Drop	Normal 50-80 ml	NONE

Figure 6: Lineboard Results. This mill replaced the OEM wear components in three screens with the Bar-Tec Rejector basket and an optimised rotor design. This increased the capacity so dramatically that the mill was able to shut down one screen. Note the debris removal increases and power decrease.

Improved energy efficiency

The DRUM 450Dolphin rotor is specifically engineered for coarse screening .It is a closed design that is ideal for eliminating fiber hang-ups.This DRUM 450 Dolphin rotor is specifically designed for maximum capacity as the arrangement of its foils prevents debris from being trapped between the rotor and the basket (Fig.7).

It has been documented that the DRUM 450Dolphin rotor can achieve 15-30%energy savings compared to a conventional foil rotor. This is mainly accomplished due to the creation of optimal pressure pulses, allowing the rotor to operate at lower tip speeds.

The foils on the DRUM 450 Dolphin body are streamlined to minimize drag and the “pumping effect “that disturbs stock flow inside the screen. The folis also create a strong negative pulse for effective cleaning of the screen basket, which minimizes plugging even with highly contaminated furnishes. The foils themselves are individually replaceable to reduce maintenance costs. (FIGURE7).

Figure 7: DRUM 450 Dolphin rotor for coarse screening. The rotor creates optimal pressure pulses (positive pulse for debris removal efficiency and negative pulse for cleaning to minimize plugging

The last stage in the Coarse Screening system is a combination TD Screen which provides screening, de-flaking and separation / thickening of the plastics while minimizing fiber loss.

Figure 8: ANDRITZModuscreen TD

Coarse Screen accepts are sent to a full-flow Forward Cleaning System which removes sand and other debris, provides protection for the Fractionating Screens, and utilizes 5 stages to minimize good fiber loss.

Cleaner System accepts are routed to the Fractionating (slotted) Screening System which provides an effective way of separating the Long Fiber, which contains stickies and therefore require additional treatment, from the clean Short Fiber which can go directly to the Short Fiber Disc Filter(s) and on to the Approach Flow system. The Fractionating Screening System also utilized existing Screens retrofitted with high-efficiency Bar-Tec™ Baskets and low-energy Dolphin™ rotors.

The 4 Stage Long Fiber Fine Screening System includes some existing Screens complimented by new but all containing Bar-Tec™ slotted Baskets and Dolphin Rotors for high sticky removal efficiency, low energy consumption, and low fiber loss, with accepts going to a rebuilt Disc Filter.

Rejects from the various unit operations are collected in Sand Separators and other material handling equipment and removed from the system .

Before approach flow ,refining is one of most important stage in the paper making process.It has been demonstrated that the strength properties of recycled fibers when suitably treated could potentially act as a substitute for virgin pulps.The study and observations of gentler (low intensity)refining with variables like specific edge loads and Net Energy inputs are key factors for product properties. Optimizing Tensile strength via refining minimizes need for starch, etcSplined shaft (Twinflo refiner model) insures "free-float" of disc, simplifies operation and minimizes maintenance

LeMaxx Spiral™ Refiner Plates for maximum strength development at minimal specific energy consumption.

Controls package included for Controls Packages for Specific Energy, Plate Clash Protection, Bearing Monitoring, and Vibration

Figure 9: TwinFlo™ Low Consistency Refiners

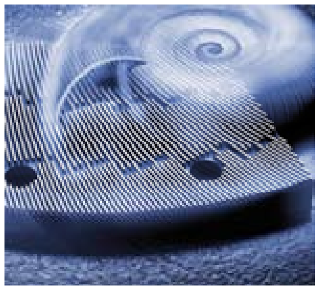

Figure 10: LeMaxx Spiral™ Refiner Plates

The Approach Flow System:

Two (2) new, inward-flow, low pulsation Head box Screens were added for the Base Ply. The existing Deculator™, which is now used for dilution water only, was rebuilt and converted from full-flow to partial deaeration.

Figure 11: AndritzModuScreen Approach Flow Screens

Paper Machine Conversion:

A PrimeFlow TW double-layer head box with Prime Profiler F consistency profiling system was installed on the wet end, with it's stiff separating lamellas separating the layers and allowing for optimum profiles and flexibility over the full grade range.

The new Prime Form TW gap former with specially-designed suction roll surfaces and forming shoes on both sides of the sheet provides high dewatering capacity and gentle dewatering at the same time and insures high first-pass retention.

Figure 12: Heinzel Group PM10

In the first drying section PrimeFlow Evo web stabilizers, with step-by-step reduction of vacuum in the free draw, are used to control and improve runnability after the press section.

In addition, PrimeRun Duo web stabilizers were used in the pre-drying section and new after-drying section to enable an even web run throughout the dryer section.

PrimeDry steel cylinders were used (instead of conventional cast iron) due to better drying performance to allow increased production or energy savings.

A new air system, including heat recovery for the rebuilt dryer section, was supplied to optimize energy costs and a new PrimeFilm film press applies starch simultaneously to both sides of the sheet for strength at speeds up to 1,600 m/min.

A PrimeAir Glide AirTurnand PrimeFeeder sheet transfer system ensure gentle turning as well as safe and rapid transfer of the web through the machine.

System Start-up:

This was a project that posed several challenges to all:

- Extremely aggressive time schedule: Less than 12 months from decision to start-up and the actual conversion at the mill site in 10 weeks or less
- All work on PM 10 to be completed while not interrupting the operation of PM 11
- Re-use as much existing equipment as possible

The above was accomplished using a dedicated project team including a skilled labor force that ranged from 600-800 workers on-site at any one time. The start-up curve, through 2017, is shown in Fig. 13. You can see that we were ahead of Target Production virtually every quarter and that has continued to-date.

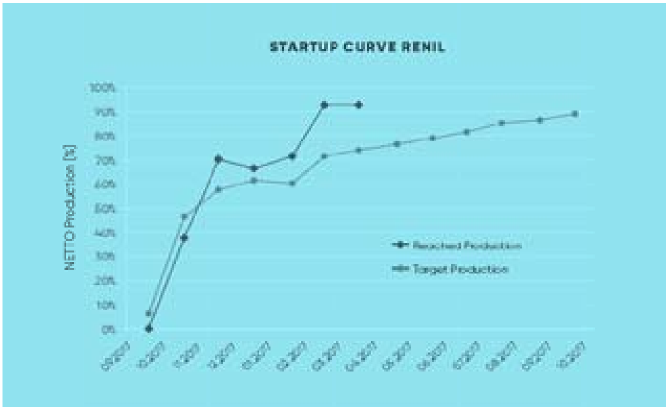

Figure 13: Start-up Curve

Summary:

In an age where paper companies are continuously challenged by a changing marketplace the decision as to whether to idle an existing machine or spend additional capital to convert can be daunting.

The Heinzel Group met this challenge in their Laakirchen, Austria mill with the conversion of their PM 10 machine from Graphical Paper to Packaging grades and together with Andritz, their single source supplier for the OCC System, Approach Flow System, and the paper machine conversion, this project was a success by any metric(s).

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