Sizing Module & New Roll Cover Application
Puddle Size Press Module
Puddle Size Press - Principle

- Starch Puddle in between Paper and Rolls
- For Surface and Internal Starch Application
- Difficult Starch Pick-up Control
- The Higher the PM Speed the Worse the Starch Control, Typically for Low Solids Starch (6-8 %)
- Not Successfully used for Pigmenting
Puddle Size Press

Starch supply

0 P&J

20 - 30 P&J

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Puddle Size Press

750 m/min

Depending on roll diameter: up to 1000 m/min possible. Example 1050 m/min with rolls Ø 1540/1230 mm

Disadvantages at high speed:
- variation of sump level
- Turbulence causing foaming and splashing
Typical Surface Sizing Application

Puddle Size Press

- Starch weights: 1.5 - 4 g/m² total
- Speed: 100 – 1100 m/min
- Cover Hardness: 0 / 15 - 30 P&J combination
- Crown: 0.1 to 0.6 mm Ø typical
- Paper Grades: Packaging, Board, Uncoated free-sheet
Puddle Size Press Optimisation

sizepress – best inlet point of starch

splashing (out) picture from other company

temperature differences on cover

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
What do you expect from a Size Press?

- Reliable and consistent run
- Long operating periods
- Cost effective production
- High quality end products
- Good starch penetration - high line loads
The Requirements on the Cover

- Wear resistance
- Impact resistance
- Elasticity
- Temperature stability
- Roughness stability
- Chemical resistance
- Long grinding interval
Actual Product Portfolio in Sizing and Coating

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Puddle Size Press</th>
<th>Film Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sizing</td>
<td>MagnaSize II</td>
<td>MagnaSize II</td>
</tr>
<tr>
<td></td>
<td>LunaSize S</td>
<td>LunaFilm S</td>
</tr>
<tr>
<td></td>
<td>LunaSize E</td>
<td>LunaFilm E</td>
</tr>
<tr>
<td></td>
<td>eVenSize</td>
<td>eVenFilm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>eVenFilm T</td>
</tr>
<tr>
<td>Pigmenting&amp;Coating</td>
<td></td>
<td>SolarCoat/SolarCoat X8</td>
</tr>
</tbody>
</table>
Puddle Size Press - Hard Covers

MagnaRock II

High chemical and thermal resistance
Higher wear resistance
Lower roughening tendency
Puddle Size Press - Soft Covers
MagnaSize II

Premium Standard Size Press Cover
Excellent compromise:

- Extremely high chemical resistance
- Excellent wear strength
- High mechanical resistance

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Puddle Size Press - Soft Covers
LunaSize

- Excellent wear resistance and roughness stability due to high-quality *filler system*

- Superior mechanical and thermal properties due to its *fiber reinforcement*

- Resistance to all chemicals used in the sizing process through customized rubber formulation
Puddle Size Press - LunaSize Fiber Reinforcement

High-value fiber reinforcement provides:
- Superior impact resistance
- Highest elasticity
- Improved wear resistance
Fiber Reinforcement Impact Resistance

conventional cover  LunaSize
Fiber Reinforcement
Highest Elasticity

Proven rubber blends and fiber reinforcement provide best elasticity.

High-quality fibers are:
- extremely strong
- highly elastic
- excellently bonded to rubber matrix
Puddle Size Press - LunaSize

The Fillers

Customized filler composition

- Increases wear resistance
- Provides even profile over a long operating period
- Keeps required roughness over long time
- Ensures good bonding to rubber matrix due to surface treatment
Puddle Size Press - Soft Covers
LunaSize

LunaSize S
Superior impact resistance

LunaSize E
- Superior impact resistance
- Enhanced wear resistance
Puddle Size Press – Soft Roll Cover eVenSize

- Mechanical Strength: 46%
- Tear Strength: 66%
- Thermal barring resistance: 50%
- Reset Rate (dyn. Elasticity): 80%

Legend:
- eVen Matrix
- Premium Matrix
- Standard Matrix
eVenSize
High-quality Filler

The eVen roll cover filler concept is key to the stable surface topography. It provides a smooth and even application profile over long operating periods by keeping the required surface topography throughout the entire life cycle.
eVenSize T
High-quality Fiber Reinforcement

The fibre reinforcement rubber matrix also greatly reduces the risk of surface damage and crack propagation by absorbing the energy generated by impacts. High-quality fiber reinforcement provides:

- Superior impact resistance
- Highest elasticity
- Lower thermal expansion
- Higher thermal conductivity
- Improved wear resistance
Comparison of Performance

- Damage resistant against dry friction
- Mechanical Properties / Impact Resistance
- Good web release
- Abrasion / Wear Resistance
- Quality of Film
- Aging
- Transfer Rate
- Long grinding interval
- Dynamical Properties
- Low thermal Barring properties

Legend:
- Grey: MagnaSize II
- Blue: LunaSize S
- Light Blue: LunaSize E
- Yellow: eVenSize

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Film Size Press Module
Indirect Application

Film Sizing

Film Coating
## Application

### Film Press

<table>
<thead>
<tr>
<th></th>
<th>Coat weight [g/m²/side]</th>
<th>Solid content [%]</th>
<th>Viscosity Brookfield [mPas]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starch-appl.</strong></td>
<td>0.15 - 6</td>
<td>4 - 15</td>
<td>10 - 100</td>
</tr>
<tr>
<td><strong>Pigmenting</strong></td>
<td>2 - 6</td>
<td>15 - 40</td>
<td>50 - 300</td>
</tr>
<tr>
<td><strong>Coating</strong></td>
<td>5 - 15</td>
<td>40 - 68</td>
<td>300 - 1600</td>
</tr>
</tbody>
</table>

- **Max. Penetration**
- **Min. Penetration**

- Strength properties, sizing for writing/printing
- Brightness, coating-holdout
- Coverage, smoothness, gloss

---

*TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.*
Process Parameters
Liquid Application and Solid Content

Application window for size press and metering size press

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Operating Window for Size Press and Metering Size Press
Indirect Application – Film Press

Gate Roll
TRC

Inverted Gate Roll
HSM

Rod Metering
SpeedSizer/SymSizer/OptiSizer/FilmPress/ValSizer

Blade (puddle) + Gate Roll Comb
Film Metering Process

- Transfer in the Nip
- Film Distribution/Transport
- Metering
- Residual Film
- Web Release
- Film Split Transfer Rate
**SpeedSizer**

Application with baffle plate („liquid seal“)

- Metering rod (diff. diameters)
- Application zone
- Flexible baffle plate
- Rod loading
- Actuators for CD profil control
- Rod bed clamping tube
- Liquid seal
- Air boundary layer
# Thermal influences on applicator head

- One-sided heating-up coating color
- Thermal loads vary at different conditions: *Operating, down time, breaks*
- Cool-down during washing/cleaning
- Radiation from IR or cylinder dryers
  - Flushing of distribution pipe

## Poor CD profiles result from deflections at the applicator head
Calculated applicator deformation with different materials

Deformation $\Delta s$ [mm] vs. Temperature difference [K]

- Cheilled Fiber Reinforced Plastic (CFRP)
- Steel
CFRP filament winding

Main influence from:

- Type of carbon fibre
- Type of resin
- Filament orientation
- Core diameter
- Shell thickness
- Layer thickness
SpeedSizer
Application system and metering elements

Profiled rod
(Ø14 mm)

Smooth rod
(Ø14 mm, Ø18 mm
Ø24 mm, Ø38 mm)
Pre-metering
Profiled rod

Film quantity = f (rod profil)
Minor impact of speed, solid content, viscosity (volumetric principle)
Pre-metering
Smooth rod

Film quantity $= f$ (rod pressure)

at otherwise constant parameters

Essential impact of speed, coating color (solids, viscosity),
roll hardness, rod diameter (hydrodynamic principle)
Pre-metering
Selection of smooth rod diameter

![Graph showing the selection of smooth rod diameter based on coat weight, speed, and viscosity.](image)

- Coat weight: [g/m²]
- Speed: [m/min]
- Viscosity: (Brookfield 100 rpm)

<table>
<thead>
<tr>
<th>Rod Diameter</th>
<th>14 mm</th>
<th>18 mm</th>
<th>24 mm</th>
<th>38 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Viscosity levels: 500 mPas, 750 mPas, 1000 mPas
Operating window
Profilered and smooth rods

Coating with profiled metering rod
Coating with smooth metering rod
Sizing with profiled metering rod only
Nip transfer
Starch transfer in the roll nip

Sheet run
Nip transfer
Starch transfer in the roll nip

1. wetting
2. pressure penetration (transfer)
3. film splitting

roll → base paper → size film

\( X_0 - \Delta X_{\text{max}} \)

\( X_0 + \Delta X_s \)

\( p \ [\text{Pa}] \)

paper with starch

Nip-length

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Nip transfer
Coat transfer in the roll nip

Sheet run
Nip transfer
Pressure distribution

- **Sizing**
  - Cover hardness: 15 ... 50 P&J
  - Nip pressure: 20 ... 80 kN/m
  - Nip length: 15 ... 45 mm

- **Coating**
  - Cover hardness: 40 ... 70 P&J
  - Nip pressure: 10 ... 25 kN/m
  - Nip length: 20 ... 50 mm

**Penetration properties**

**Film formation**
What do you expect from a Film Press?

- Application of starch/coating in an even, controlled, and stable manner
- High availability enabling high machine efficiency
- Cost effective production of high quality products
- Production flexibility
How can this be achieved?

- Uniform and stable pre-metered film
- Stable process conditions
- Customized transfer of starch/coating with improved profiles
- Optimum and stable web release
- Improved runnability through minimized misting and rod spitting
Cover Requirements

- Thermal and dynamic stability
- Impact and marking resistance (elasticity)
- Wear resistance
- Wettability
- Defined roughness level for good sheet release
- Chemical resistance ensuring hardness stability
Covers for Film Sizing & Coating

MagnaSize II
LunaFilm S
LunaFilm E
eVenFilm
eVenFilm T
SolarCoat/SolarCoat X8
LunaFilm

- Improved mechanical properties due to fiber reinforcement
- Excellent wear resistance and roughness maintenance due to high-quality filler system
- Well-defined starch penetration due to optimized dynamic properties
- Minimized process variations due to thermal, mechanical and chemical stability
Covers for Film Sizing & Coating
MagnaSize II

Premium Standard Size Press Cover
Excellent compromise:

- Extremely high chemical resistance
- Excellent wear strength
- High mechanical resistance
The Luna Principle
Fiber Reinforcement

High-quality fiber reinforcement provides:

- Superior impact resistance
- Highest elasticity
- Lower thermal expansion
- Higher thermal conductivity
- Higher wear resistance
Covers for Film Sizing & Coating
LunaFilm

- **LunaFilm S**  
  high impact/marking resistance

- **LunaFilm E**  
  even higher wear resistance
The Luna Principle – Impact / Marking Resistance

Conventional cover
MagnaSize II

Luna series cover
Fiber reinforcement → absorption of impact energy → reduced crack propagation
LunaFilm S
Fiber Reinforcement

High-quality fiber reinforcement provides:

- Superior impact resistance
- Highest elasticity
- Lower thermal expansion
- Higher thermal conductivity
- Improved wear resistance
- Vibration dampening
LunaFilm E
Fiber Reinforcement & Polymeric Fillers

- Raise wear resistance to one level higher
- Provide even application profile over long operating periods
- Keep required roughness throughout life cycle
- Ensure superior bonding to rubber matrix
- Higher roughness leads in reduced misting
eVen rubber covers for high demands

Performance Index

- eVen Matrix
- Luna Matrix
- Standard Matrix

Comparison:
- Wear Resistance: 46%
- Surface Topography: 20%
- Low Swelling: 50%
- Impact resistance: 52%
- Tear Strength: 66%
- Thermal barring resistance: Standard
Three corners of success
eVen cover benefits

- Longer grinding intervals
- Better mechanical strength
- Higher abrasion resistance

- Low swelling
- Low Hysteresis
- Stable surface topography

Machine Runability
Consistent Application
Maintenance cost savings
- Longer running times
- Higher machine efficiency
- Less maintenance required
Machine Runnability

Machine runnability is one of the key factors for efficient production. This is supported by the features of the new eVen polymer matrix:

- Excellent wear and abrasion resistance
- High tear strength for improved impact damage resistance
- Lower hysteresis
- Uniform surface topography
- Increased vibration dampening
- Improved denting and marking resistance
Consistent Performance

Consistent high-level sizing and pigmentation is crucial for stable paper quality.

Key targets:

- Stable surface topography
- High abrasion resistance
- Reduced wear
- Very low swelling and water absorption
Improved performance  
High-quality Filler

The eVen roll cover filler concept is key to the stable surface topography. It provides a smooth and even application profile over long operating periods by keeping the required surface topography throughout the entire life cycle.
Improved Performance
High-quality Fiber Reinforcement

The fibre reinforcement rubber matrix also greatly reduces the risk of surface damage and crack propagation by absorbing the energy generated by impacts. High-quality fiber reinforcement provides:

- Superior impact resistance
- Highest elasticity
- Lower thermal expansion
- Higher thermal conductivity
- Improved wear resistance
eVenFilm & LunaFilm
Comparison of Performance

---

TRADE SECRET This specification and the procedures contained herewith are a Trade Secret, property of Voith Paper Fabrics & Rolls. This information is confidential and legally privileged. This information is intended only for authorized individuals. You are hereby notified that any unauthorized disclosure, copying, distribution or the taking of any unauthorized action in reliance of the contents of this information is strictly prohibited and that Voith Paper Fabrics & Rolls will pursue all legal remedies available to mitigate any damages caused by such action. This document should be returned to Voith Paper Fabrics & Rolls immediately if you are not the intended authorized recipient.
Polyurethane Covers for Applicator Rolls
(Film press / Speed sizer)

**SolarCoat (PU)**
- Thickness: 17.5 – 20 mm
- Hardness: 20, 25, 35, 40, 45, 55, 60, 70 P&J

**Advantages:**
- Higher Film transfer rate → already running in several applications
- Longer grinding intervals due to less abrasion
Film thickness on different Roll Covers
Materials Test Results – Voith Pilot coater

Polyurethane covers provide a higher film thickness on the roll cover (similar cover roughness)
Polyurethane covers yield a higher film transfer ratio and therefore less misting (depending on paper grade and absorption)
SolarCoat

- Maximum hardness stability due to unique hydrolysis resistance
- High impact resistance due to WebNet Bonding Layer
- Misting and rod spitting minimized at high coat weights and high machine speed due to excellent wet ability
- Superior coating film quality due to optimized polyurethane cover

Minimized swelling
Minimized heat build-up

→ Best profile maintenance
→ Best behaviour at very high speed
Do you know following problems?

- reduced coating quality and transfer rate
  ➔ linked to reduced roughness

- web release gets worse
  ➔ linked to reduced roughness

- Scratches on cover surface?
  ➔ „low quality“ coating solution damage the cover
SolarCoat with fillers

Adaptation of the “Luna Idea” = Fillers in PU

Advantages:
- keep the roughness on a high / stable level ➔ increased run times
- increased wear resistance
- stable an consistent profile over long run times
- PU Base material unchanged, therefore no adaptations of actual parameters needed
- „scratch resistant“
Sensitivity of Polyurethane Covers

Scratches / Damages of cover surface by colours with abrasive particles together with tendency to generate agglomerates
Sensitivity of Polyurethane Covers

solid abrasive colour agglomerate
Trouble Shooting

- Mechanical damages - cracks on cover surface
- Thermal damages – sectional thermal overload
- Aging - mechanical markings
- Washboard surface
- Chemical attack
Trouble shooting

Cover Cracks

Cracks in cause of paper wraps
Trouble shooting

Cover Cracks

What is responsible for this effect?
A hard object was passing the nip.
- Starch / color deposits on goosenecks
- Machine parts (screws, rust from beams..)
- Paper carrier rope
- Objects from operator (lighters, pens...)
Trouble shooting

Cover Cracks

Damages resulting in web breaks
Stress cracks from localized overloading
Trouble shooting

Thermal overload in edge area

Possible reasons are:

- Edge moistening not properly adjusted
- Moistening nozzles blocked
- Support of doctor in contact to roll
- Support of sealing in contact to roll
- Wear of scraper
- Hard object under doctor system
Trouble shooting
Mechanical cracks - cover aging

Aging phenomenon as a result of:

- Long runtime of roll
- Wear of cover material
- Climatic conditions
- Aggressive agents / fluids
Trouble shooting

Thermal Overload

- Increased machine speed without cooling system
- Cooling temperature too high
- Cooling system not working properly (pumps, flow, pressure...)
- Cooling water turned off by operator
Trouble shooting

Thermal Overload

- Nip pressure overloaded one and/or both sided
- Paper wrap after web break
- Very hard web breaks
- Vibrations
Trouble shooting

Chemical attack

Most all covers have chemical limitations

- Immersion testing can be performed on suspected chemicals
- Control cleaning agent
- No dilution of cleaning agent after application – please clean with a lot of water
- Control cleaning time
- Aggressive additives in application or in moistening water

mittig) Blasen und klebt in diesen Bereichen sehr stark; siehe weiteres im Protokoll von H. Jansen
Helpful are: Temperature - Measurement
Nip Measurement for better film transfer

static and dynamic nip impression by powder, blue paper and Fuji strips

optimization:
- cover material
- nip impressions
- crowning
- cover thickness
Example NipSense: Over- and under-crowned situation
Example of NipSense:

Start Up of Nip Closing SpeedSizer

NipSense measurements in steps of 5 seconds typical press process of applicator rolls
Roll Alignment