



# Kruger's PM 4 at Wayagamack Meeting Expectations After Fast, Flawless Startup

PM 4 prior to startup.

By KEN PATRICK, EDITORIAL DIRECTOR;  
JACK O'BRIEN, EDITOR IN CHIEF;  
MICHAEL O'BRIEN, PUBLISHER

## New machine with online film coater and supercalendering is producing high quality LWC and ultra LWC grades for the growing lightweight publication papers market.

Kruger recently brought one of the world's most technically advanced LWC paper machines on stream at its Wayagamack mill in Trois Rivières, PQ, Canada. The new, 8-m-wide, 1,500-m/min PM 4 began producing saleable coated product within a few days of startup, employing an online film coater and supercalendering system to deliver 200,000 mtpy of high quality LWC and ultra LWC papers (41 - 60 g/m<sup>2</sup>) to customers in North America and the world.

Startup of PM 4 vaults Kruger into the position of second largest producer of ultra lightweight grades in North America, behind International Paper Co. The privately-held company now has more than 830,000 mtpy of coated and specialty papers capacity, including the LWC, ultra LWC, supercalendered, and directory grades made at its mills in Wayagamack, Trois Rivières, and Manistique, Mich.

The other members of Kruger's Publications Paper Division, the Bromptonville, PQ, and Corner Brook, New Foundland, mills, manufacture newsprint. Altogether, Kruger produces some 2 million mtpy of paper and board

and tissue with its 43 machines at mills around the world.

PM 4 incorporates the most current paper machine design and engineering concepts, supported by a state-of-the-art control system that firmly positions Wayagamack as a leader in the global LWC arena, not only in terms of quality and performance but overall cost competitiveness as well. The lightweight grades being produced on the new No. 4 machine will compete primarily with No. 5 LWC in the publication papers market.

The PM 4 project (known as *Relance 2002*) cost approximately C\$400 million. Some C\$320 million went for the Metso OptiConcept paper machine and supporting infrastructure, and about C\$80 million was used for improvements in other areas of the mill.

At the Wayagamack mill during startup the last week of October 2003, PaperAge met with Daniel Archambault, general manager, to discuss the new machine's design and operating strategies as well as Kruger's marketing vision and plans for the LWC and ultra LWC papers it produces. Archambault describes the startup as extremely smooth, fast, on budget, and on schedule.



Visiting Kruger's Wayagamack mill during startup week in late October are PaperAge Staffers (L-R) Ken Patrick, Jack O'Brien, and Mike O'Brien (far right), along with Daniel Archambault, general manager at the mill (second from right).

### Fast Startup Curve

After commissioning and testing of the machine's various sections were completed during the final week of October, a sheet was on the reel by that Saturday. A few more days were needed to set the machine and close the coater, after which the first saleable production reached the winder November 7.

"The startup curve was very fast," Archambault notes. "Our approach to this project involved close teamwork—Kruger teams daily met with Metso and other supplier teams. Every functionality was tested before we tried to make paper. If it was there and programmed, it was tested and linked prior to startup. It was the most intense and detailed preparation I've been involved with during my 25 years in the industry."

In addition to the new PM 4, the project included a screen room upgrade and construction of a sodium hydrosulfite bleach plant for the groundwood plant. New presses were installed for white water management, and the water system for the mill's other two machines was rebuilt. The kraft pulp mill was upgraded with new process controls.

### PM 4 Products and Markets

Archambault notes that Kruger has been producing LWC papers since it purchased the Donohue mill at Trois Rivières in the early 1970s. "We have some 30 years of experience as a coated paper supplier in North America and Europe," he says, adding that "until the recent startup of PM 4 at Wayagamack, we were a relatively small player, with 145,000–160,000 mtpy of capacity in a total market of around 5 million mtpy."

### KRUGER'S WAYAGAMACK MILL

In partnership with SGF Rexfor, Kruger acquired the Wayagamack mill from Abitibi-Consolidated in May 2001. With a current production capacity (including PM 4) of 334,000 mtpy, Wayagamack is a member of Kruger's Publications Papers Unit, which also includes company mills at Trois Rivières (665,000 mtpy) and Bromptonville (440,000 mtpy) in Quebec and the Corner Brook, New Foundland, mill (429,000 mtpy), as well as the Manistique Papers mill (133,000 mtpy) mill in Manistique, Mich.

Located on the St. Lawrence River some 150 km northeast of Montreal, the Wayagamack mill operates three paper machines, including the new PM 4:

- **PM 2** (60,000 mtpy) 3.8-m-wide, hybrid twin wire swing machine producing directory or supercalendered papers (four soft nip calenders), SC-B and soft roll calendered grades (37 – 52 g/m<sup>2</sup>), 25 gloss, 59 – 72 ISO, 840 m/min, rebuilt 2002.
- **PM 3** (74,000 mtpy) 5.4-m-wide gap former, standard directory papers (32 – 36 g/m<sup>2</sup>), 59 – 65 ISO, 950 m/min, rebuilt 2002.
- **PM 4** (200,000 mtpy) 8-m-wide OptiConcept gap former, LWC and ultra LWC papers (41 -60 g/m<sup>2</sup>), 70 – 72 ISO, online film coating and supercalendering, 1,500 m/min, started up late-October 2003.

Fiber supply (100% softwood):

- **Groundwood** (147,000 mtpy) 12 grinders, automated loading, new screen room, new sodium hydrosulfite bleach plant, 67 – 69 ISO brightness.
- **Chemical (kraft)** (99,750 mtpy) Continuous digester, ECF bleach plant, 82 – 83 ISO brightness, recovery boiler with ESP/wet scrubber.
- **TMP and deinked** (imported from other Kruger mills).

The Wayagamack mill has 600 employees. Some 125 new jobs created by the startup of PM 4 and other modernization/expansion projects at the mill.

When Kruger made the decision to produce coated papers at Wayagamack, "we were looking for a market niche where we had expertise and experience, and also one with some significant growth opportunity," Archambault continues. We firmly believe that the new technology we selected for PM 4 will allow us to be a very strong competitor in this market, in terms of both quality and cost.



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— Daniel Archambault

“We are not making average LWC and ultra LWC grades on PM 4. Our products on this machine are at the very top of the spectrum. PM 4 is the first new machine in North America to make these grades using online film coating and calendering,” Archambault points out.

PM 4 produces the company’s Krukote grade for offset applications, with an ISO brightness of 70 – 72. Archambault says that the mill is also considering the future production of high brightness grades in the 76 – 77 ISO range.

PM 4’s Krukote grades are targeted at the magazine and catalog markets, as well as inserts and other publication applications. “We are confident that there is a strong and growing demand for these neutral light weights, driven in particular by postage rates that have skyrocketed in the past 10 years, and are continuing to increase,” he says.

“We intend to compete head-on with No. 5 LWC, and be a low cost producer in the top five worldwide. We are aiming for the large, long-run, low basis weight customers with PM 4 at Wayagamack, and the smaller runs, higher basis weight customers at the Trois Rivières mill.”

According to Archambault, market studies show the demand for these grades growing at 1% - 2% per year, which represents a new machine with PM 4 capacity every two years. He emphasizes that PM 4 is designed specifically for the neutral lightweights and that it will be operated to “stay down” in those ranges, around a design average of 51 g/m<sup>2</sup>.

Compared with SC-A and SC-A+ or SC-A++, the ultra LWC being produced on PM 4 has considerably higher gloss, opacity, etc., and much better overall printing properties, Archambault explains. “The print gloss or snap is much better with PM 4 grades. There has been some migration into the No. 5 LWC market as SC technologies have evolved, but there is still a distinct difference between SC grades and the premium, fully coated grades made on PM 4.”

## **Mechanical and Chemical Fiberlines**

The mill processes 100% softwood (mainly spruce) in both its mechanical and softwood pulp mills. Depending on basis weight, 20% - 30% kraft is blended into the furnish for PM 4.

Kraft pulp is cooked in an existing Kamyr continuous digester and sent to a new bleach plant that was converted by Stone Consolidated to an ECF (DoEOPD) sequence in 1997. The mill is currently producing about 285 mtpd of bleached kraft pulp (82 – 83 ISO brightness), most of which it uses internally, with any excess being shipped as semi-bleached wet lap to the company’s nearby Trois Rivières mill.

The groundwood mill has a total of 12 grinders (six chain and six hydraulic) with a combined capacity of 450 mtpd. All of the grinders were rebuilt and new automation was installed. A new sodium hydrosulfite bleach plant was built for the groundwood fiberline, constructed from some of the towers and equipment in the old chemical pulp bleach plant. The resulting upflow/downflow arrangement bleaches the groundwood pulp to 67 – 69 ISO.

Archambault notes that the rebuilt bleaching operations easily provide the final 70 – 72 ISO range needed for No. 5 LWC and ultra LWC grades. “If we wanted to go to higher brightness, we probably would add some peroxide bleaching capacity in the groundwood plant. But right now, it’s not needed. Our raw material purchasing strategy provides very fresh wood year-round. The spruce and jack pine used in our processes have an average natural brightness of 61 – 62 ISO.”

Dual Metso pressurized MUST screens installed as part of the Relance project have “dramatically improved pulp quality and strength,” Archambault reports. Rejects from this stage go to a rejects refining system that was upgraded to have 15,000 hp of total refining capacity.

Bleached and refined groundwood pulp is sent to a new double-wire dewatering press, from which two separate streams emerge. One feeds PM 4 and the other feeds PM 2 and PM 3.

During the past two years, the mill has begun adding 10% - 40% deinked pulp (imported from the Bromptonville mill) in the directory grade furnish for PM 3, and is in the process of replacing some of PM 3’s groundwood/kraft furnish with TMP also imported from Bromptonville. This will free up groundwood and kraft

fiber for use in PM 4 (and for export to the Trois Rivières mill).

### White Water/Stock Prep

At the groundwood double-wire dewatering press, an effective seal (or “wall”) is created between the mill’s pH neutral and acid white water systems. For practical reasons, Archambault says the mill kept its existing paper machine systems acid, while bringing PM 4 neutral by adding ground calcium carbonate (GCC) as a wet end filler.

From one side of the double-wire press, stock at 35% consistency is diluted with the neutralized white water from PM 4 and sent to a storage tank. Naturally acidic groundwood pulp from the other side of the dewatering press is stored for use on the Nos. 2 and 3 paper machines.

Along with mixed broke as a sweetener stock, the kraft and groundwood furnishes go to the mixing chest and are then sent by an Andritz fan pump into the machine chest ahead of a five-stage Andritz centrifugal cleaner/deaerator unit. A secondary fan pump delivers the deaerated stock to a Metso three-stage screening system and into the OptiFlo headbox, with dilution control.

Depending on basis weight and specific grades being made, 6% - 8% GCC, supplied by Omya, is added at the wet end. Due to the lightweight grades being made on PM 4, addition of minerals at these and particularly higher levels could affect critical strength of the base sheet. “This is where the online film coating and calendering technology play a key role,” Archambault says.

“Prior to the last dryer on the machine, there’s no open draw on PM 4,” he explains. “So by the time the sheet encounters its first open draw, it’s dry. The film coater that follows provides very ‘gentle coating,’ compared with, say, a blade or jet coater. The online supercalender is equally important in this regard, compared with conventional calendering.”

The computer control functions and quality systems of the new machine are respectively provided by Metso Automation’s DNA and QCS technologies. Gauging (measurements only) is handled by Honeywell-Measurex’s da Vinci systems. Stand-alone and paper machine variable speed AC drives were provided by ABB, who also supplied the web inspection system.

### Wet End Operations

The forming section of the 161.6-m-long PM 4 consists of an OptiFlo hydraulic headbox and an OptiFormer forming section, controlled by Metso Automation’s IQHeadbox,



To attain the narrow control and uniform basis weight profile needed, a total of 129 intelligent actuators are spaced 60 mm apart across the OptiFlo headbox, which is also equipped with an automatic cleaning sequence for washing valves (one group at a time) when stock is taken off of the wire.

IQDilution, and IQWeight MD software packages.

Since startup, the OptiFlo headbox has been providing a very uniform CD stock profile distribution, Archambault reports, as well as efficient deflocculation of fibers. It is equipped with EdgeFlow controls to compensate for friction at the wall surfaces and to provide uniform fiber alignment across the sheet.

The forming zone contains a forming roll, a two-zone multi-foil shoe, and a loading blade unit. Following the forming zone are a suction box, a high wrapped couch roll, and a high vacuum suction box. By closing the separate sections inside the machine as much as possible, water splashing and misting are minimized. This prevents mist from spreading into the machine room and, keeps air amounts required for ventilation at a reasonable level.

The vacuum pump system on the wet end was supplied by Nash. Wet end variables are monitored with Metso’s KajaaniRMi and KajaaniCATi. Fines and filler retention are calculated from this information. All process pumps were provided by ITT Industries.

### Press Section

The PM 4 press section is made up of a Metso SymPress B followed by a SymBelt shoe press in the third nip position. The first press nip is double felted to minimize web flutter. The SymPress B consists of a SymZS press roll and SymZLC center roll, which are hydraulic deflection compensation mating rolls. A Metso/VIB steam box is located against the press suction roll, with IQMositureCD handling CD moisture control.

The SymBelt shoe press mates against the SymZLC center press roll, which contains a non-rotating shaft that carries the nip load. The shell features special hydrostatic



The three-nip SymPress B press section includes a SymBelt shoe press in the third nip. The section is equipped with a steam box located against the press suction roll and an IQMositure CD control package.

loading elements that support the shell in the direction of both nips, maintaining shell straightness regardless of load level.

In the SymBelt press, a hydrostatic shoe is hydraulically loaded against the center press roll. The SymBelt roll is covered with a grooved rotating belt. Oil is injected into a hydrostatic pocket between the belt and the shoe to prevent mechanical contact, reduce power consumption, and extend belt life. All press nips and pickup rolls have savealls that are ventilated to eliminate moisture and misting in the press section.

### Dryer Section

The single-tier SymRun dryer section has 26 dryer cylinders on top and 25 vacuum rolls on the bottom, divided into five drive groups. The last vacuum roll in each group is driven by a shaft mounted speed reducer. DRG-type gears mounted outside the bearing housings drive the last two drying cylinders in each group.

Sheet support between the dryer cylinders and vacuum roll is provided by SymRun HS blow boxes that create vacuum by the Coanda effect. This creates a non-contact seal that eliminates fabric wear.

Stationary siphons are mounted on the dryer cylinder bearing housings or the drive gear casings. The steam joints are equipped with flanges for connecting them to the steam and condensate system. All dryer cylinders (except the first, second and last) are equipped with dryer bars.

### Coating Operations

The single-nip, OptiHard Slim Line pre-calender system on PM 4 provides an even thickness profile and smooth surface finish on the base sheet prior to coating. It has a 36-

metric-ton, water-heated Thermo roll and a SymCDS/HP self-loading, deflection compensated roll.

The SymCDS/HP roll is comprised of a stationary shaft, a shell with bearing arrangements on the shaft, and loading elements. A design feature of this unit permits closing and loading of the nip with shell movement while the roll shaft is locked into place. This allows very accurate correction of local caliper profile variations.

A Metso IQCalCD control package adjusts CD caliper profile by varying pressure in each loading element of the counter zone in the roll. A Honeywell-Measurex da Vinci scanner before the pre-calender can gauge grammage, moisture, dry weight, ash, opacity, color, and brightness.

The coating formulation for PM 4 includes GCC (Omya), kaolin clay (Imerys), and latex (Dow), along with other ingredients. The formulation is applied at 65% - 70% solids, which, according to Archambault, totally eliminates any orange peel, misting problems, etc.

The OptiCoater has separate applicator beams for simultaneous coating of both sides of the sheet. Each beam distributes coating color to a 10 – 35-mm, chrome-plated coating rod that rotates at 100 – 250 rpm, metering the film of coating color onto two polyurethane-covered applicator rolls whose hardness can be varied according to the specific grade being produced. Metso's IQCoatWeightCD software package manages the coat weight profile of the film transport station.



The online OptiCoater, designed for high speed production, uses film coating technology for superior paper surface properties. It is followed by a TurnDry air dryer and two rows of electrical infrared dryers. Coat weight profile of the film transport station is provided by IQCoatWeightCD.

Archambault points out that film coating closely follows the contours of the base paper, resulting in a very even coating thickness, compared with various blade coating techniques that scrape to a flat surface and create radically varying levels of thickness. Film coated papers thus provide a more consistent printing surface, compared with conventional coating concepts. "This is especially important for customers using lower basis weights," Archambault notes.

A Metso Paper TurnDry air dryer following the coater simultaneously turns and dries the sheet contact-free. This unit is equipped with powerful, high-density gas operated dryers that raise the air temperature to 350° C and generate 70 m/min air velocities. Two rows of Solaronics IRT electrical IR dryers follow the TurnDry unit. Moisture profile of the sheet is handled with an IQCoatedDryCDE software package.

The fully automated coating kitchen, supplied by Metso Paper, is located in the PM 4 building adjacent to the tending aisle. The control sector for the coating kitchen is located in the paper machine control room. The coating color mixer is fully automated and operates continuously on 30-min batch cycles.

### Supercalender/Reel/Winder

The 8-roll/7-nip OptiLoad calendering system consists of three Thermo rolls (heated up to 150°-160° C with oil), two multizone-controlled deflection compensated SymCD/HP rolls on the top and bottom positions, and three polymer rolls. Archambault notes that the calender can be run in a 2-nip or a 7-nip configuration, depending on specific grades being manufactured.

Nip pressures (70 and 450 kN/m) are controlled with individually-controlled loading elements. Tension is measured before and after the calender stack. In case of a sheet break (built-in web break detection unit), the nip can be opened quickly.

Consistent sheet gloss is maintained with an IQCalGlossCD software package that controls the SymCD roll loading elements using zone-specific control pressures. A Sensodec system controls the entire machine, including monitoring of the calender functions, oil monitoring, vibration, and dewatering measurements. A Honeywell-Measurex da Vinci scanning station after the supercalender gauges top and bottom sheet gloss, as well as brightness, color, opacity caliper, dry weight, moisture, and grammage, as requested.

Archambault points out that efficient tail threading was critical with the online coater and supercalender. The

calender has to be threaded at full line speed with the nips open so that the polymer roll covers are protected from the hot Thermo rolls and marking by the tail. The nips can be closed only after a stable, full-width web has been established at the reel.

The FoilForce approach combines conventional carrier rope threading with new vacuum foil threading conveyors.

The conveyors handle threading from the end of the dryers through the pre-calender to the film coater. Carrier ropes then take the tail through the coater, after-dryer, and supercalender. This threading approach, Archambault notes, has proved to be very smooth and was not a start-up issue at all.

The OptiReel Plus handles parent rolls up to 3,300 mm that weigh up to 82,600 kg. The reeling sequence is fully automated. Linear load is adjusted with hydraulic cylinders, peripheral force by the center drives, and web tension by the reel drum drive. MD web tension is controlled by an IQTensionlite system.

Winding of the paper rolls is handled by a fully automated Metso WinBelt L winder. The winder uses a rear drum, a belt bed, and an articulate rider roll. The winder runs automatically as long as there are new parent rolls ready at the unwind stand, requiring only one operator to supervise the process.

The slitter section is in a sublevel as a free standing module, which reduces the overall space required for the winder and results in a quieter operating floor. WindPosit positions the slitters and edge trim, which are checked with Metso TrimCheck optical and magnetic measurement tools.

Rolls are transferred to a slat conveyor, processed individually through a bar code stenciller, then conveyed to the existing, upgraded roll wrapping area. The roll handling system for PM 4 was also supplied by Metso Paper. Paper machine clothing is provided by Albany Canada, Weavexx, and AstenJohnson. ■



The 8-roll OptiLoad supercalender has three Thermo rolls, two multizone-controlled SymCD/HP rolls on the top and bottom positions, and three polymer rolls.