Sleeve roll technology

Transforming forming process

Why leave pressing only on Press section?

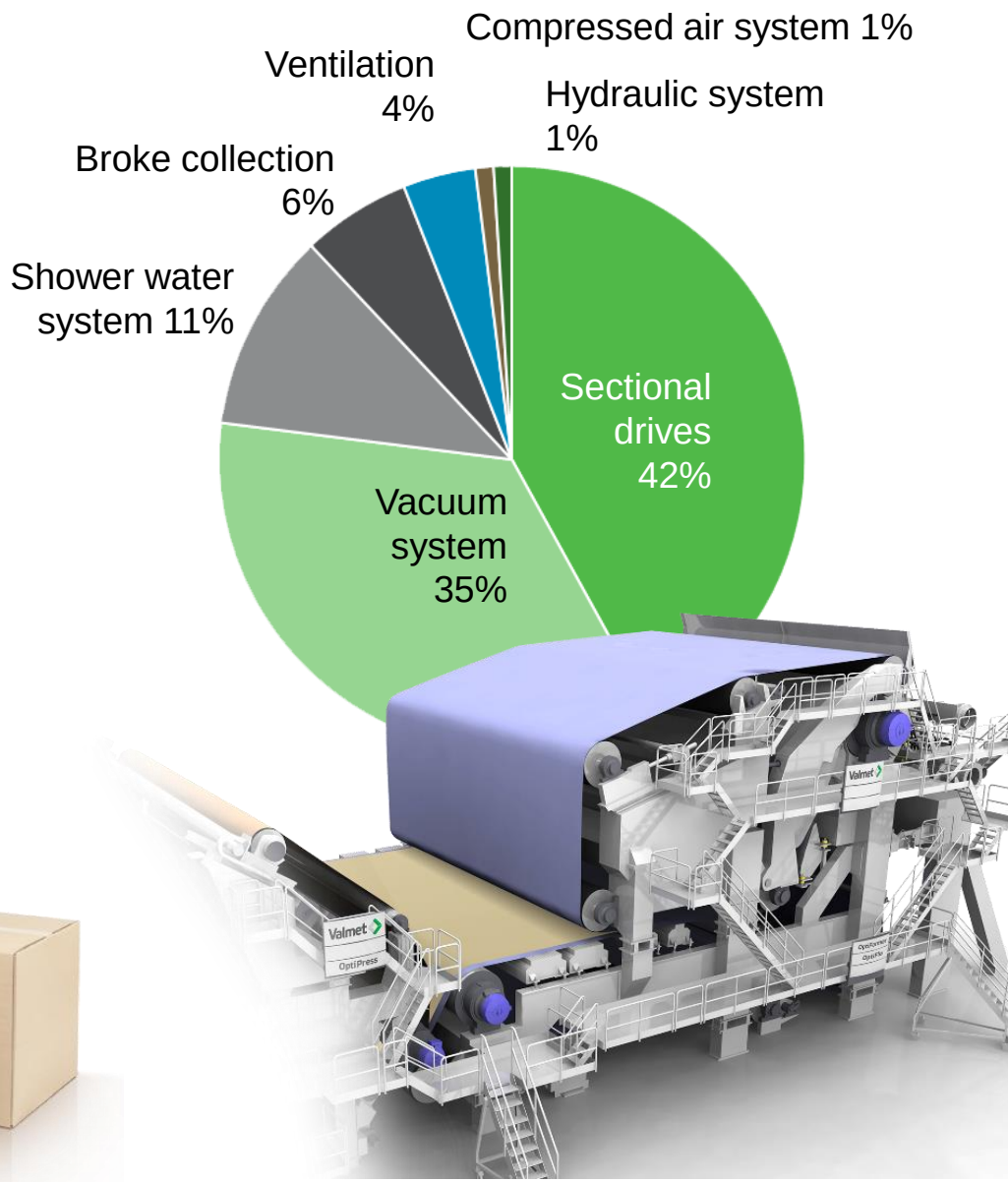
Sleeve roll dewatering principle

Conventional dewatering

Sleeve roll dewatering

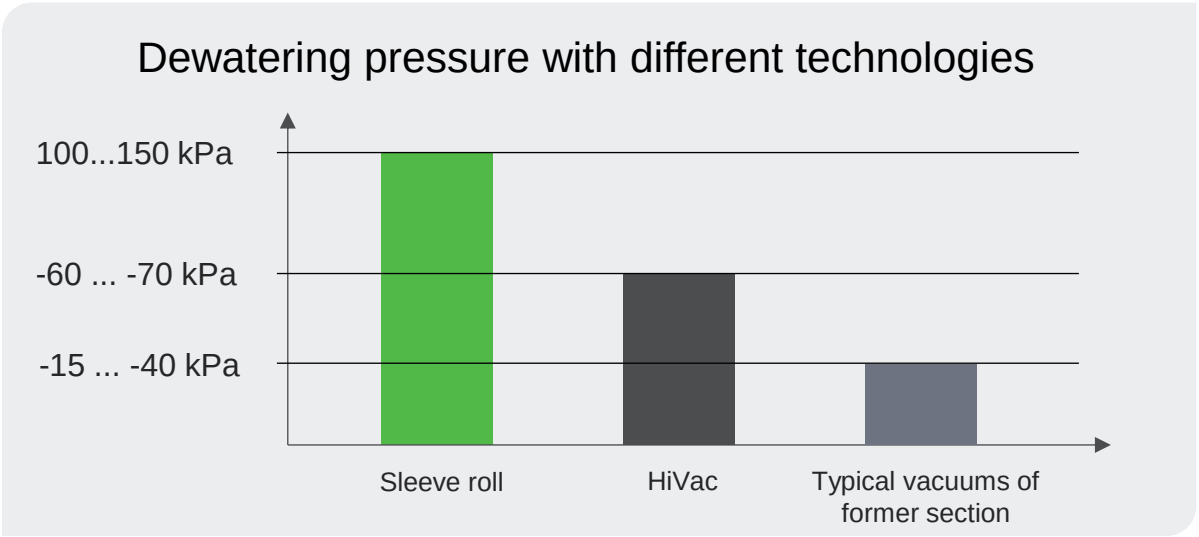
Improve sustainability with Sleeve roll technology

1. Stronger and lighter packages from less raw materials
2. Deteriorating fiber properties after multiple reuse cycles
3. Using less energy improves sustainable performance
   - Sectional drives & vacuum system constitute appr 80% of forming section energy usage
   - Reducing vacuum immediately reduces drive power because of less friction from stationary dewatering elements

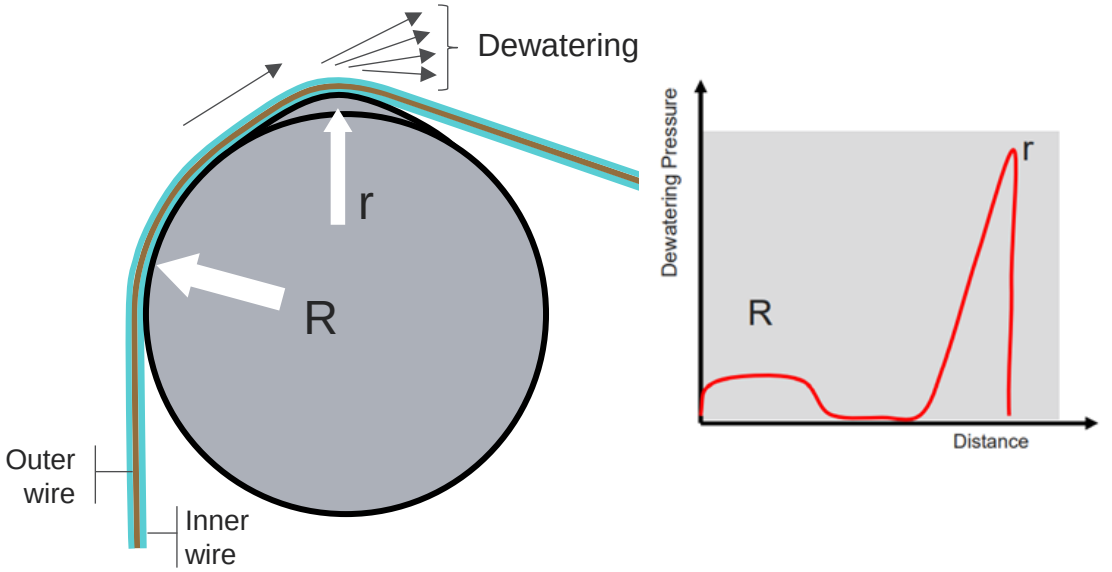


Forming section energy usage

Sleeve roll dewatering principle



- To create very high dewatering pressure between forming fabrics with small shoe radius
- Dewatering pressure is affected with
  - Outer wire tension
  - Shoe radius
  - Top dewatering pressure can be calculated with formula
    - P=T/R, where P=pressure, T=outer wire tension, R= smallest roll radius

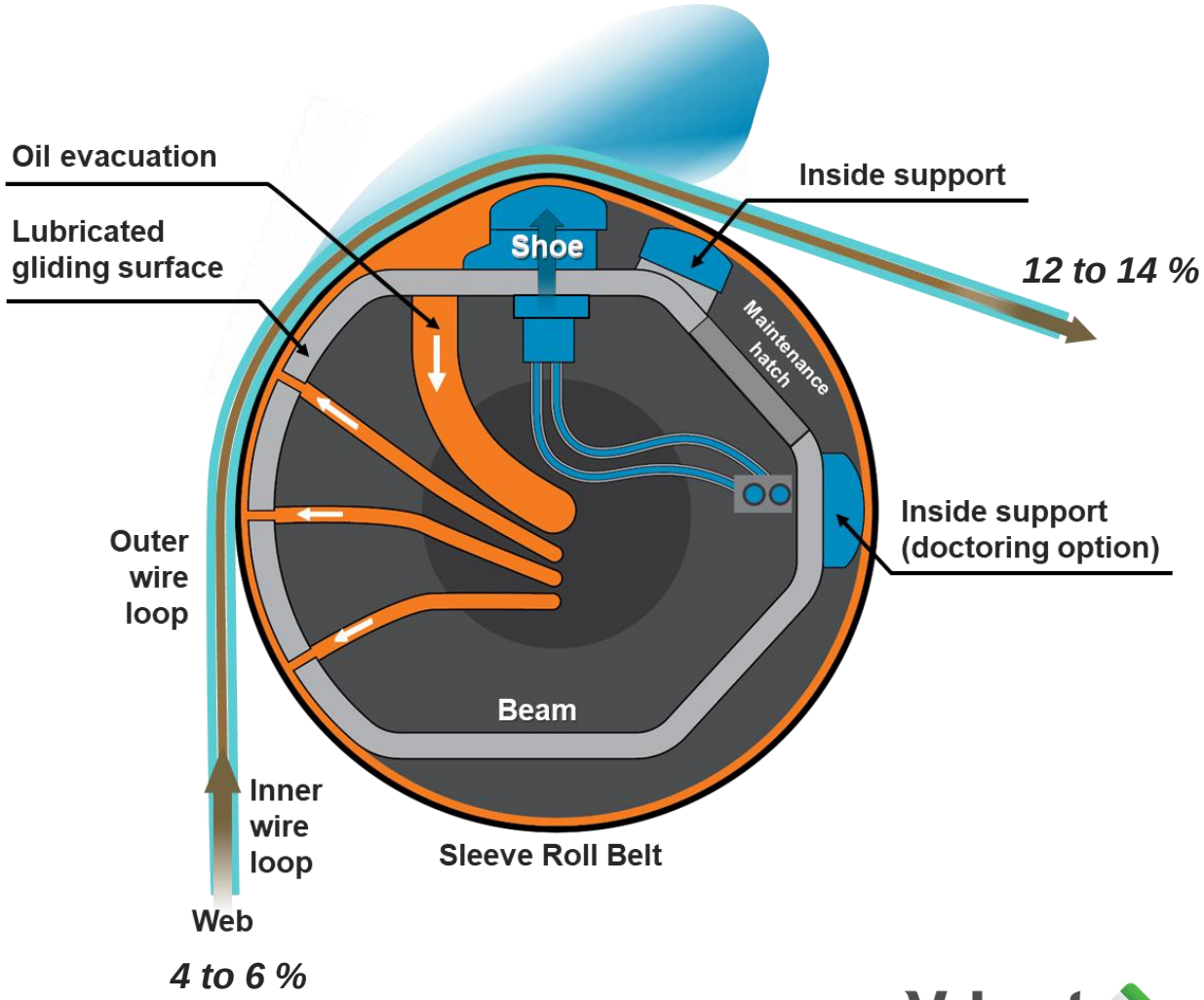


The direction of the Sleeve roll small radius shoe can vary

Sleeve roll operating principle

- Construction of Sleeve roll
  - Stationary beam
  - Small radius shoe
  - Rotating heads
  - Lubricated polyurethane belt rotating around

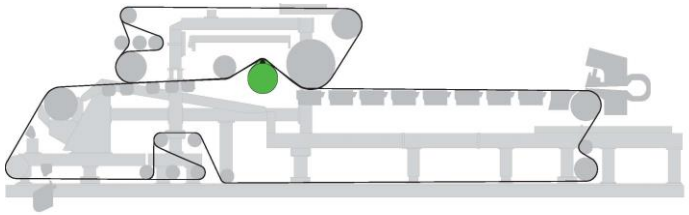
- Sleeve roll has a very high dewatering capacity
  - No need to use high pulsation to get water out of sheet
  - Water is sprayed out of the web and forming fabric and captured in a save all pan
- Ingoing consistency of Sleeve roll is 4-6% and outgoing consistency 12-14%



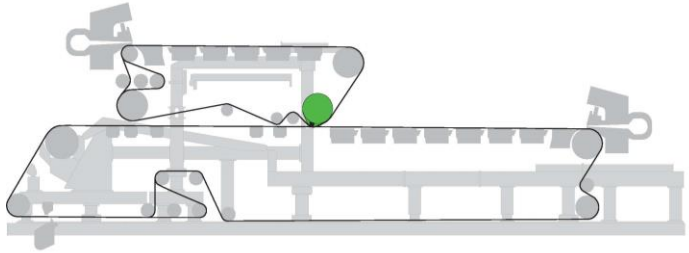
Dewatering with Sleeve roll technology

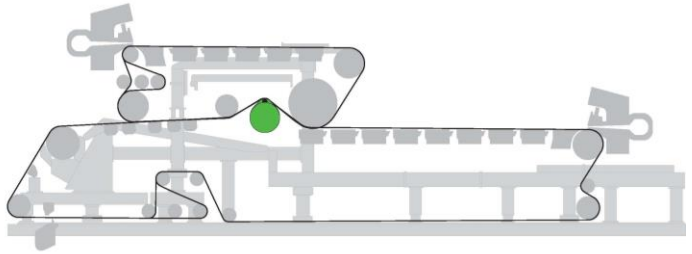
Sleeve roll applications tested in Pilot trials

Sleeve roll in Hybrid Former

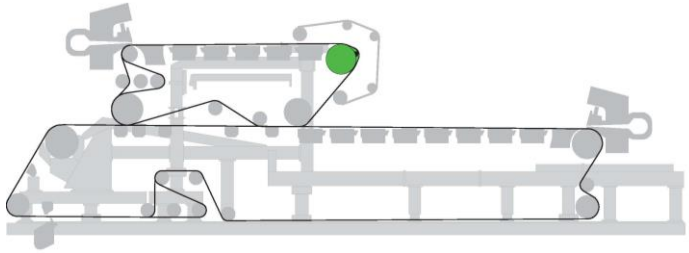


Sleeve roll in combining position

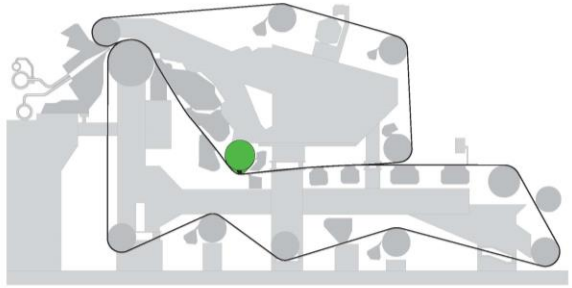


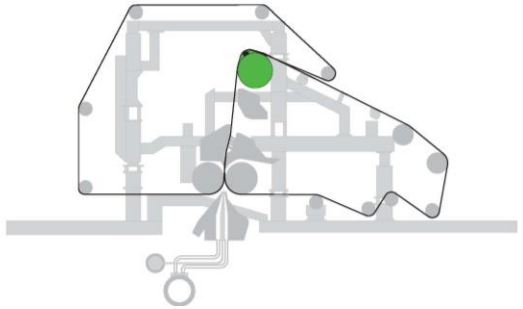


Sleeve roll in Multi fourdrinier



Sleeve roll in Gap Formers

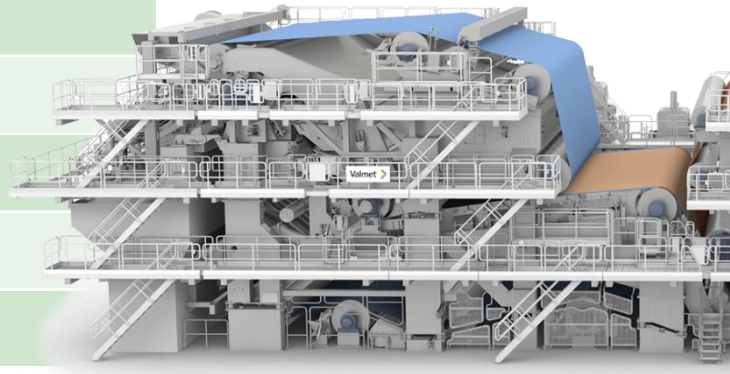


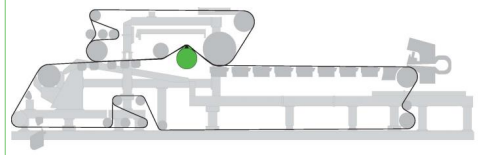


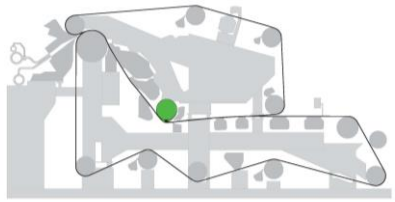
Comparison from pilot trials of Sleeve roll technology to conventional Former

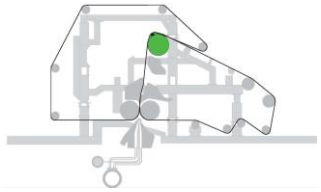
Without sizing, OCC

	Hybrid Former with Sleeve roll	Board Gap Former with Sleeve roll	Shoe & Blade Former with Sleeve roll
Energy saving	+++	++	++
Capacity	+++	++	++
Huygen	++	++	+
SCT CD	=/+	+	+
Burst	=	=	=
Density	+	+	+
Dryness	+	+	+







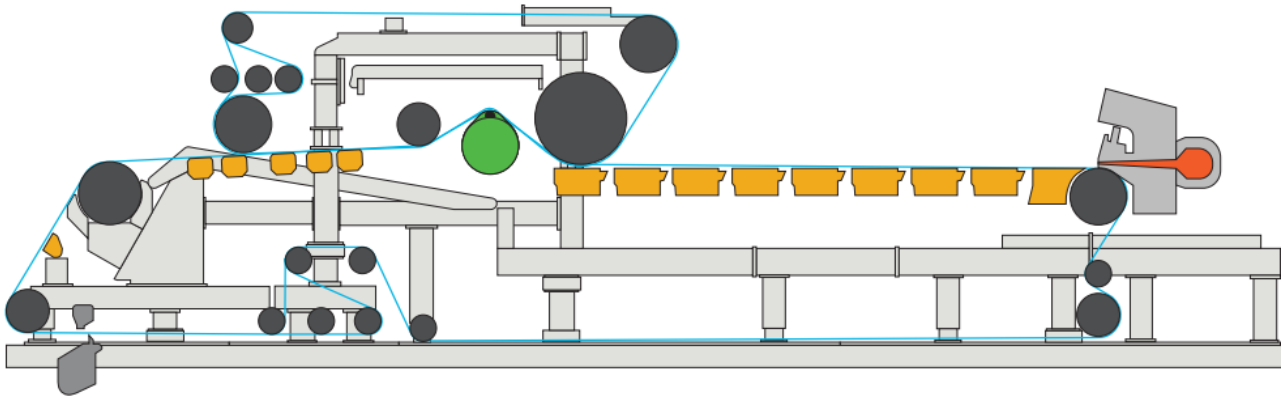


Hybrid Former with Sleeve roll technology

AJIN P&P, BM 3, first commercial installation started 4/2021

Hybrid Former rebuild	
Grade	Recycled fluting
Wire width	5,900 mm
Design speed	1,300 m/min
Basis weight	90 to 300 g/m²

Rebuild target to increase production and improve end-product quality

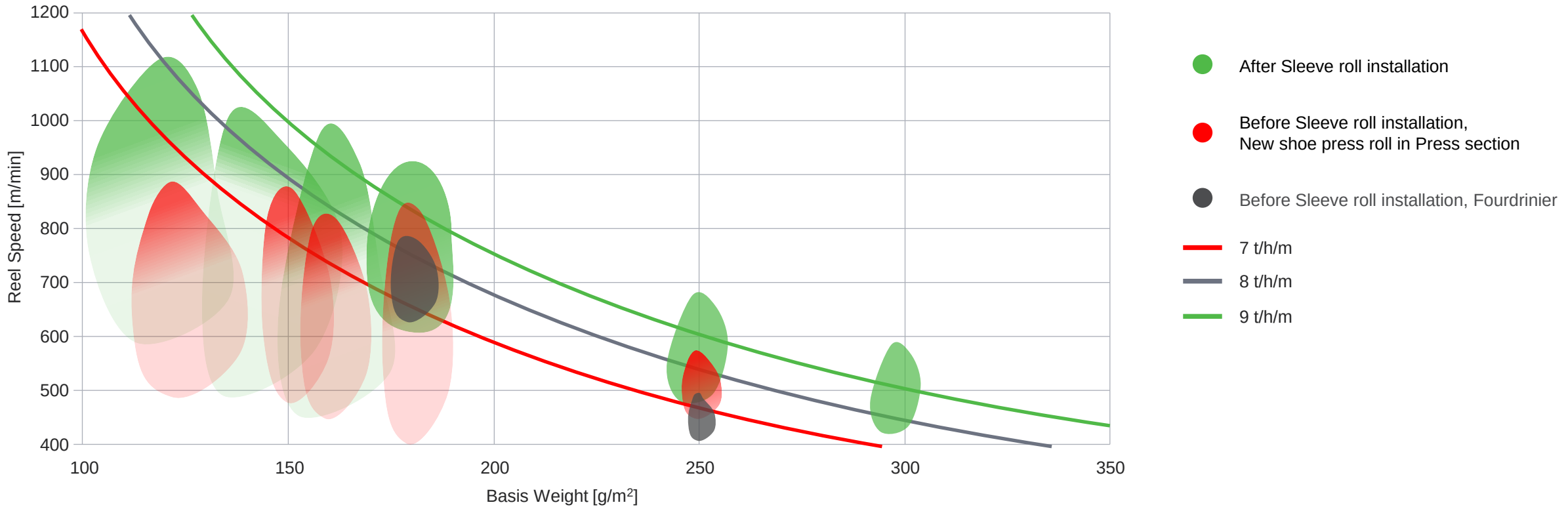


”The performance of all the newly installed equipment has exceeded our expectations by far, especially the energy-saving capability of the Sleeve roll. We are more than 100% satisfied.”

Jin-Doo Kim, *CEO, AJIN P&P*

Production capacity results from Ajin BM 3

Fluting Aasian OCC



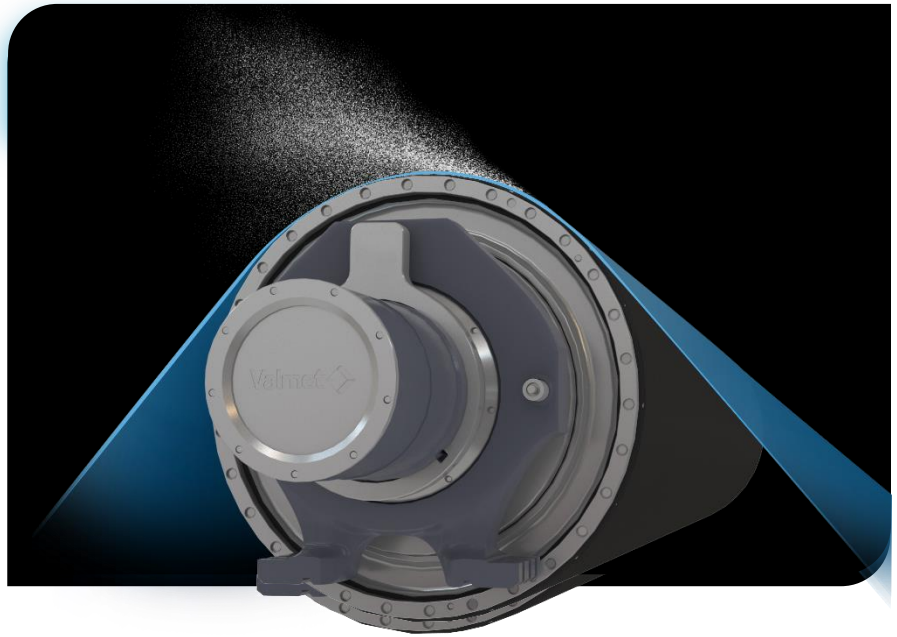
Production capacity increased 18%

Dryness results from Ajin BM 3

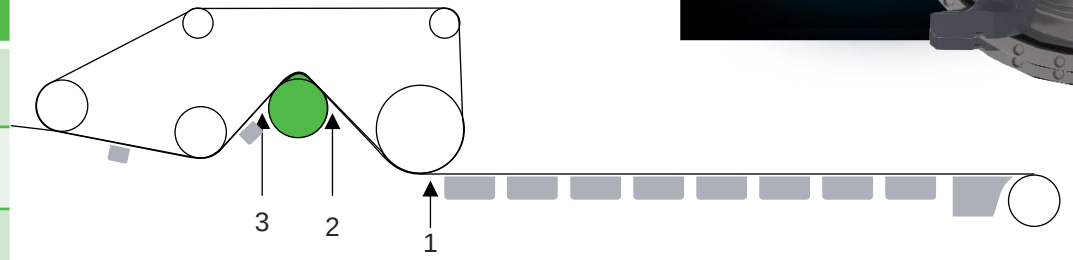
Hybrid former with Sleeve roll technology

- Outgoing dryness from Sleeve roll is constant high level **12 to 13,5%**
- On forming table before Sleeve roll and Forming roll is possible to use very **low vacuums**. Sleeve roll is **not sensitive for ingoing dryness**
- Outgoing dryness from forming section is high level **25 to 26 %**
- Possible to use higher headbox flow. Sleeve roll removes water very effectively from the web

"Headbox flow could be dramatically increased, almost by 60% " *- Jin-Doo Kim, CEO, AJIN P&P*



	(1) Before Forming roll	(2) Before Sleeve roll	(3) After Sleeve roll
120 g/m2	2,0 %	5,5 %	12,3 %
180 g/m2	3,0 %	6,5 %	13,0 %
250 g/m2	3,0 %	6,2 %	13,5 %

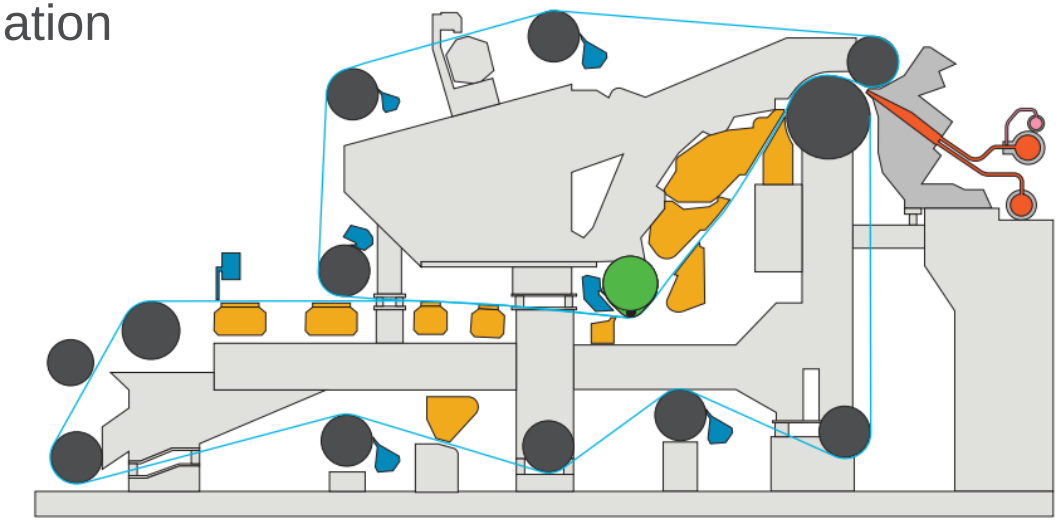


Outgoing dryness from Sleeve roll 12 to 13%

Board Gap Former with Sleeve roll technology

Papierfabrik Palm Aalen, PM 5, second commercial installation started 7/2021

New Board Gap Former	
Grade	Recycled fluting and liner
Wire width	11,700 mm
Design speed	2,000 m/min
Basis weight	60 to 110 g/m²

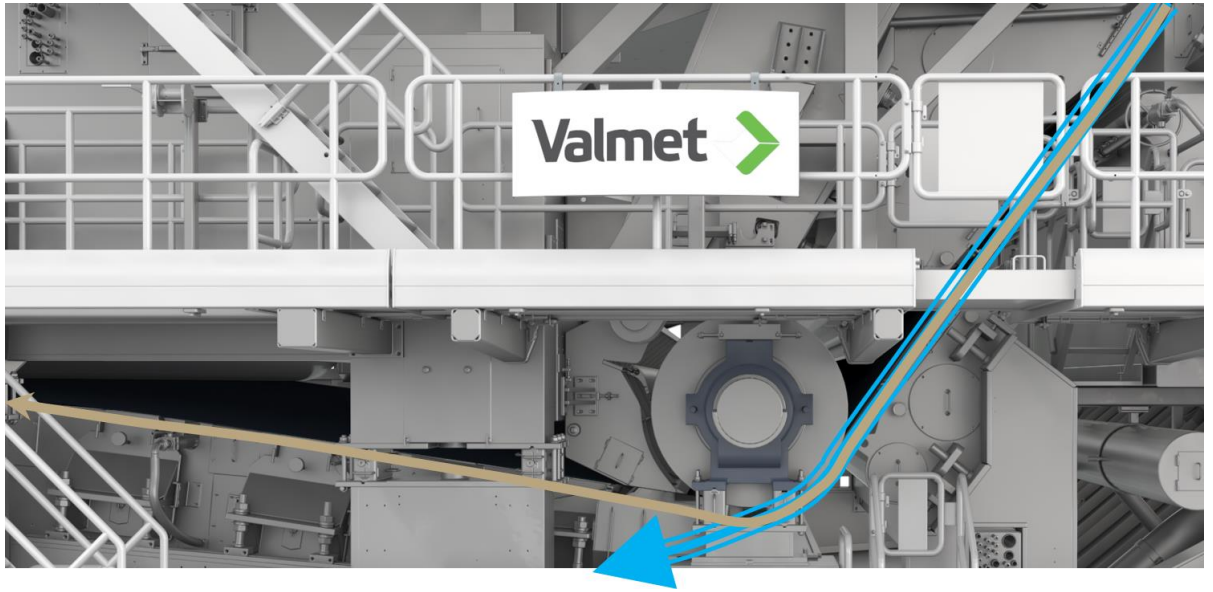


> One outstanding highlight is Valmet's Sleeve roll technology in the forming section, which enables high water removal capacity without using any vacuum. We have reached our dryness target already and we would absolutely install this unique technology again. ”
>
> ***Stephan Gruber,*** *Managing Director CTO, Papierfabrik Palm*

Energy saving results from Palm PM 5

Board Gap Former with Sleeve roll technology

- The dewatering of the forming section is effective and that is clearly visible in the power consumption of drives and vacuum pressure
- Forming section **energy saving from drive power is 10%** when there is no vacuum before the Sleeve roll
- Less CO2 emissions
- Compared to conventional forming section technologies **Sleeve roll dewatering down from corner roll is 100 to 140 l/s**, depending on former speed and web ingoing consistency to Sleeve roll. Normal plain roll does not remove any water in this position!



Energy savings from drives -10% | sustainable board making

Dryness results from Palm PM 5

Board Gap Former with Sleeve roll technology

- Mechanical pressure with wire tension **improving dryness and strength properties** of the web
- Outgoing dryness from Sleeve roll is **11 to 13%.** Sleeve roll is not sensitive for ingoing dryness
- With Sleeve roll technology it is possible to achieve **stable dryness in MD & CD direction**, which improves runnability
- Dryness after forming section is on **a high level, 22-24%** (no need for Couch Suction roll on forming section)
- Dryness after forming section with Sleeve roll technology, that enables less vacuums on the forming section, is on the same level than with conventional technologies.

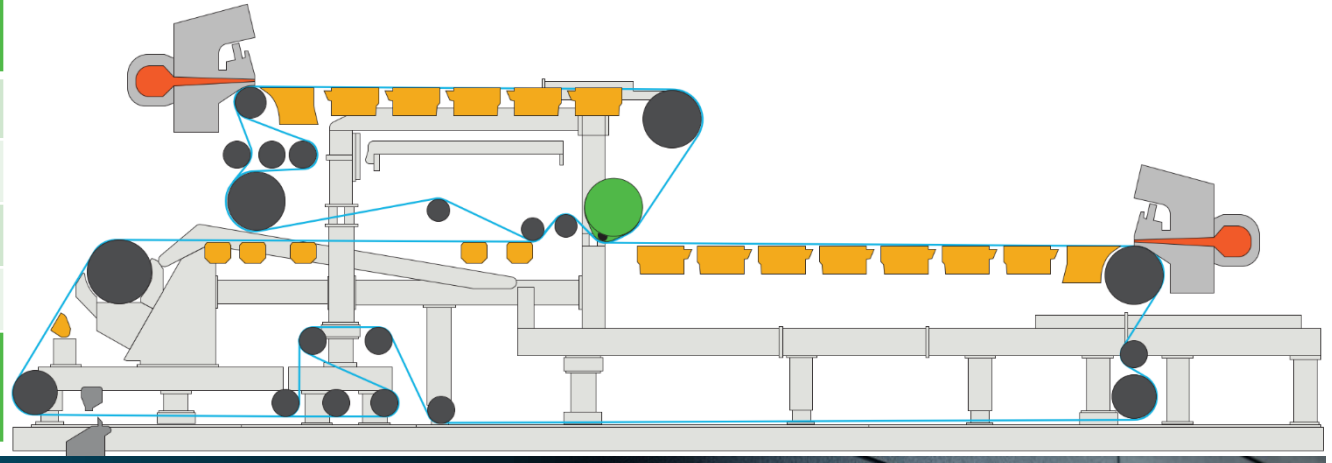
Outgoing dryness from Sleeve roll 13%

Multi Former with Sleeve roll technology

AJIN P&P, BM 2, third commercial installation, started-up 09/2024

Multi Former rebuild	
Grade	Test liner
Wire width	4,650 mm
Design speed	1,000 m/min
Basis weight	115 to 250 g/m²

Rebuild target is to improve bonding of the two combined plies and at the same time increase machine capacity.



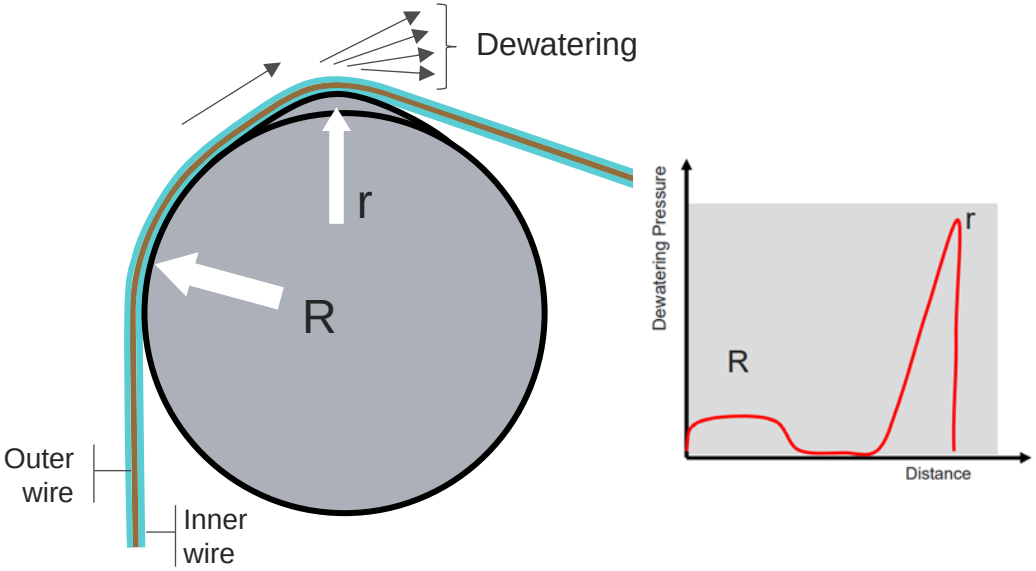
”Ajin has been impressed with the high-performance result of the previous BM 3 Sleeve roll rebuild. Together with the excellent co-operation and support from Valmet it has encouraged us to repeat the order of a forming section rebuild.”

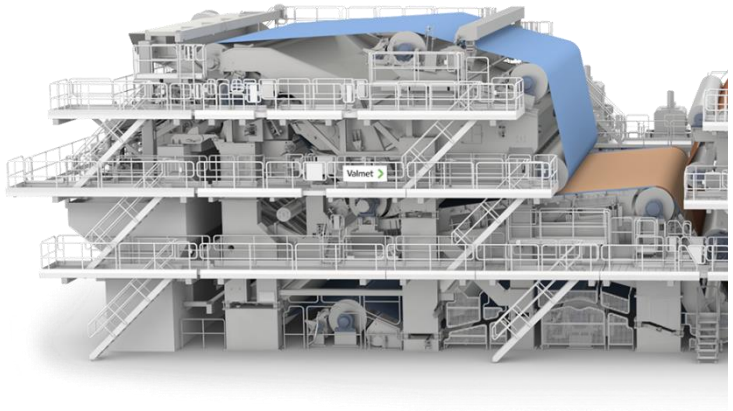
I have a high confidence on Valmet technologies and their project deliveries based on the long co-operation and history together. I was positive that we will succeed also in this BM 2 project. By systematical and hard work before and during shutdown, installation, and start-up we reached all common performance and safety targets. With Sleeve roll technology Ajin P&P can make a leap forward to produce even higher quality board.”

Jin-Doo Kim, *CEO, AJIN P&P*

Summary

- Effective dewatering
  - Compressing between two forming fabrics against the small radius shoe
    - P= T/R
    - Steady increasing compressing pressure doesn't cause defects to the web
  - Unlimited dewatering volume thorough the forming fabric
    - Not sensitive for ingoing dryness
    - Dryness after sleeve roll is constant 13 %
  - Good strength properties
    - Less pulsation keeps fines on the web
    - Biggest improvement on Huygen / Scott Bond
  - Energy efficiency
    - Less vacuums on initial dewatering of the forming section
    - High dry solid content end of the forming section when dewatering high with sleeve roll
    - → less resistive structure of the web






Valmet
FORWARD