



TOWARDS BETTER UNDERSTANDING OF VOID VOLUME IN PRESS NIPS

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Abstract

What I have come to believe:

- Typical operating felts do not have enough affective void volume to produce optimum press dryness
- To Create sufficient void volume, “Venting” must be provided in roll covers and shoe press belts to reach optimum press dryness
- Residual water or broke in the venting pattern reduces the theoretical void volume to an “Affective Void Volume” & too little Affective VV can create press dryness loss and sheet property non-uniformity
- This non-uniformity contributes to sheet breaks and therefore lost machine efficiency

Press Felt Mission

In Simplest Terms:

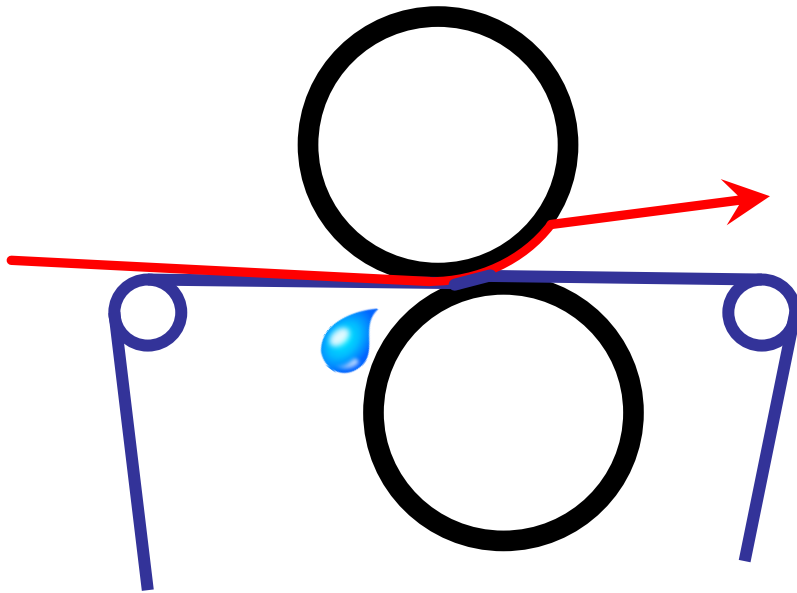
- Accept all the water the sheet wants to give up in a press nip
- Allow excess water to pass easily into the Void Volume (“VV”) of the roll cover or shoe press belt
- Present a smooth surface to the sheet to reduce felt marking
- Bridge the open area of the venting pattern to create uniform pressure at the sheet interface

Conventional Wisdom

- Many calculate there is sufficient void volume in felts to accept all of the water coming from the sheet.
- In actual practice this is functionally not the case – at least not through the life of the felt. If a press nip is un-vented, sheet dryness loss occurs long before the felt is theoretically “saturated.”
- However, providing void volume behind the felt in the form of grooves, suction holes, or blind-drilled holes virtually eliminates any felt moisture affect on sheet dryness IF they are not already filled with broke or water.

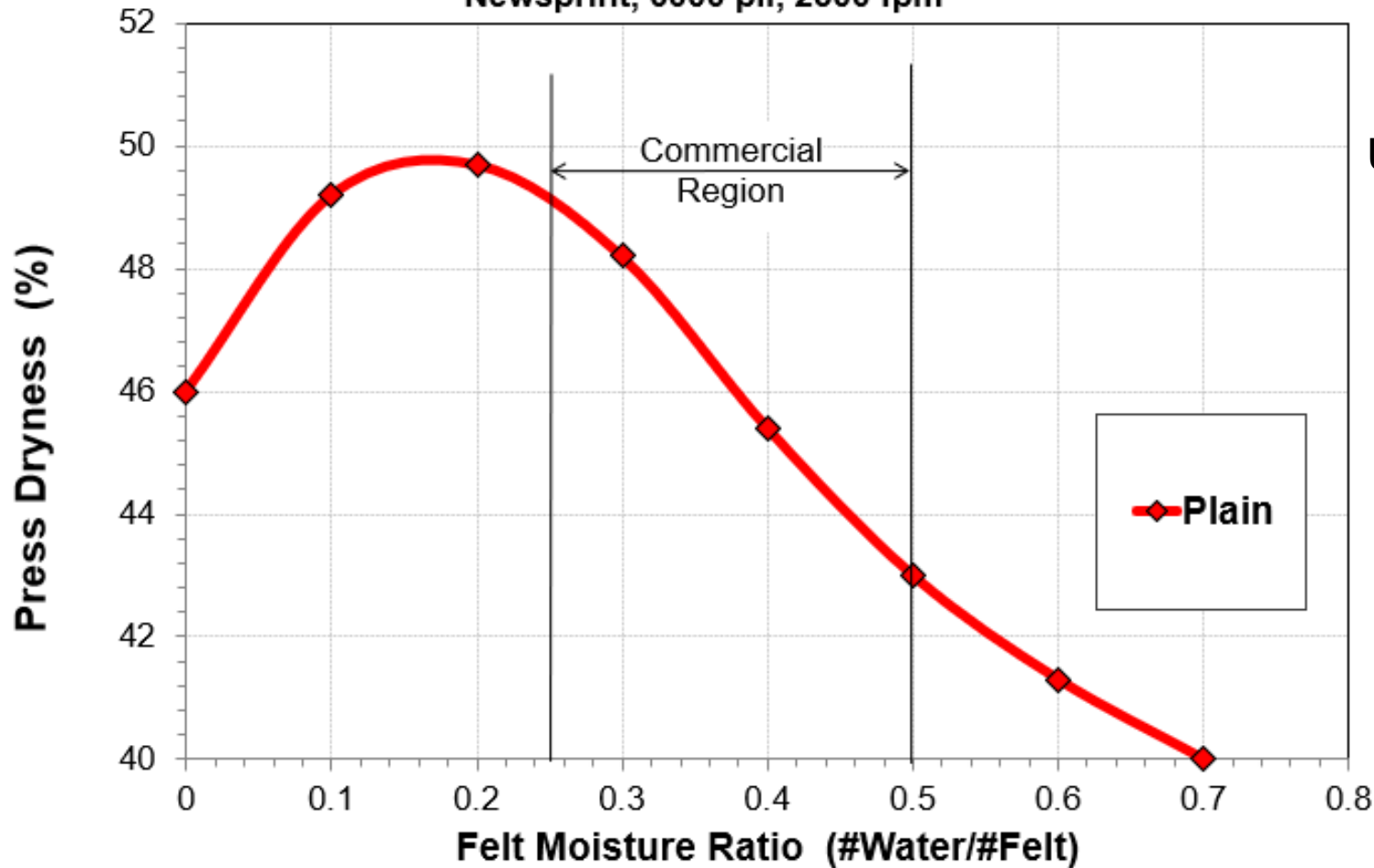
Plain Nip dynamics

The Felt is incapable of accepting all of the sheet water causing Nip Rejection



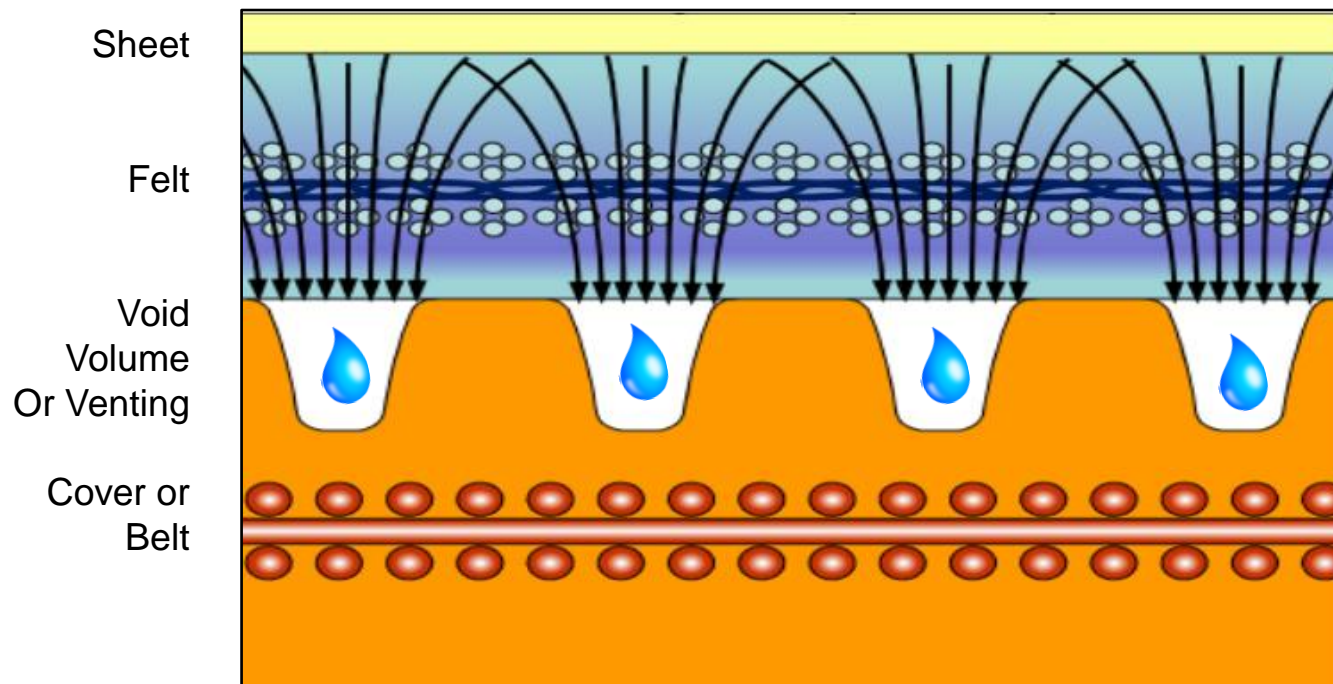
Press Dryness vs. Felt Moisture

Newsprint, 6000 pli, 2500 fpm



Up to 6 Points
Of Dryness
Loss In the
Commercial
Range of Felt
Moisture

Sheet / felt / venting interface



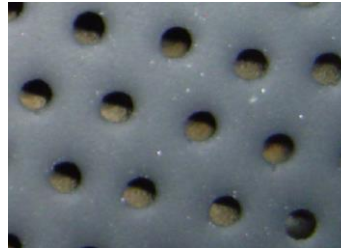
Oliviera, L., 2017. *Panel Kraft-Finos VII*, s.l.: Albany International.

Press Nip Venting Evolution

Fabric



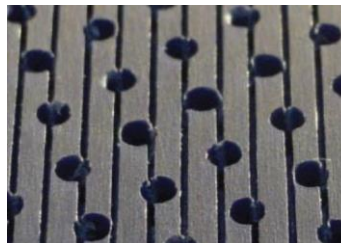
Suction



Grooves



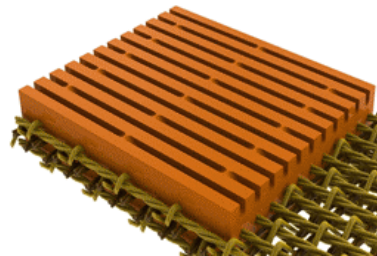
Suction + Blind Drilled
+ Grooves



Suction + Grooves



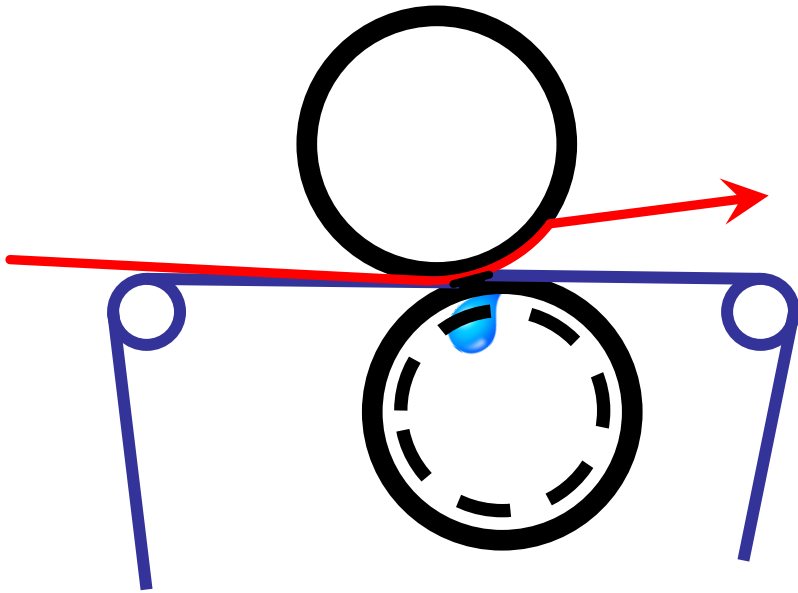
Blind Drilled



Interrupted Grooves

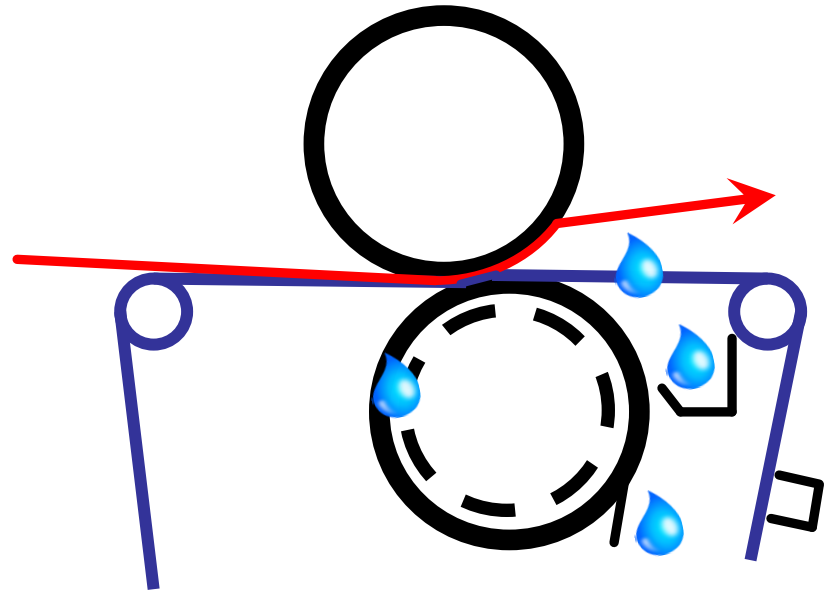


Vented Nip dynamics



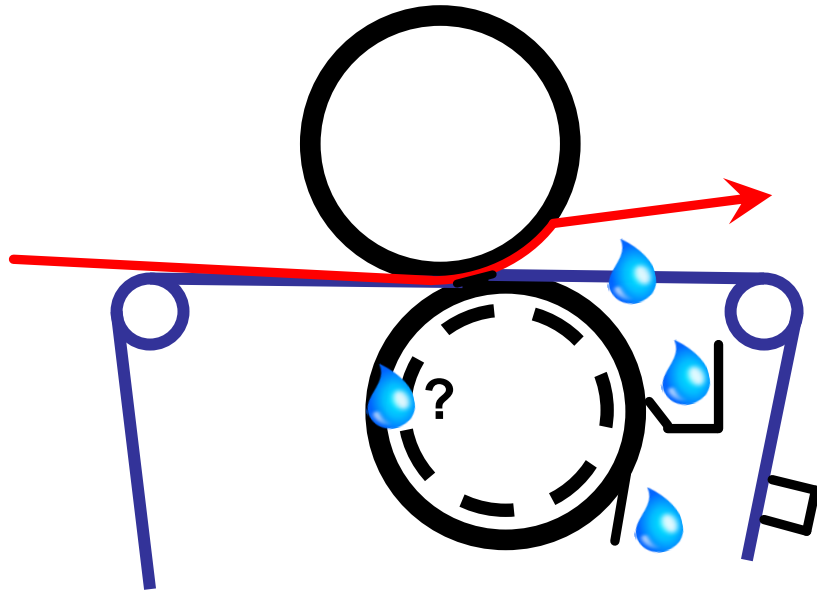
Mid-Nip Water

200 to 2000 gsm Theoretical VV



(4) Water Scenarios After the Nip

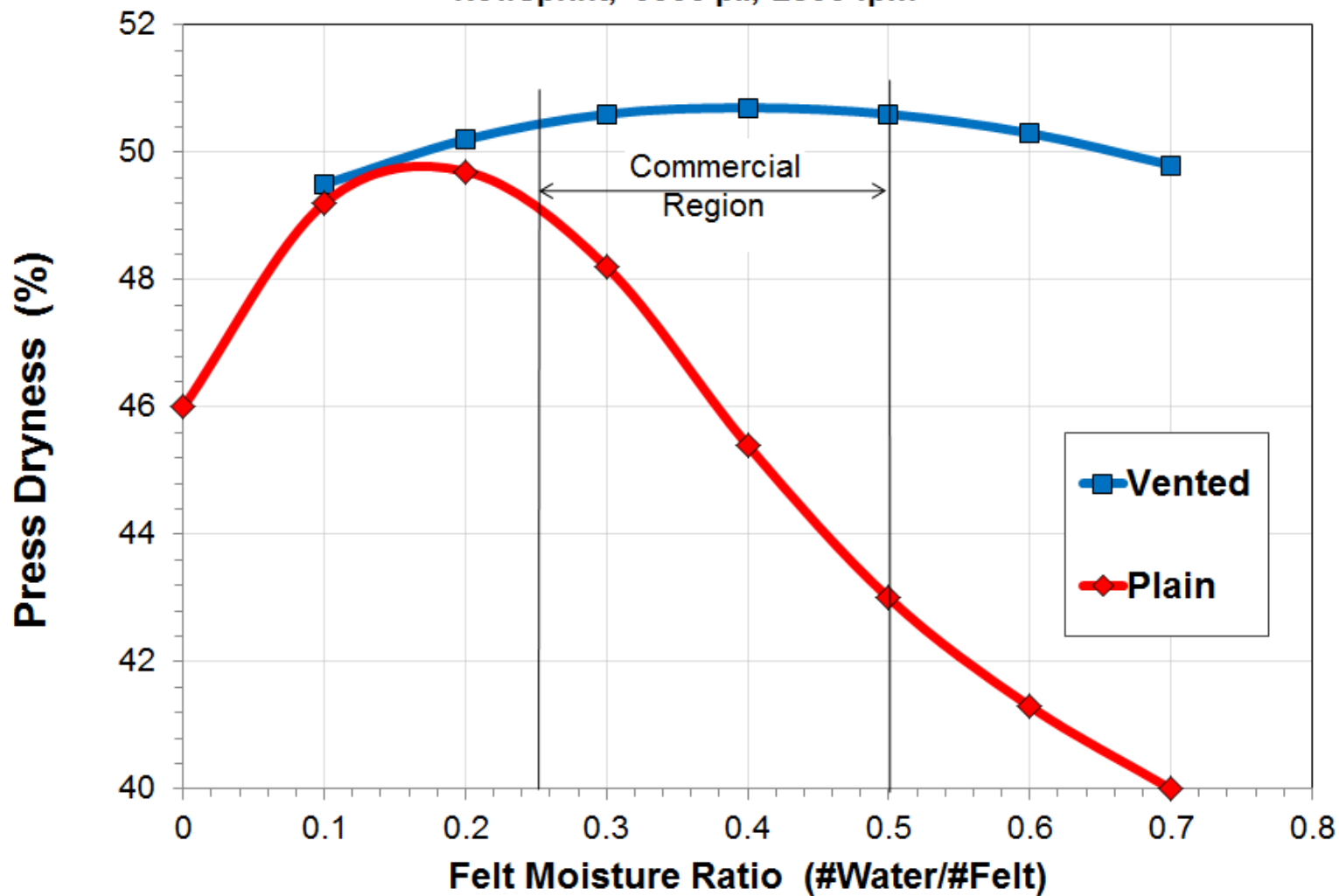
Vented Nip dynamics



Affective VV?
Hugely Speed, Felt, Geometry, and
Venting Pattern Dependent

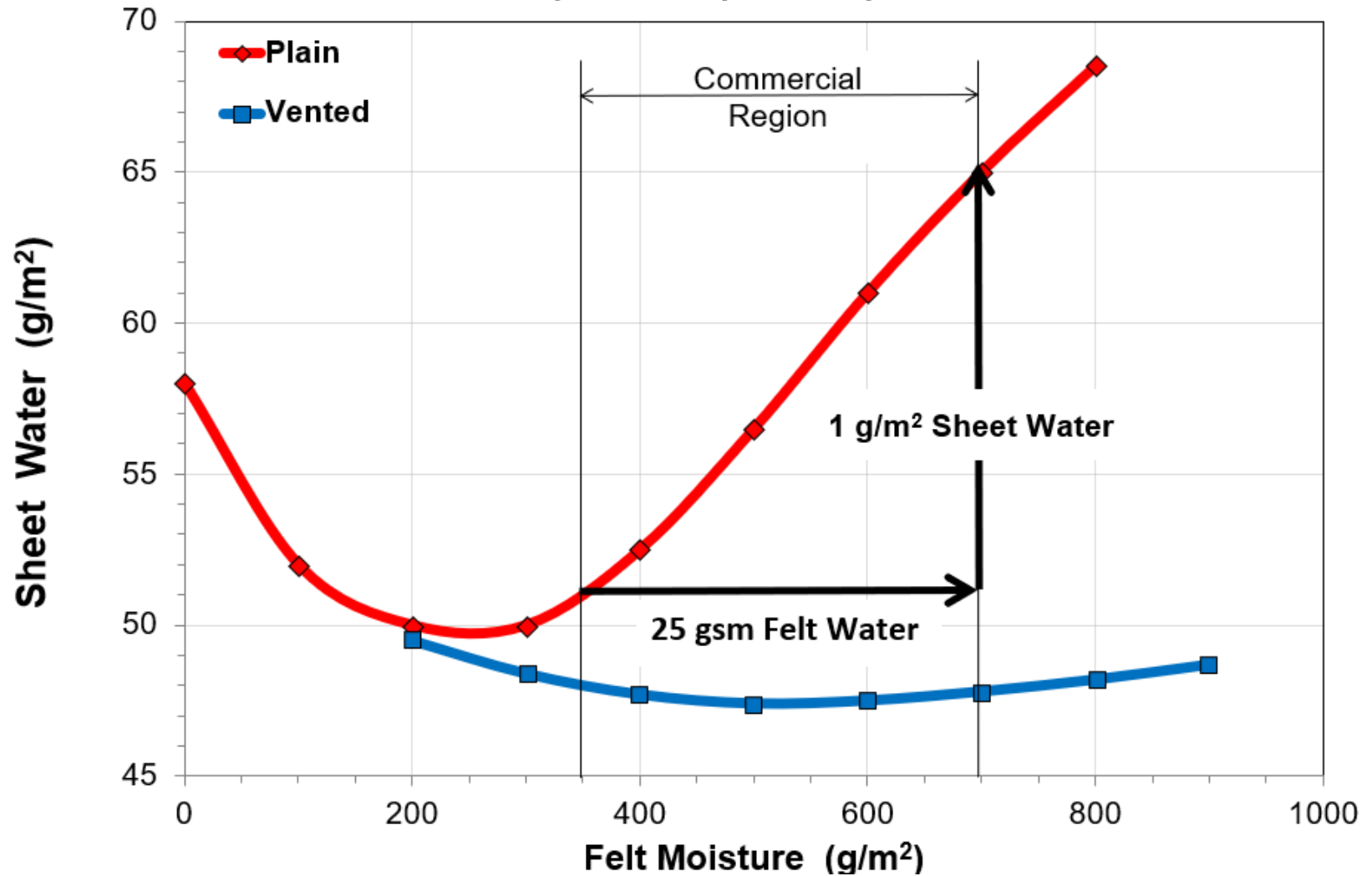
Press Dryness vs. Felt Moisture

Newsprint, 6000 pli, 2500 fpm



Press Dryness vs. Felt Moisture

Newsprint, 6000 pli, 2500 fpm

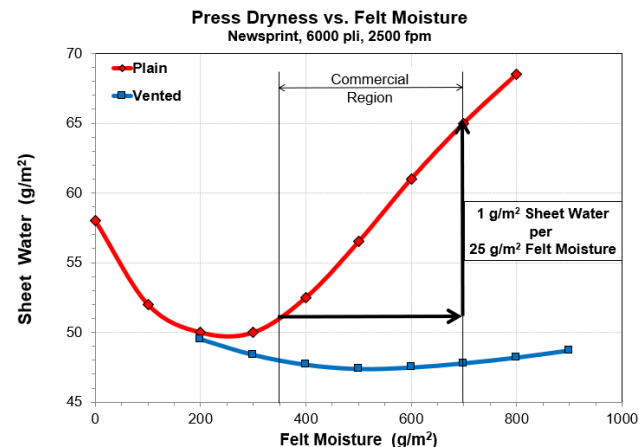


“Saturation”

The 25 gsm of felt water per 1 gsm of sheet water ratio for the unvented nip tells us that the conventional wisdom of calculated “felt saturation” does not describe the empirical results. That is, “Saturation” is not a specific moisture content, but some kind of continuum.

The same is true for total Nip Saturation.

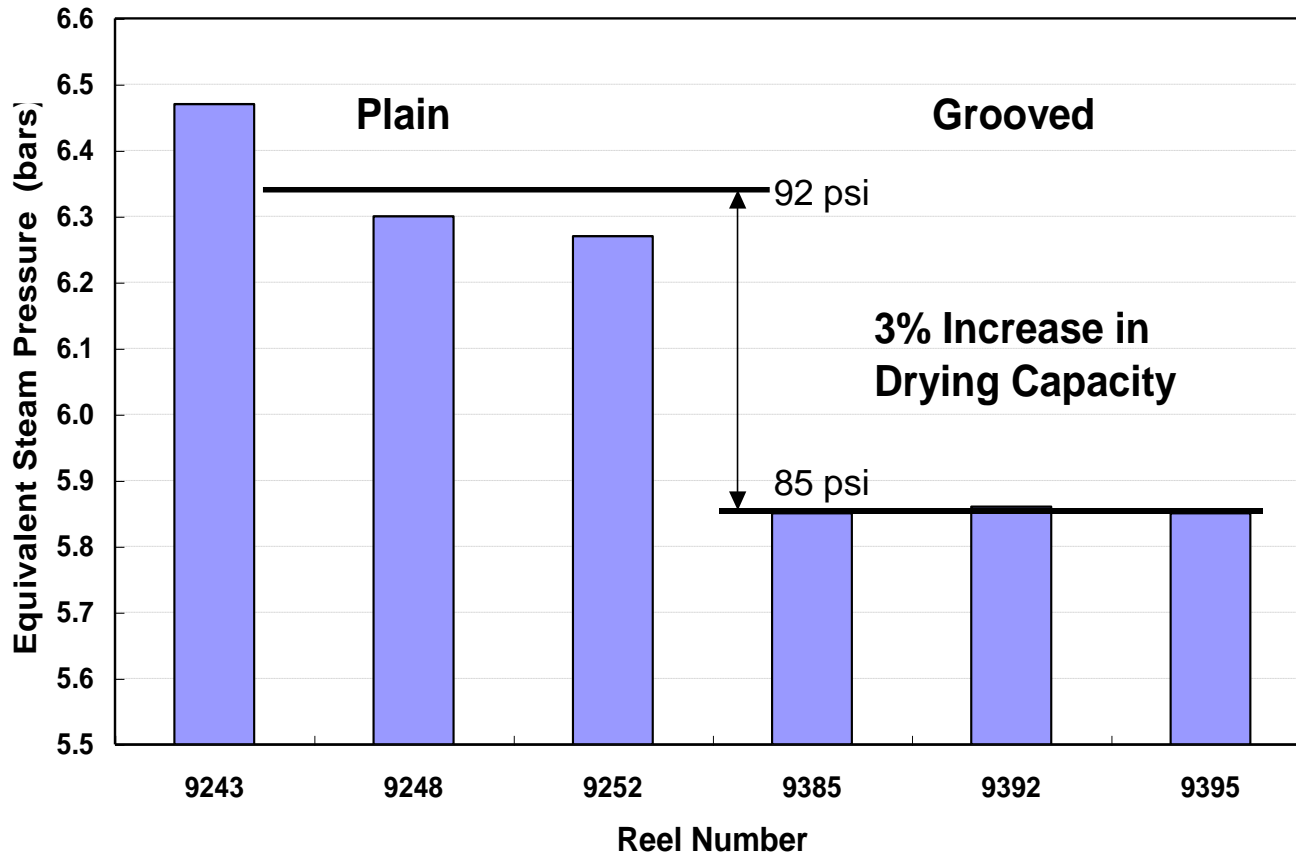
IF we have to use the word “Saturation”, it should mean any moisture content above the point where it affects sheet dryness and/or properties



Single vs. Double Venting

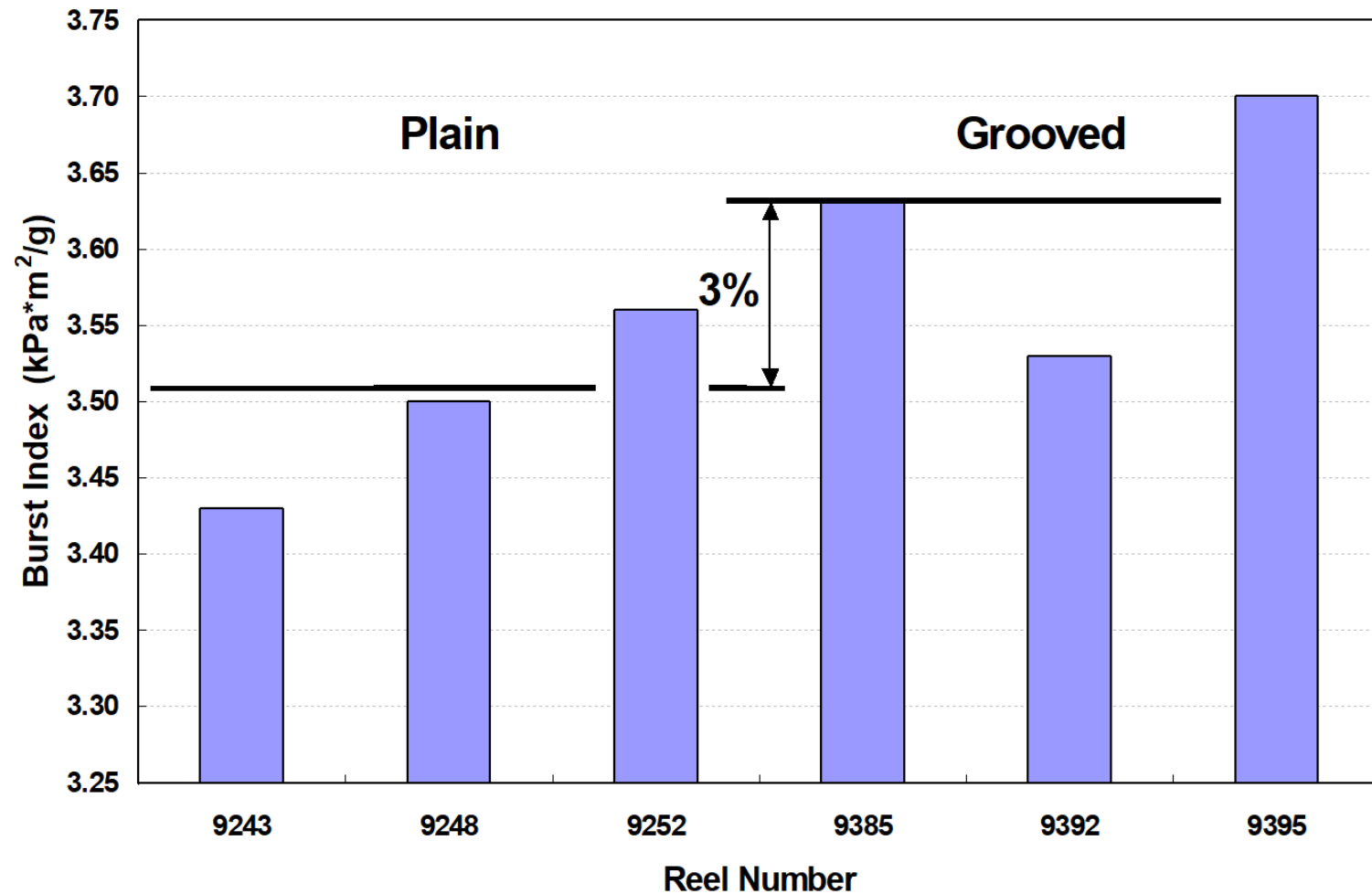
Grooved Belt Dryness Benefit

205 gsm Double Felted Linerboard, Grooved Mating Roll



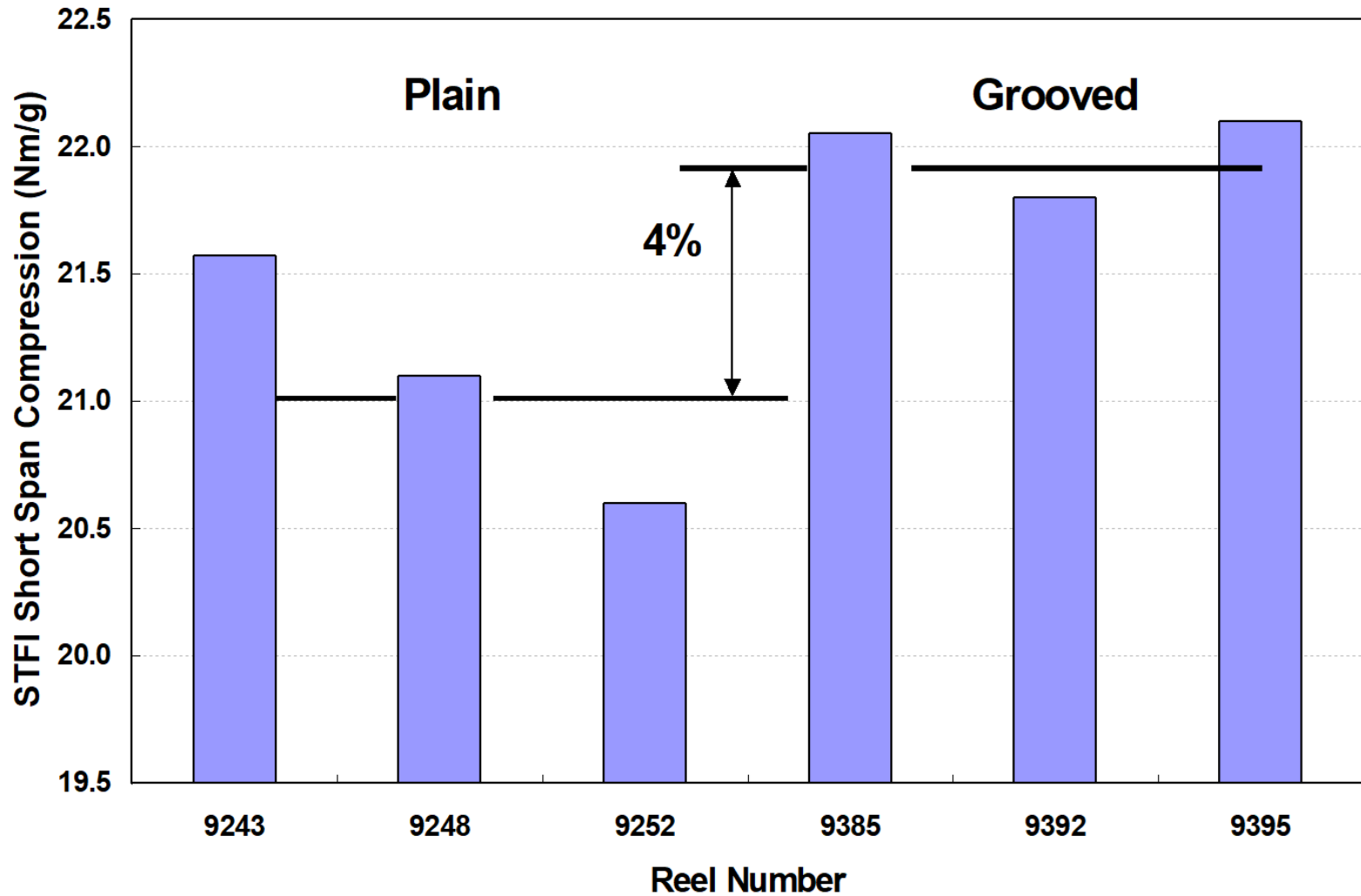
Grooved Belt Burst Benefit

205 gsm Double Felted Linerboard, Grooved Mating Roll

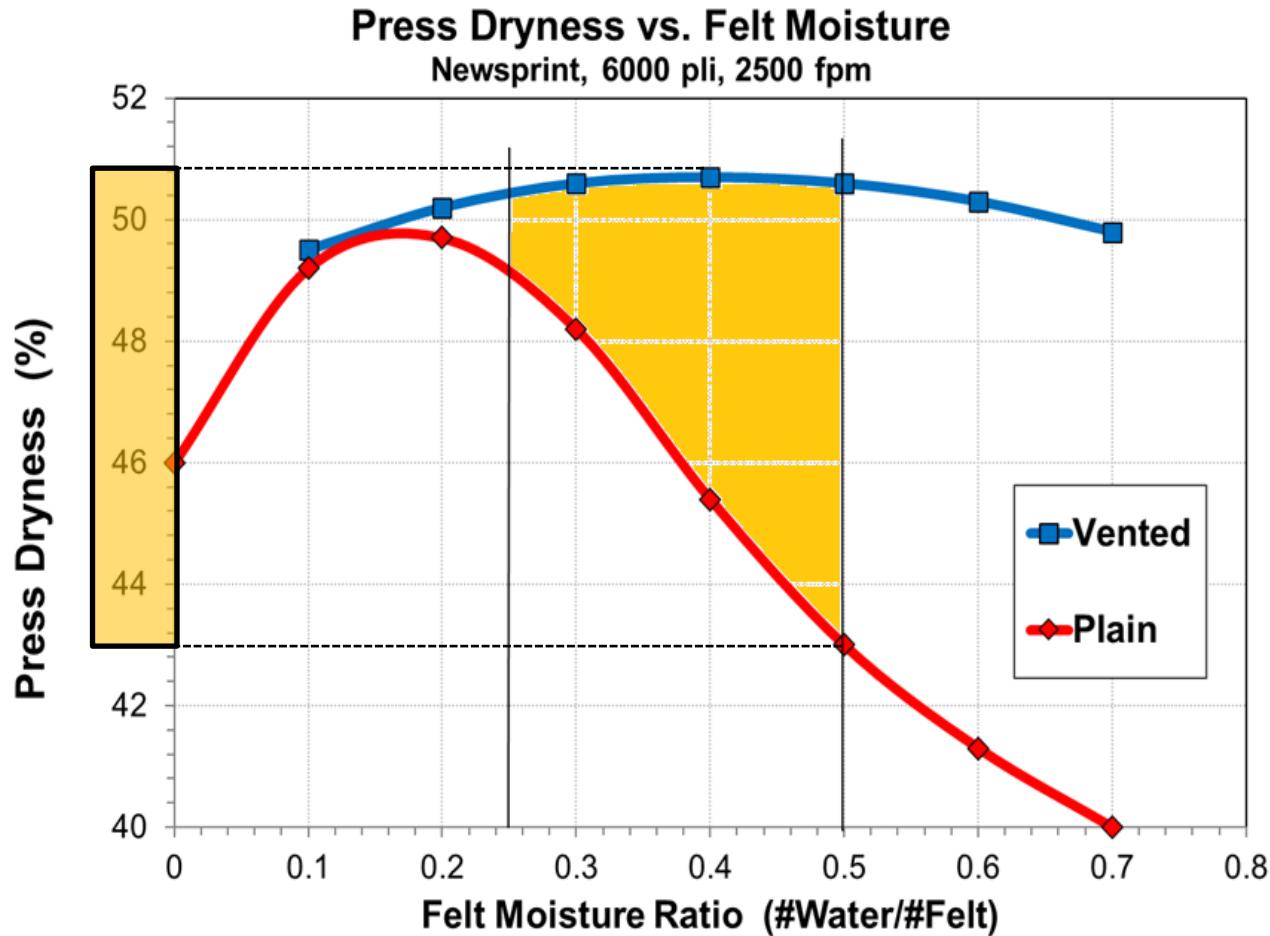


Grooved Belt STFI Benefit

205 gsm Double Felted Linerboard, Grooved Mating Roll



Too Little Affective Void Volume Zone



IF the Affective
VV
In the nip
Is less than
Optimal, the
Press
Dryness can be
Anywhere in this
Zone

Venting Affective Void Volume

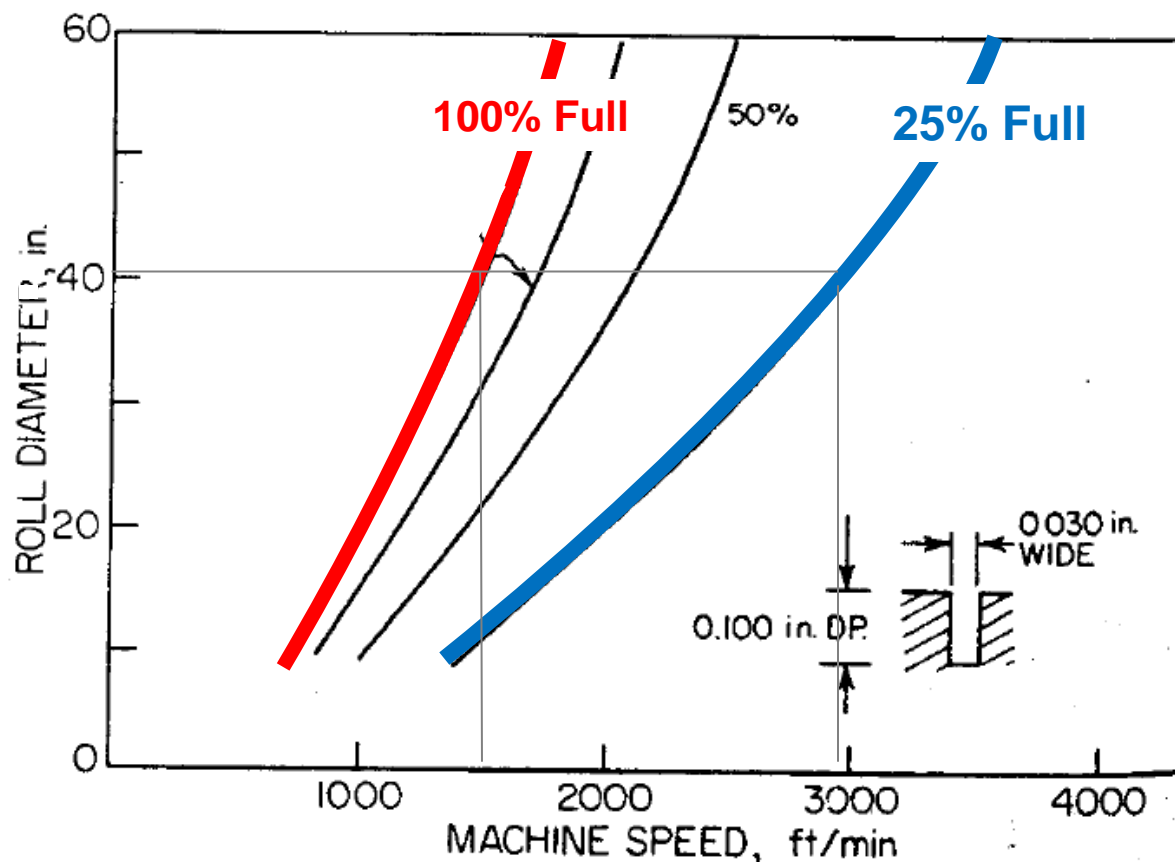


Fig. 4. Theoretical speed at which centrifugal force of water in the groove equals the surface tension for a 0.030 in. wide groove.

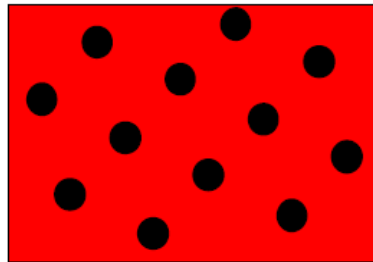
Nip Dewatering and Throw-Off Water



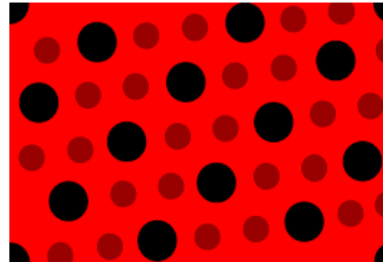
With enough
Machine
Speed, the right
Venting Pattern and
Felt, *Some* of the
water in the
Venting will leave
the
Void volume on its
Own

Venting Patterns in Suction Roll Covers

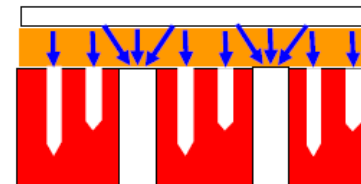
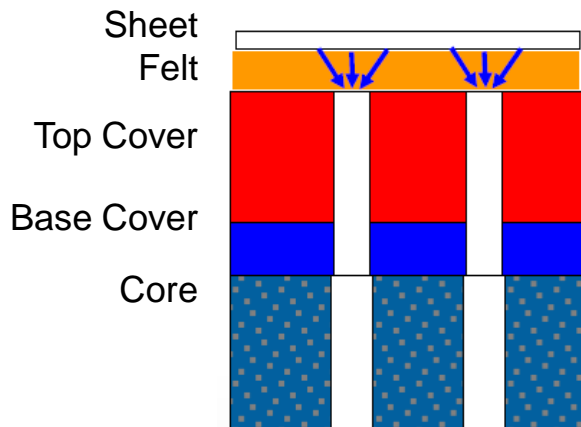
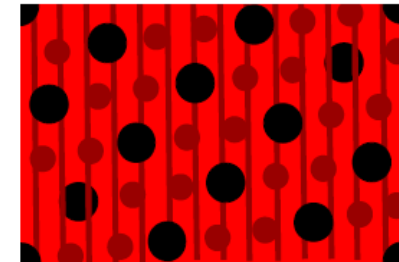
Suction Drilled



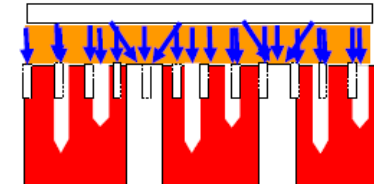
Drilled + Blind Drilled



Drilled + Blind Drilled + Grooved



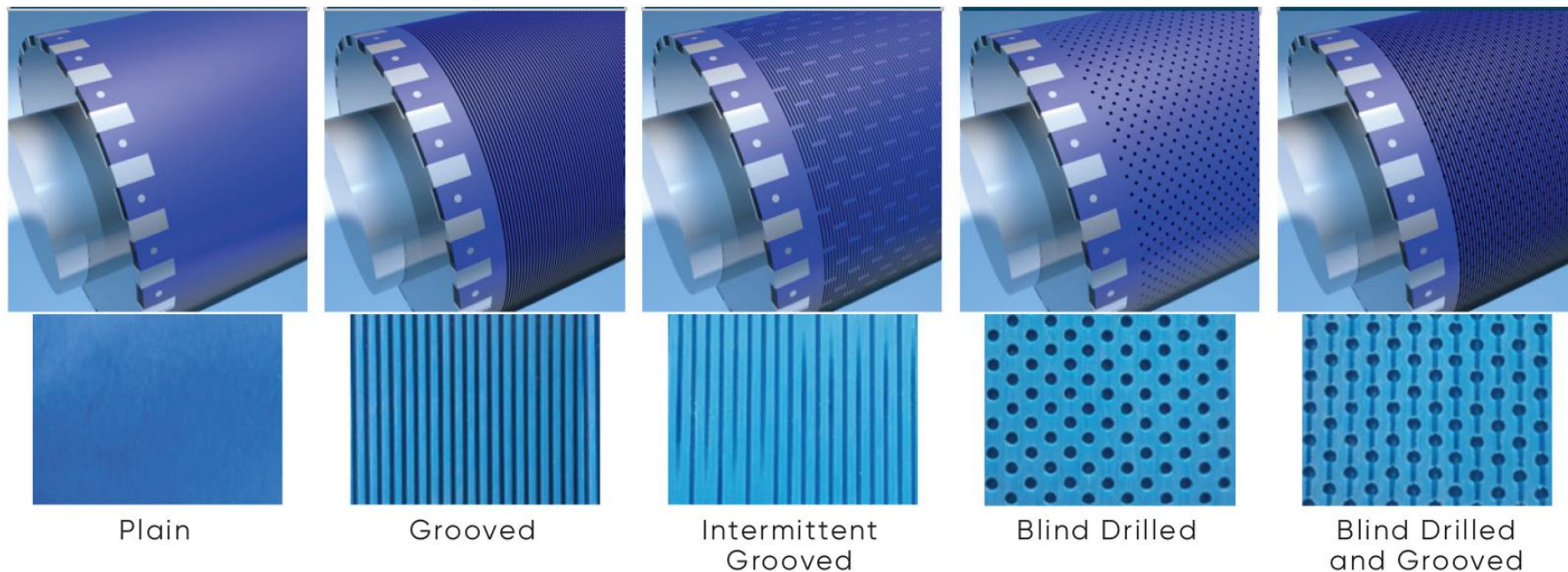
Do the BD Holes
Increase Affective
VV or return to the
Nip Filled?



Same BD Holes
At least have
Access to the
Suction Holes

Venting Patterns in shoe press belts

Same Concept as with Roll Covers. Except - No Suction and ~550 gsm max Void Volume



Nip Rejection



**Water Spray out the
Entrance of a Grooved
Nip**

Yes, it is Ugly

**Most often No Problem -
The Grooves are Relieving
Hydraulic Pressure in the
Nip**

**Grooves open to
Atmosphere can still
Be effective**

**At Extreme conditions this
Can cause Crushing &
Loss of sheet properties**

Plugged VentaNip Grooving



In the Plugged Areas:

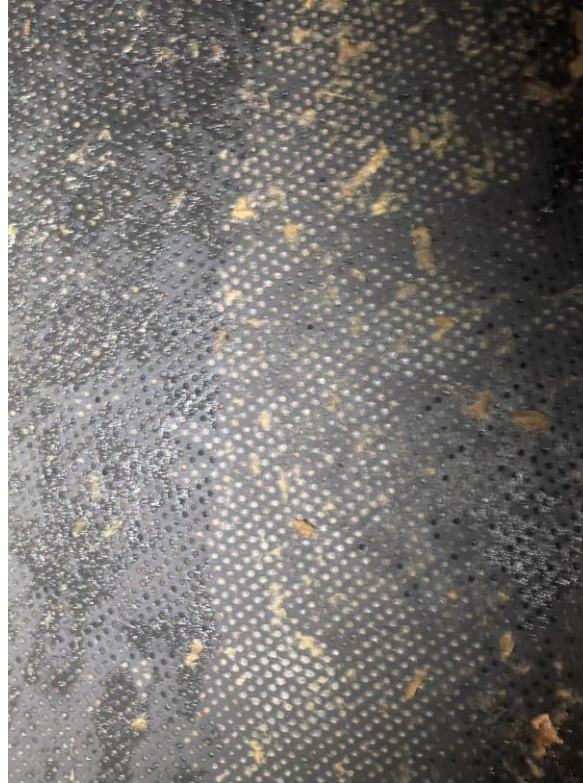
IF Single Felted:

**~5 Points of Dryness
Loss**

**IF Double Felted
And The Other Side is
Properly Vented:**

~1 Point of Dryness Loss

Blind drilled Roll Plugging



Holes filled with broke

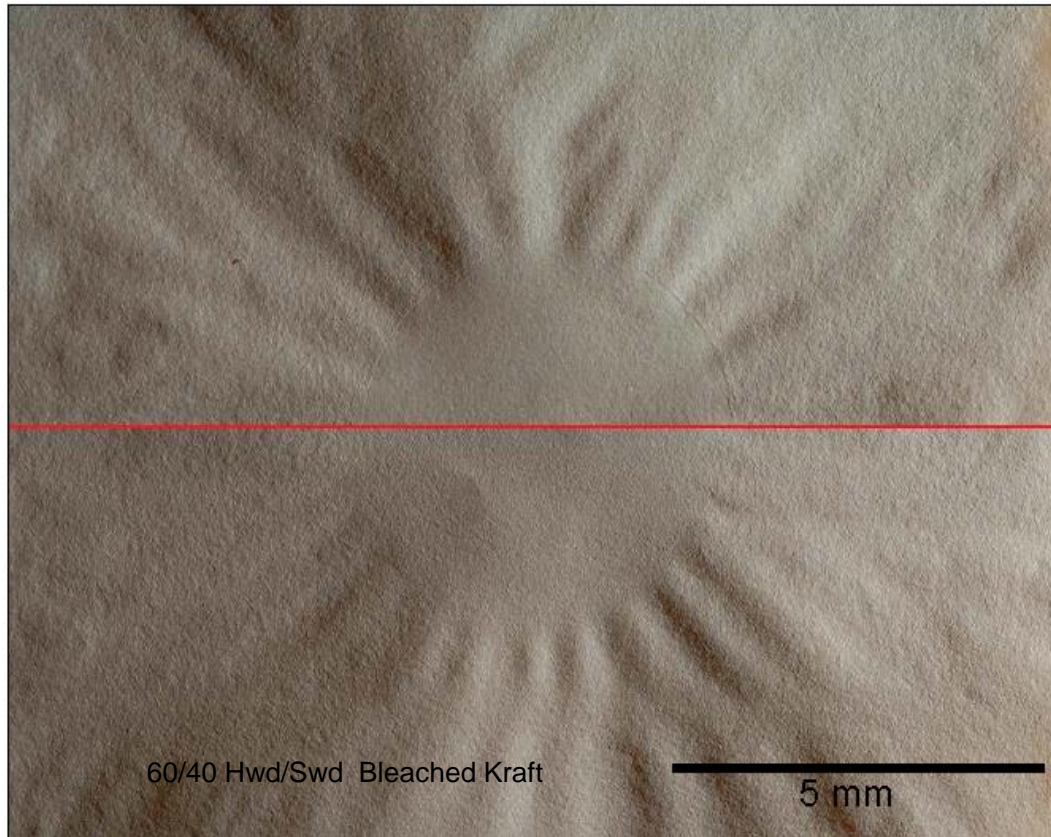
- Press Dryness Loss
- Minor Strength Loss

Large areas covered over with broke

- Sheet Crushing is likely
 - Can Increase Dryness
 - Will be huge Strength Loss

Any variation in venting
Means non-uniformity
In the sheet and this
Affects Runnability &
Breaks

Dryness variation into Dryers Causes Cockle



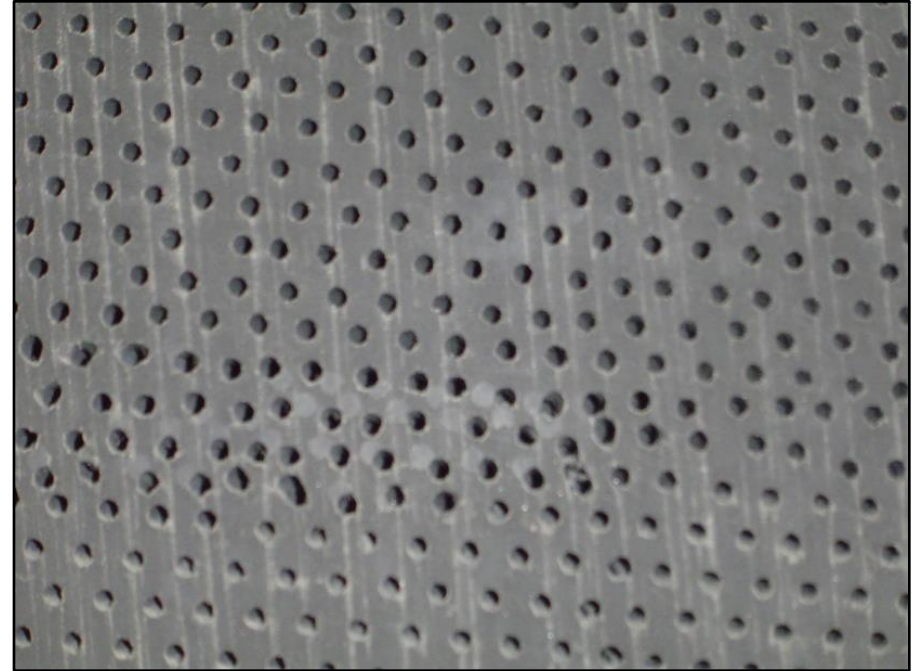
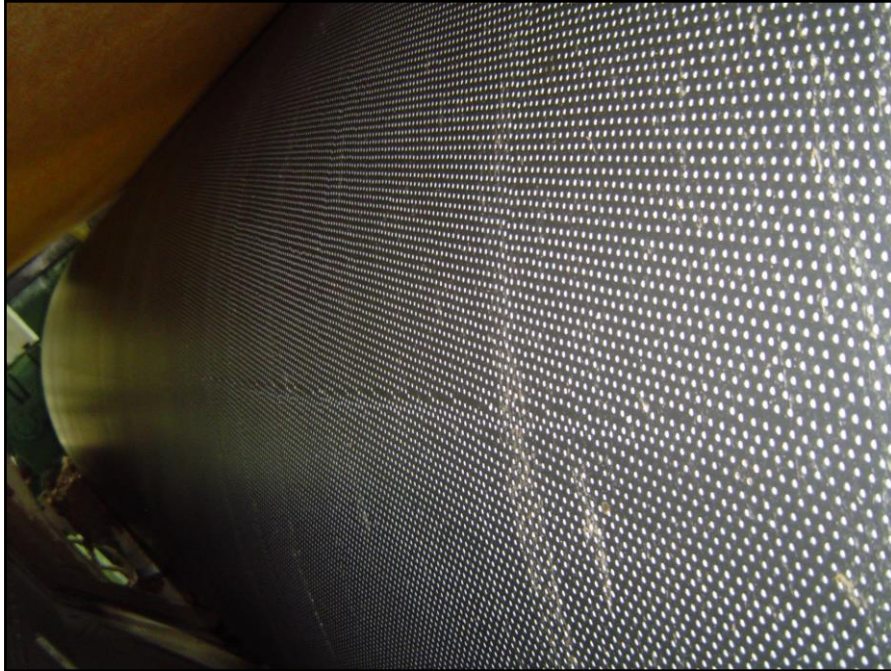
Wet Spot

- Dries Last
- Shrinks Last
- Pulls Cockle in to Surrounding Sheet

Wet Spot Has

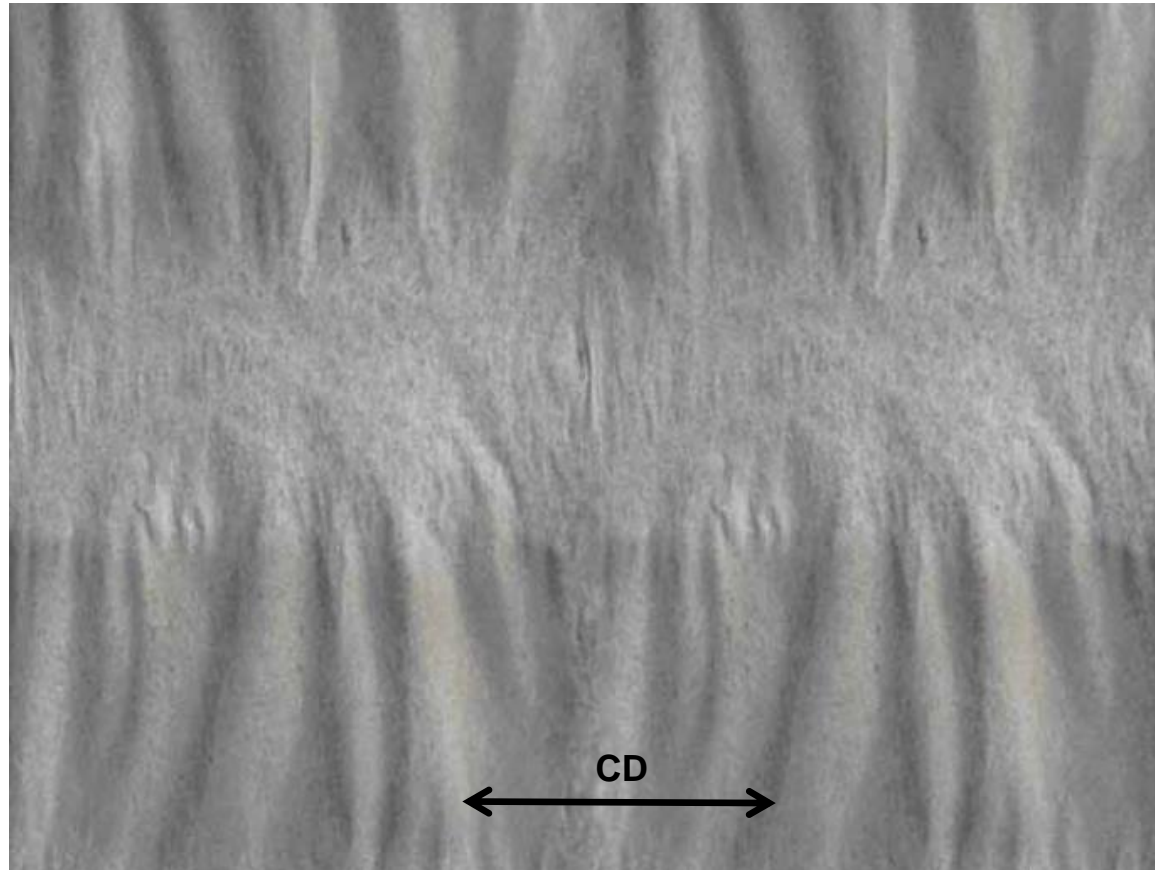
- Low Basis Weight
- Low Strength
- High Caliper
- High Opacity
- High Permeability

Non-Uniform Venting Pattern



Drilling faults create non-uniform venting

CD Wet Stripe Makes Adjacent MD Wrinkles



Uniformity

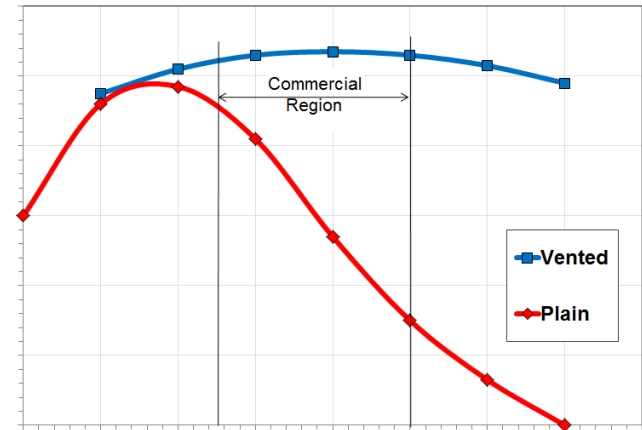
IF EVERYTHING Was Uniform, Breaks Wouldn't Happen, But just from the Press Section:

- Less than optimal Affective Volume causes press dryness loss & variation
 - Wet Tensile Strength varies ~7% per point of press dryness
 - Dry Strength varies ~1 to 4% per point of press dryness
- Sheet moisture variation causes
 - Release line variation from center rolls
 - Cockle in the dryers
- When Pressing non-uniformity meets with other sheet & machine variability, the sheet breaks and machine efficiency is lost

Increasing Affective Void Volume

What can we do?

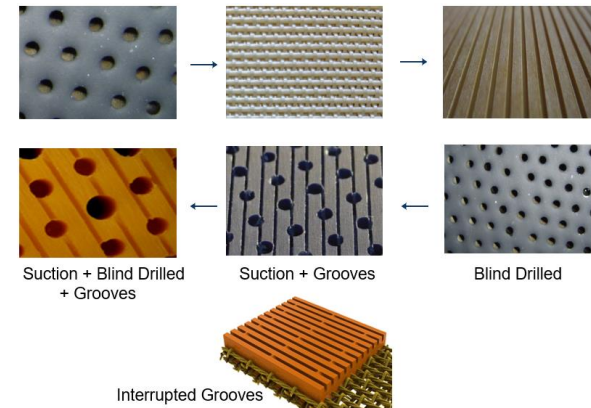
- Replace plain covers or belts with venting



Increasing Affective Void Volume

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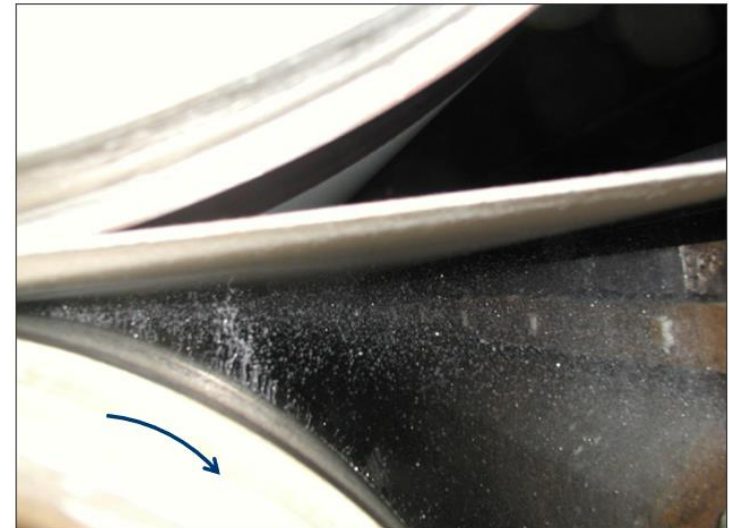
- Replace plain covers or belts with venting
- Adopt the right venting pattern for your application



Increasing Affective Void Volume

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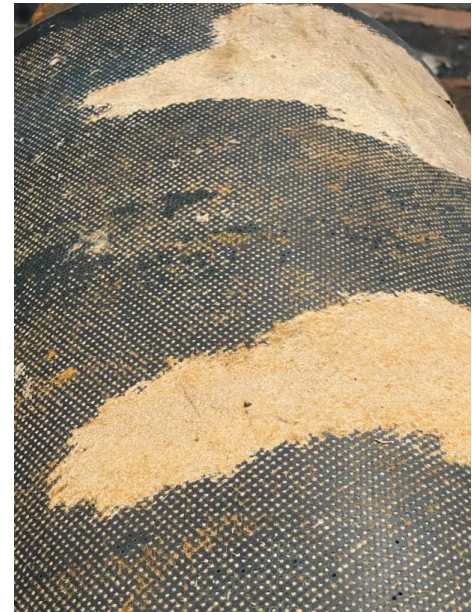
- Replace plain covers or belts with venting
- Adopt the right venting pattern for your application
- Adopt the right felt if nip dewatering is possible



Increasing Affective Void Volume

What can we do?

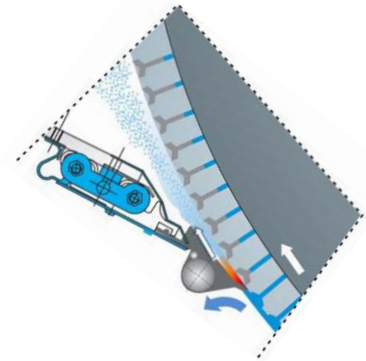
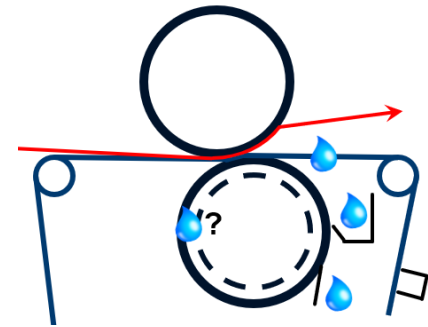
- Replace plain covers or belts with venting
- Adopt the right venting pattern for your application
- Adopt the right felt if nip dewatering is possible
- Keep the venting pattern clean



Increasing Affective Void Volume

What can we do?

- Replace plain covers or belts with venting
- Adopt the right venting pattern for your application
- Adopt the right felt if nip dewatering is possible
- Keep the venting pattern clean
- Extract post-nip water from the venting
 - Increase post-nip felt wraps
 - Collect all throw-off water in pans
 - Doctor the surface: single, double, foils, air blades



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