

Tissue 201: Improving Dry-End Performance

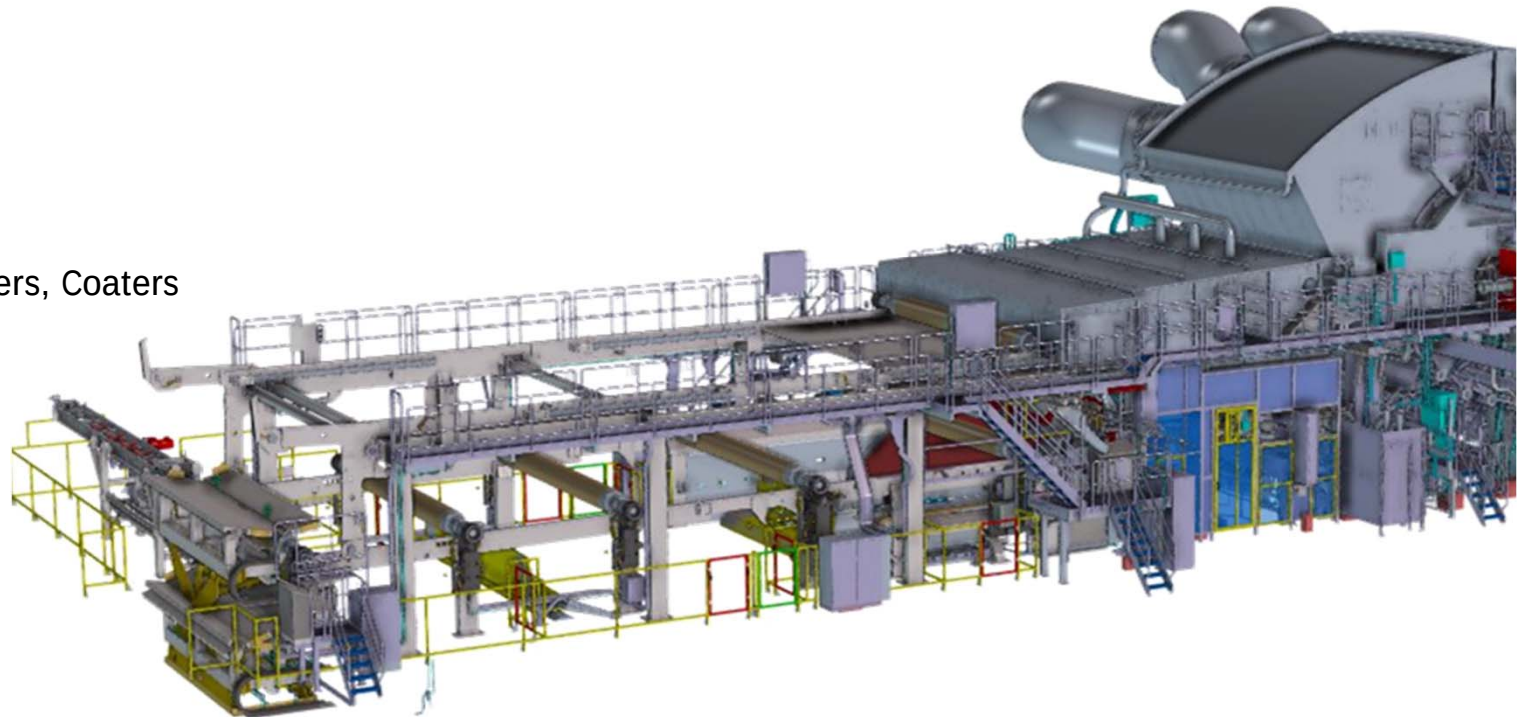
Presented by:

Todd Vanden Heuvel
Senior Product Mgr. – Reels, Calenders, Coaters
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Co-Presented by:

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Improving Dry-End Performance

Learning Objective

Participants Will Be Better Equipped to:

- Identify Runnability Problems and Opportunities for Improvement On the Dry End of the Tissue Machine

Improving Dry-End Performance

We Plan To Do More By Identifying:

- Common Sources of Dry-End Paper Losses
- Practical Ways to Reduce Those Losses
- Common Reasons for Unplanned Downtime Events

Improving Dry-End Performance

Pop Quiz

We Have Learned About:

- Wet End Chemistry & Equipment
- Forming Fabrics
- Cleaning and Conditioning
- Coating & Creping
- Calendering
- Drying

What Have We Learned to Make ?

Improving Dry-End Performance

Pop Quiz

BROKE !



Improving Dry-End Performance

Wisdom from a Papermaker:

“We Live From What We Sell...

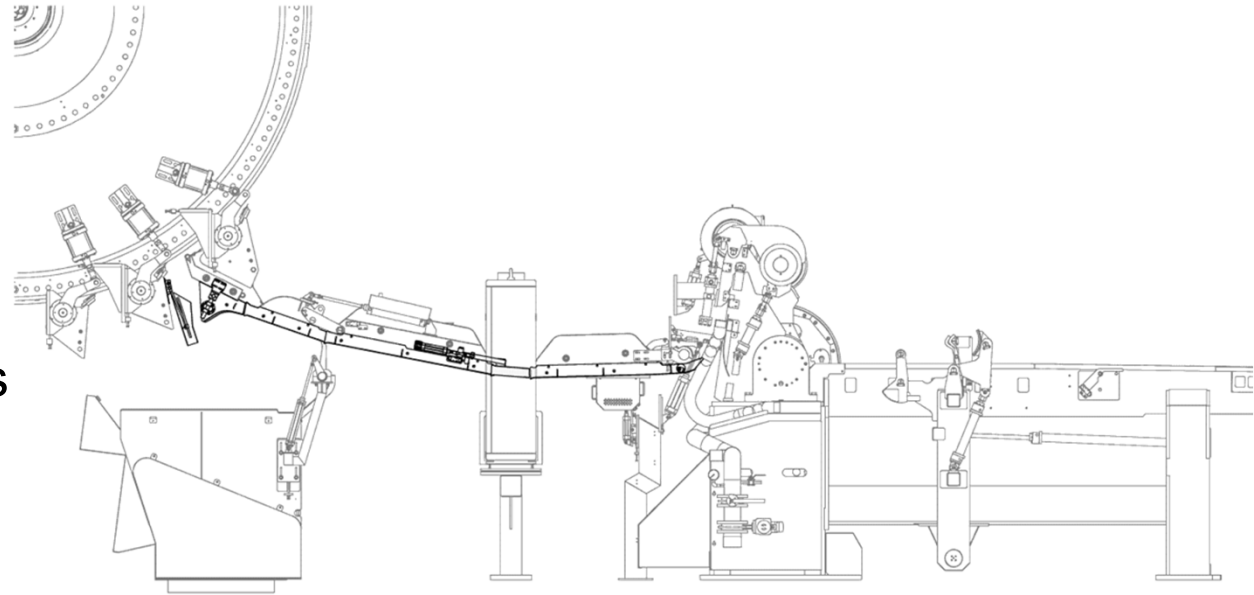
...Not From What We Produce.”

Klaus Roth

Improving Dry-End Performance

Agenda

- Threading
- Sheet Transfer
- Slitting
- Reel Turn-up Efficiency
- Roll Building
- Losses After the Machine
- Unplanned Downtime Events



Requirements of a Good Threading System

- Safe
- Provides Fast & Efficient Delivery of Tail
 - In Production Facilities, Time is Money
- Easy to Operate
 - Not Person or Shift Dependent
 - Preferably Automated (Pushbutton Threading)
 - Little or no interaction with personnel (Safety)
- Needs Little or No Maintenance
 - Reliable and Consistent

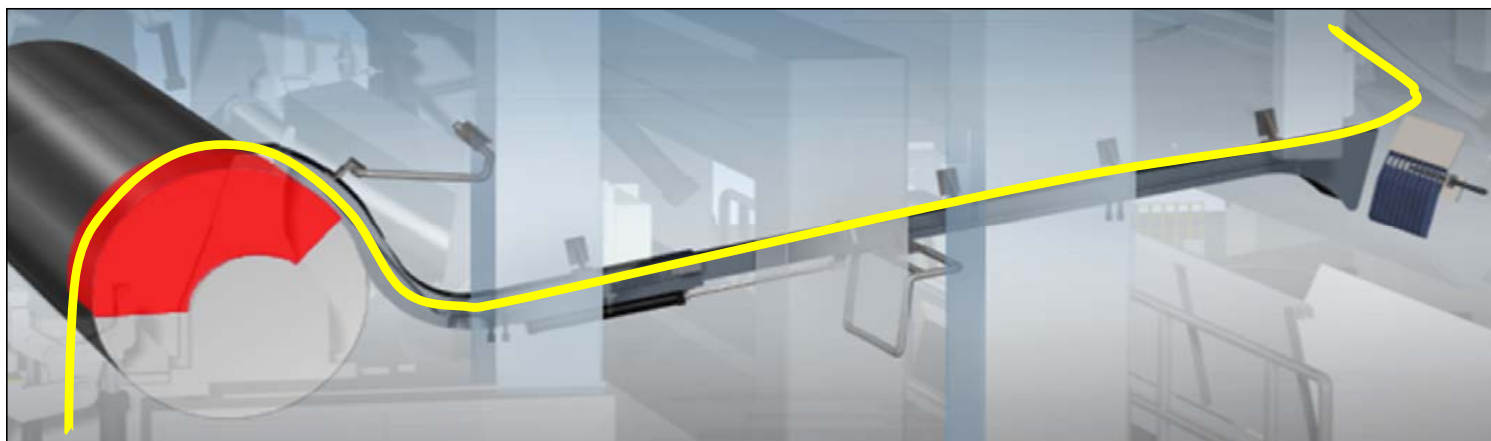


Various Tissue Machine Threading Methods

- **Hands**
 - UNSAFE: Do Not Use
 - More Common on Older Machines
 - Many Alternate Solutions Available
- **Ropes**
 - More Common on Older Machines
 - Convoluted Sheet Paths
 - Better Solutions Available
- **Air (Tube, Chute, etc.)**
 - Most Common
 - Simplest
- **Vacuum Belt**
 - Gaining Ground
 - Good for Complicated Sheet Runs

Air Threaders

Most Common Method for Tissue Machines

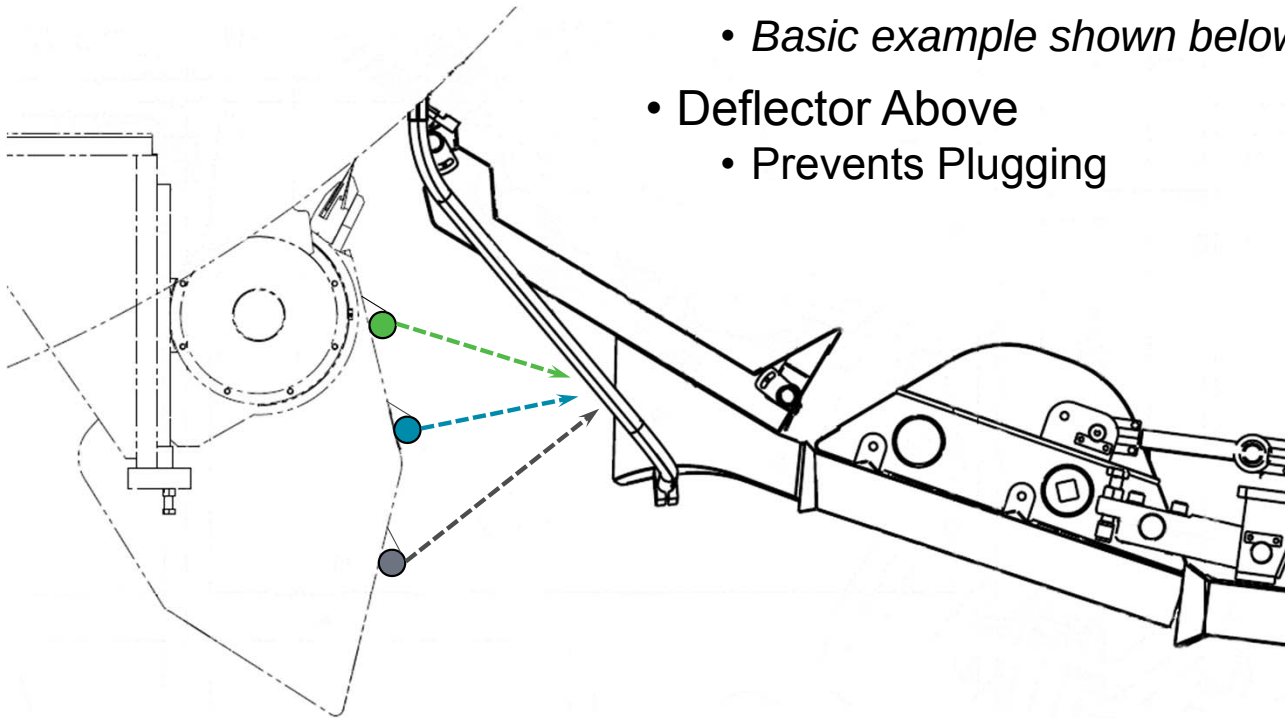


- Tail Transported in Air Channel
- Preferred Systems Have No Open Span to Reel
 - No Gaps in Threader = Higher Efficiency
- Air Pressure/Volume is Important
 - Most Common Issues include:
 - Too Much Air
 - Misalignment

Starting the Tail

At the Yankee

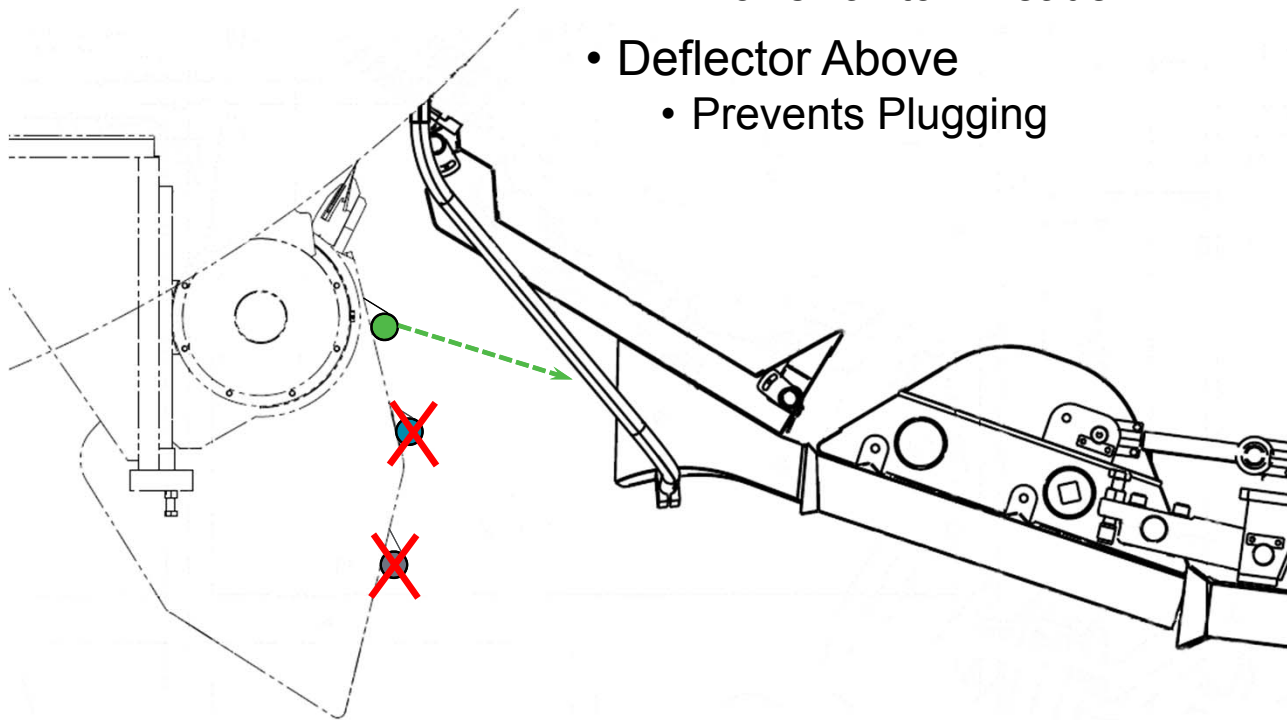
- Tail Shower (Blow Pipe) on Doctor
 - Blows Tail to Threader
 - *Basic example shown below.*
- Deflector Above
 - Prevents Plugging



Starting the Tail

At the Yankee

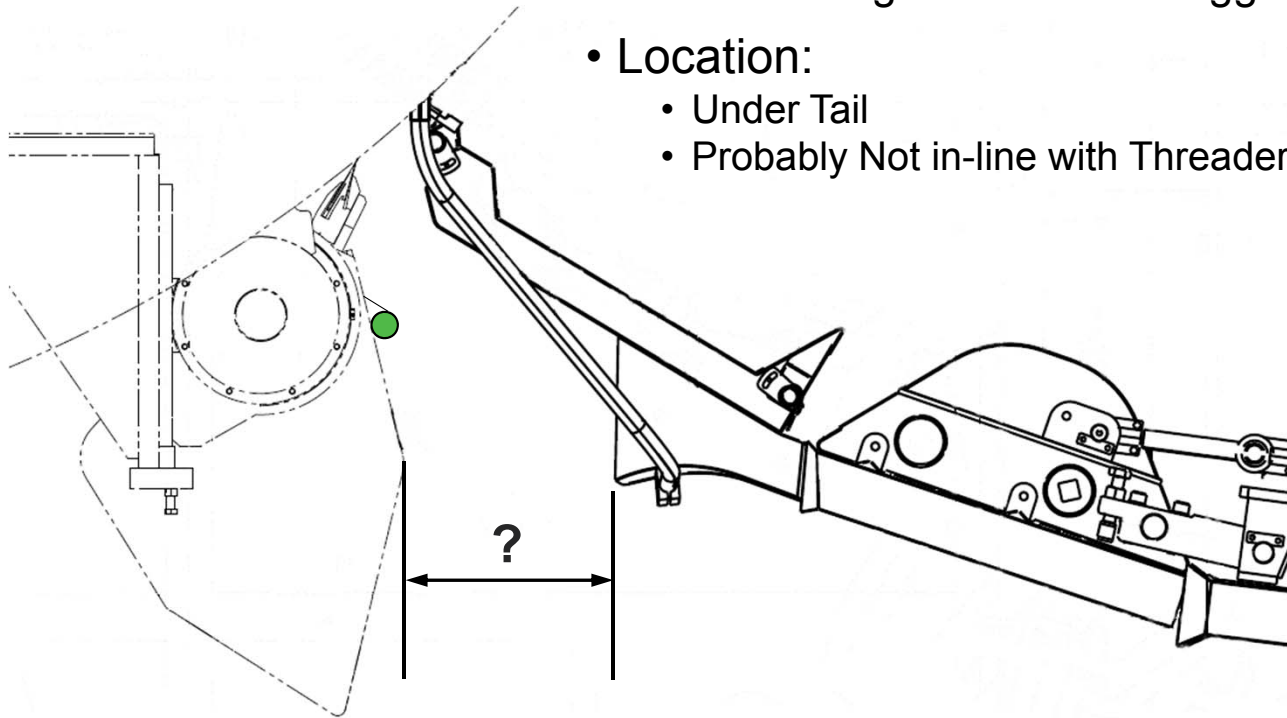
- Tail Shower (Blow Pipe) on Doctor
 - Blows Tail to Threader
- Deflector Above
 - Prevents Plugging



Starting the Tail

At the Yankee

- Small Distance to Threader
 - But Enough to Prevent Plugging
- Location:
 - Under Tail
 - Probably Not in-line with Threader



Transporting to the Reel

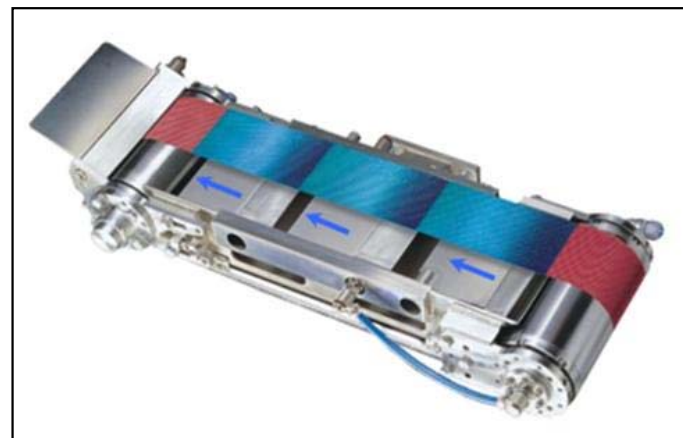
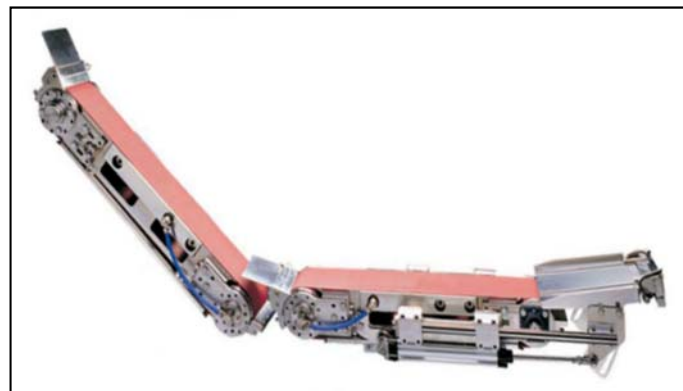
Continuous Threader – No Gaps

- Moveable Sections
 - Position to Thread
 - Retract for Running
 - May Be:
 - Pivoting
 - Translating
 - Telescoping
- Integrated with Sheet Support
 - Less Tail Slack
 - Smooth Transition from threader to Sheet Path
 - Better Threading Efficiency



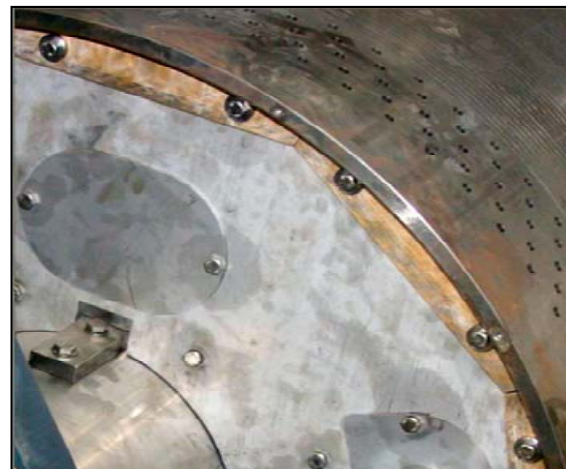
Vacuum Belt Threading

- Positive Mechanical Contact With Tail
- In-line with Tail
 - Below & Above
- Optimum Tail Gripping
 - High Vacuum Levels
 - Sectional Vacuum Zone Adjustment
- Not Sensitive To Tail Width Changes
- Can Set Exact Speed & Measure
 - Typically Reel Speed +10%
- Fast, Reliable Threading
 - More Time on the Reel
- Must Evaluate Initial Cost / Long Term



Reel Drum Vacuum Zone

- Holes Under Tail Area
- Vacuum Box Provides Suction
- Tail Locked to Reel Drum
- Carries Tail to Nip Point
 - Primary Arms
 - Secondary Arms
- Vacuum Sources
 - Dedicated Blower
 - Machine Vacuum System



Reel Drum Vacuum Zone

Possible Issues

- Tail Pulled Into Seals
 - Creates Friction
 - Safety Hazard
 - Possible Source of Fires
- Solution: External Cover
 - Designed to Isolate Vacuum
 - Prevents Tail from Entering
 - Eliminates Fire Hazard
- HOUSEKEEPING!
- REGULAR MAINTENANCE!



The Tail is to the Reel

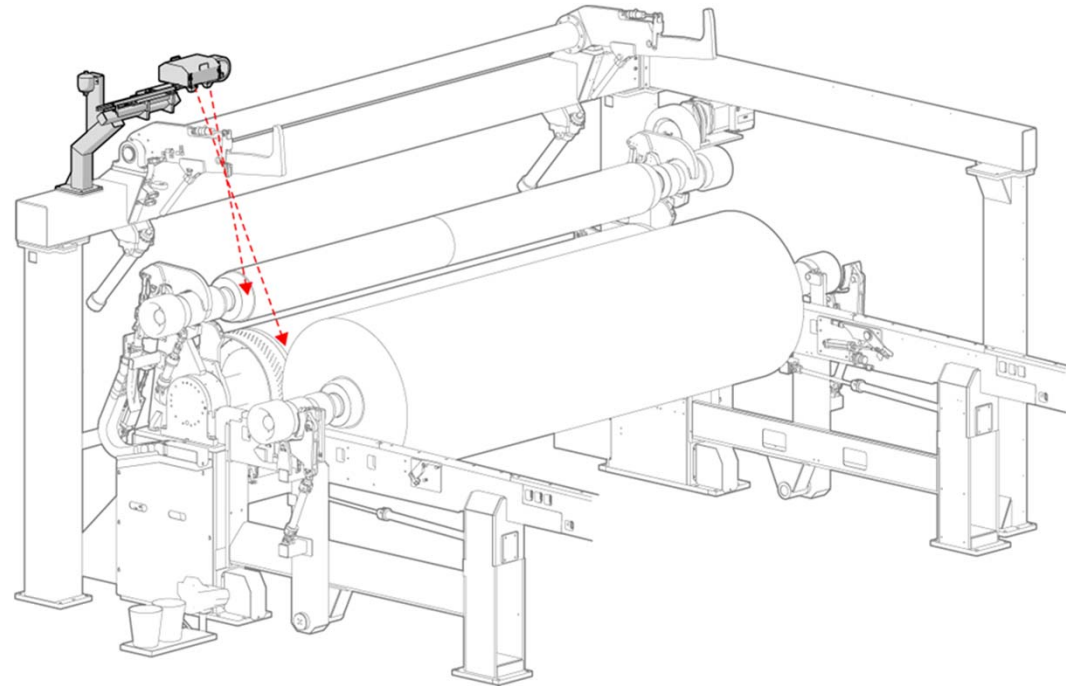
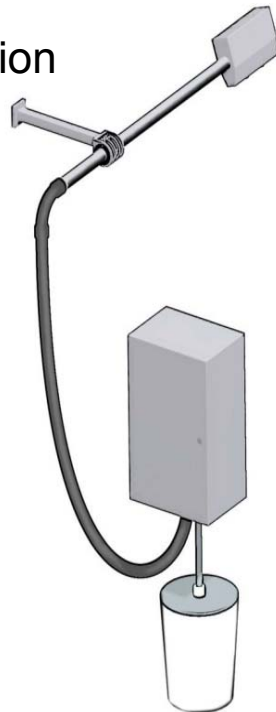
Are We Done, Yet ?



Securing the Tail for Winding

Wrapping onto a Spool or Partial Roll

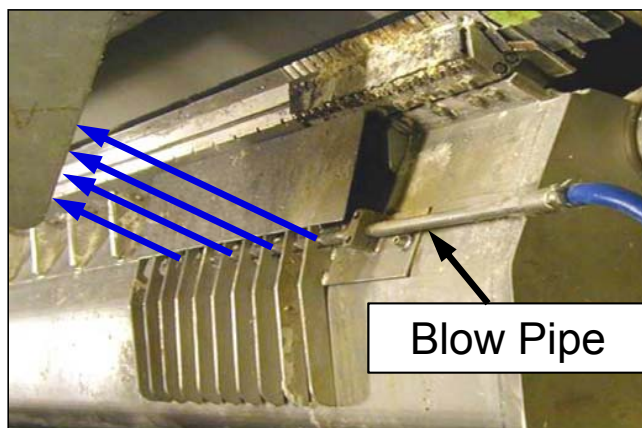
- Manual or Automatic
 - Hand - Held
 - Remotely Operated
 - Glue, Water, Combination



Putting It All Together

Starting at the Yankee

- Blow Stable Tail Into Threader
- Wrap in Reel Spool / Partial Roll
- Widen to Full Sheet



Putting It All Together

To the Reel



Assume 5,500 fpm (1,676 mpm) Reel Speed; Dry Crepe Bath (low bulk); 17.5" OD Core

What is the approximate build-up on the Threading Side... before sheet reaches full width?

~0.27" (6.8 mm) & ~97 wraps X 2 !
0.54" (14 mm)

Why is Efficient Threading Important ?

Time is Money (Production)

Threading Time	3.0 minutes
Operating Days / Year	350
Number of Sheet Breaks / Day	10
Time Threading / Year	175 hours (7.3 Days)
w/ Profit / ton = ~\$400 (11# @ 6500 fpm)	~\$667,000

Reducing Threading Time by (1) Minute, Increases Annual
Production by 58.3 hrs – Almost (2.5) Days

Threading Issues: What to Look For...

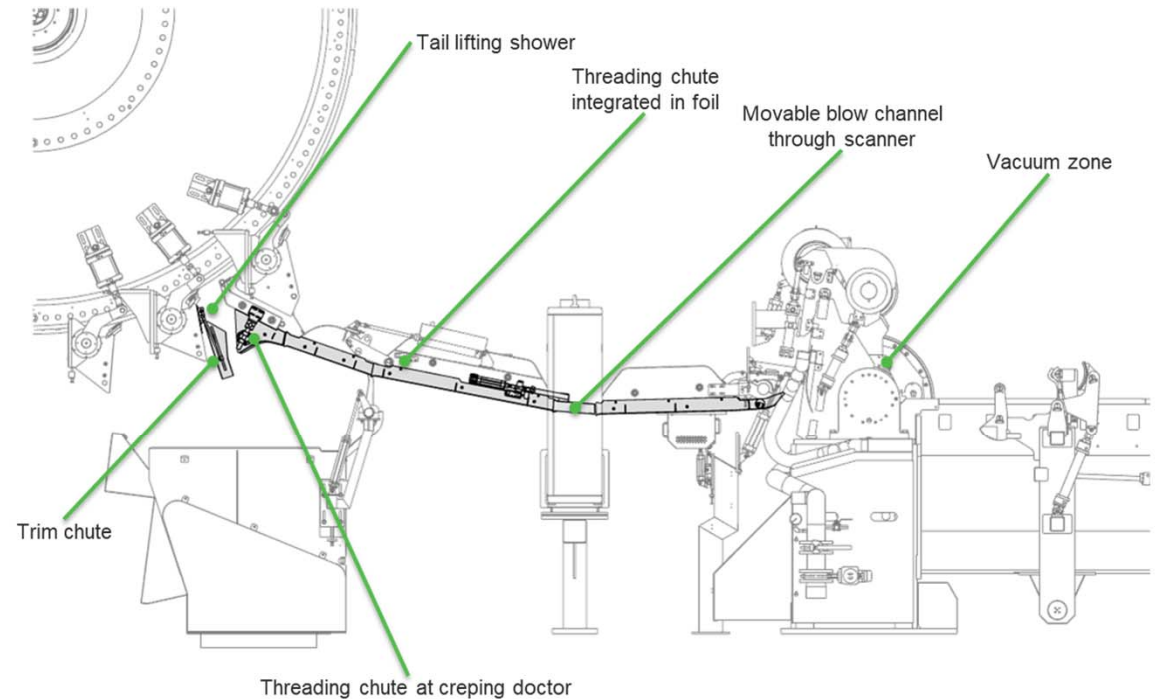
Does the Tail:

- **Successfully Enter the First Section**
 - Blow Pipe Properly Set and Secured
 - Air Aimed Into / Onto Threader
- **Stay In / On Threader to Reel**
 - Alignment, Air Pressure, Vacuum
- **Wrap the Empty Spool or Partial Roll**
 - Empty Spool vs. Partial Roll
 - Glue Assist
- **Widen to Full Sheet**
 - Tail Cutter Speed, Cut Quality
 - Double Tail on Threading Side (Particularly on Empty Spools)
 - Conical Rolls, Gaps with Reel Drum, High Nip Intensity
 - Faster Speed, Lower Nip Pressure, Break Excess Tail

Sheet Support

Full Support: Yankee to Reel

- Fast Threading
- No Open Gaps
- Flat Tail to Vacuum Zone
 - Easy to Catch
- Adjustable for Grade and Speed
- High Efficiency > 90%



The tail cutter or beaded-wire create a tail in the wet end (~100mm wide)



The tail threading equipment transfer the tail to the reel



Widen the sheet to full width

Foil Types

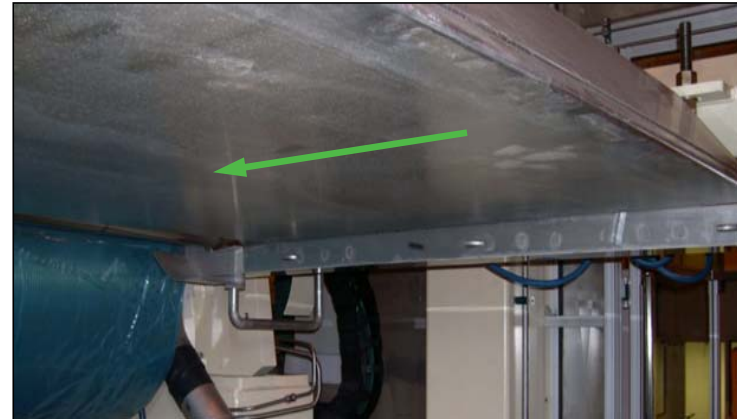
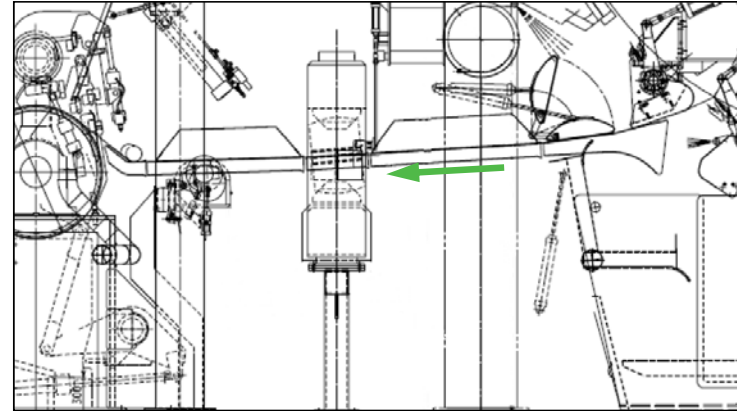
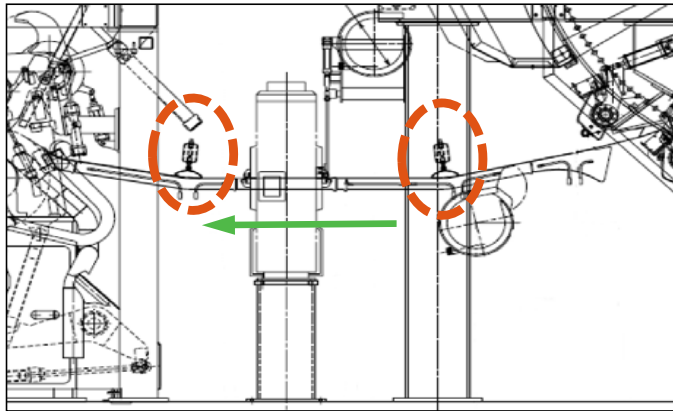
Several Options Available – Same Goal

- Pipes, Bars, Wing Type
 - Narrow and Slow Machines
 - Smaller Spans
 - Where Dust is Less Concern
- Passive Support
 - Inexpensive
 - Covers Wide Areas
 - Good on Most Grades
- Active Support
 - Coanda Air, Non-Contact
 - More Complex (More Parts)
 - For Premium Grades



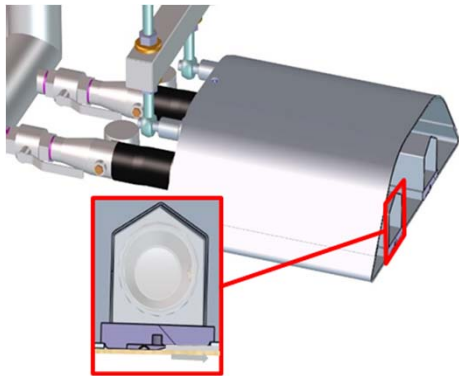
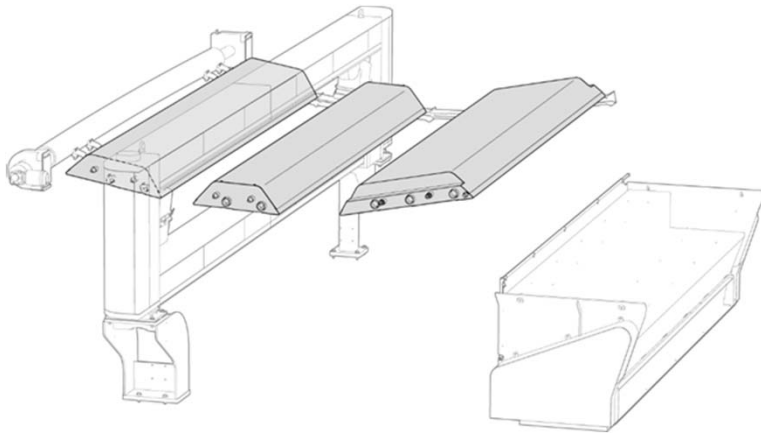
Passive Foils

Wing & Flat Designs



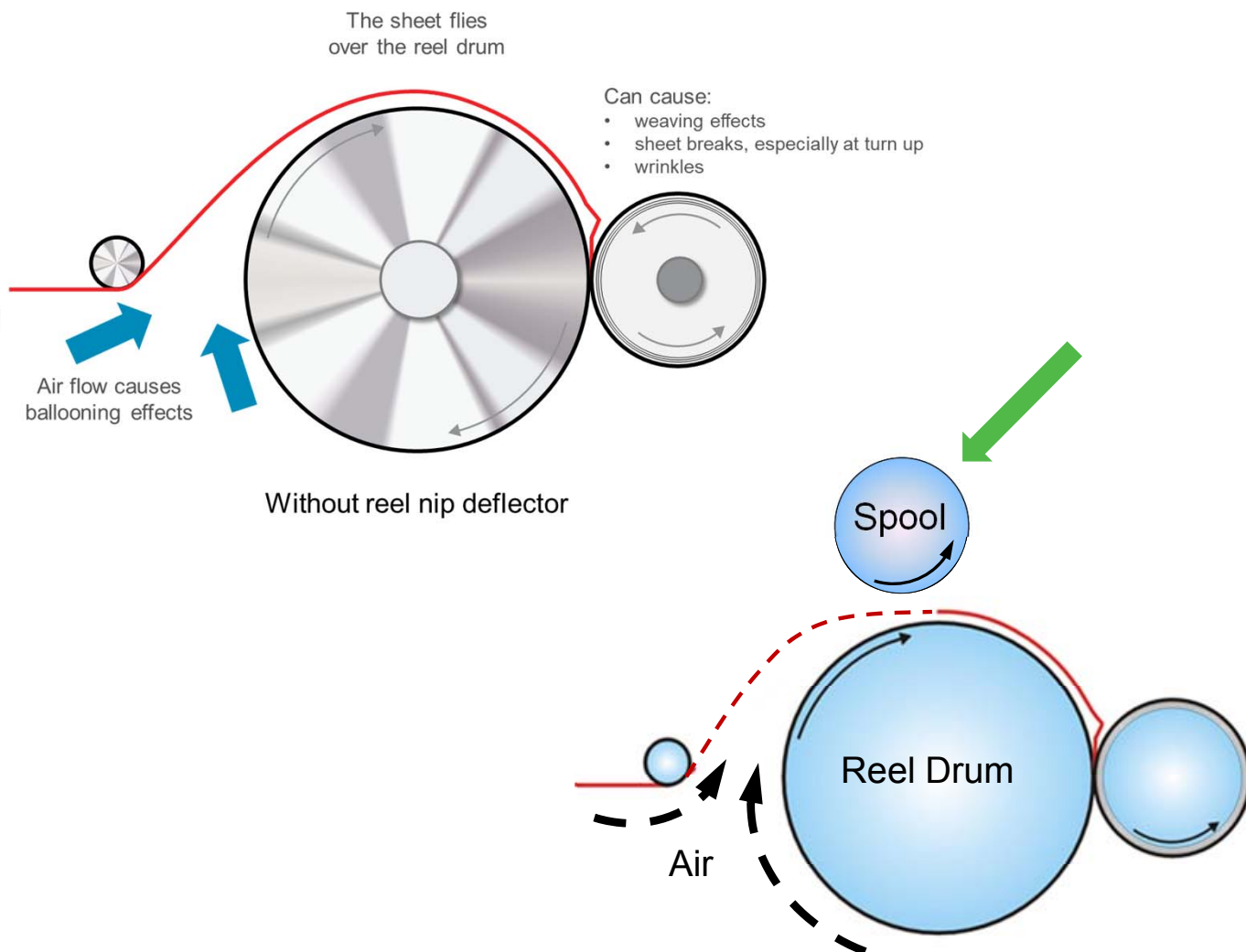
Active Foils

With & Without Dust Removal Capability



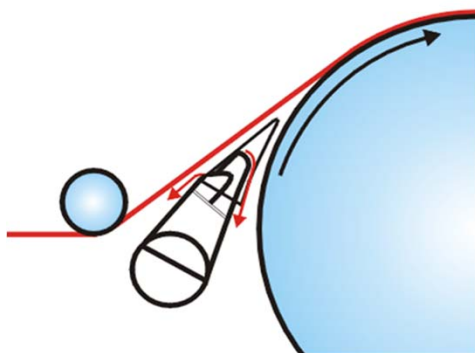
Reel Boundary Air

- At High Speeds:
 - Sheet Lifts Off Drum
 - Reel spool spinning will also impact the sheet
- Results in:
 - CD Instability
 - Wrinkles / Foldovers
 - Sheet Breaks
 - Particularly at Turn-up



Reel Nip Deflector

Two Solutions



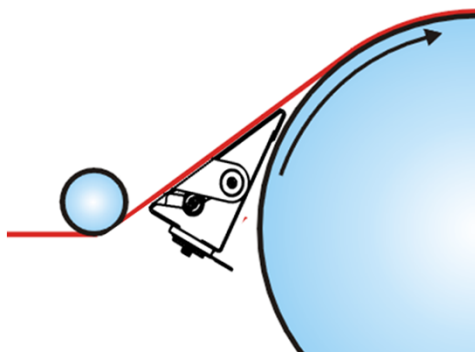
Reel Nip Blow Box

Adjust airflow for different grades

No contact with sheet

Less dust

Web cleaning effect



Reel Nip Deflector

Passive

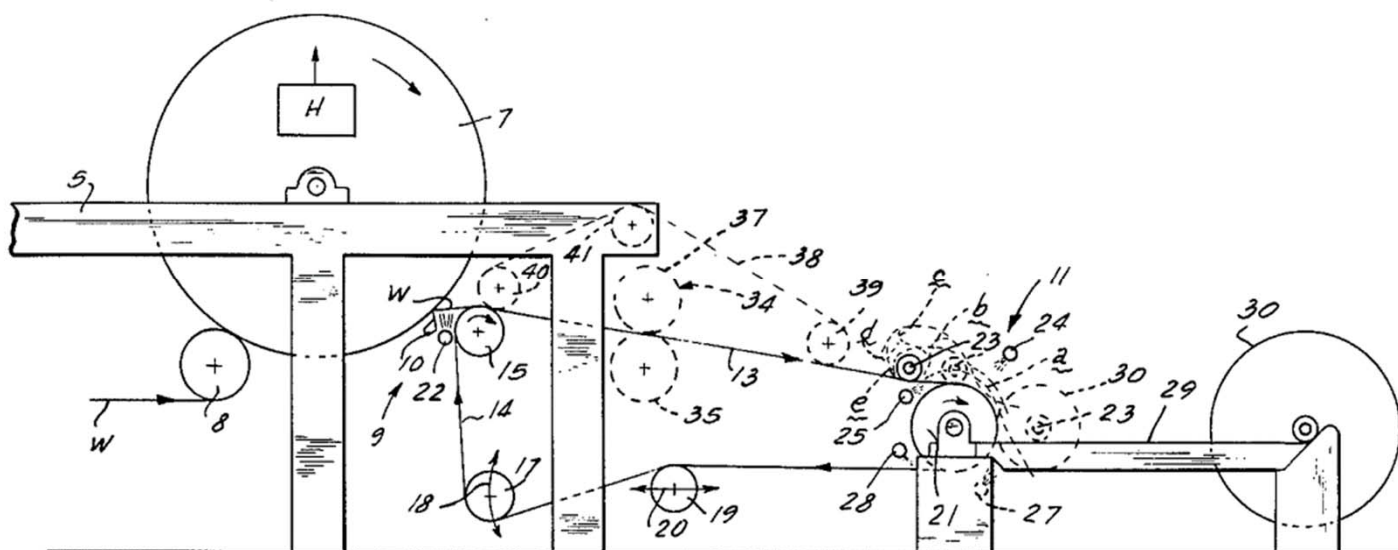
In contact with sheet

Generates more dust



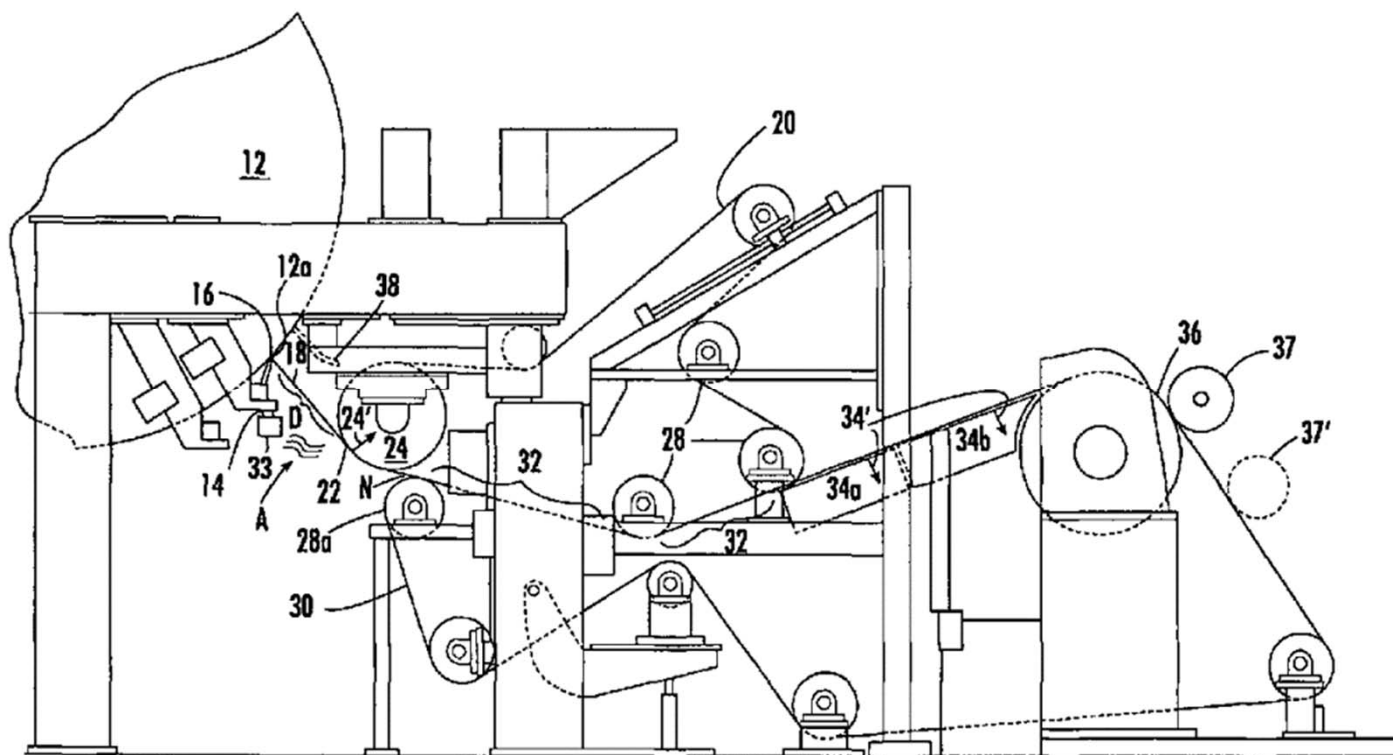
Dry End Sheet Handling Limitations

1978 Patent – Belted Sheet Support

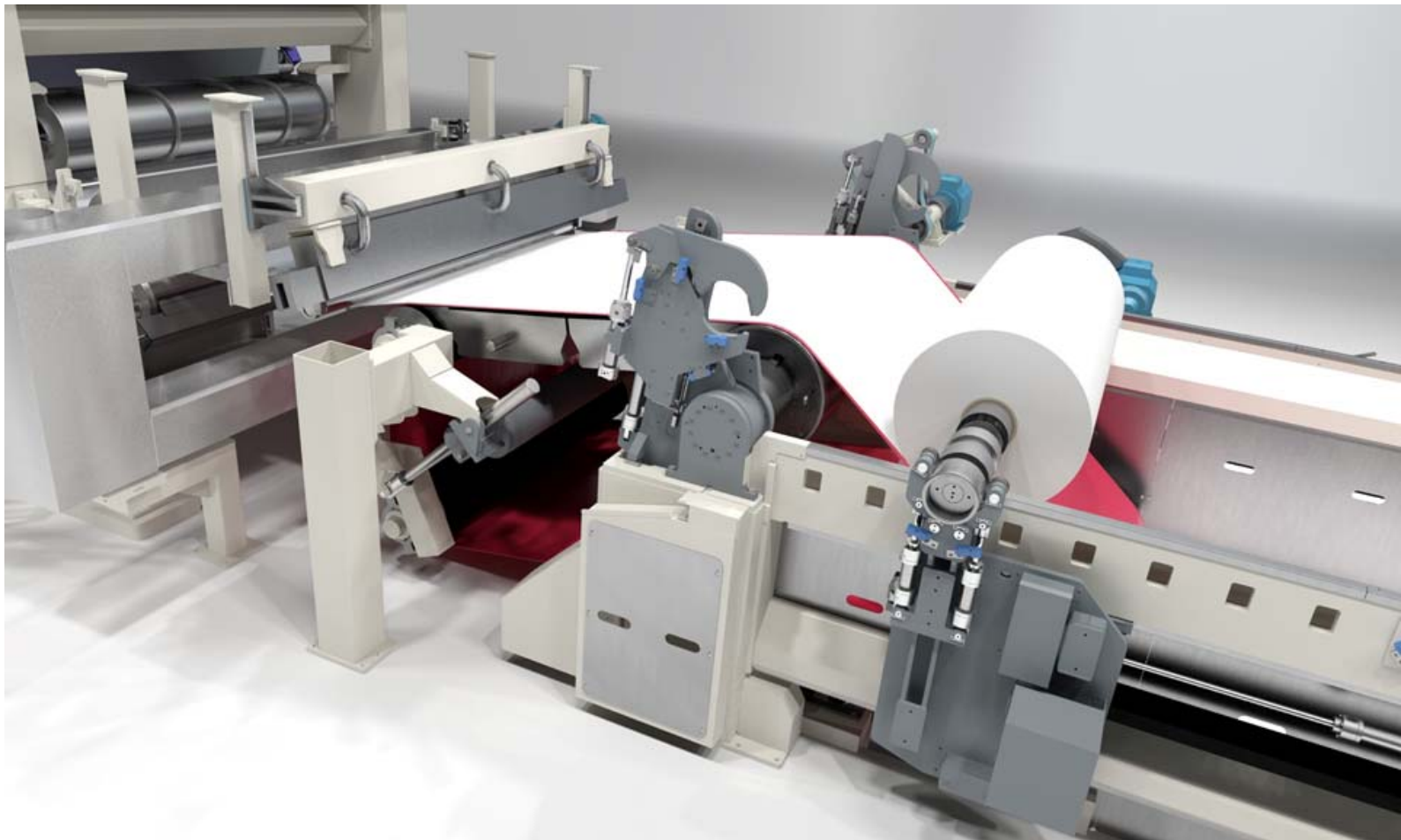


Dry End Sheet Handling Limitations

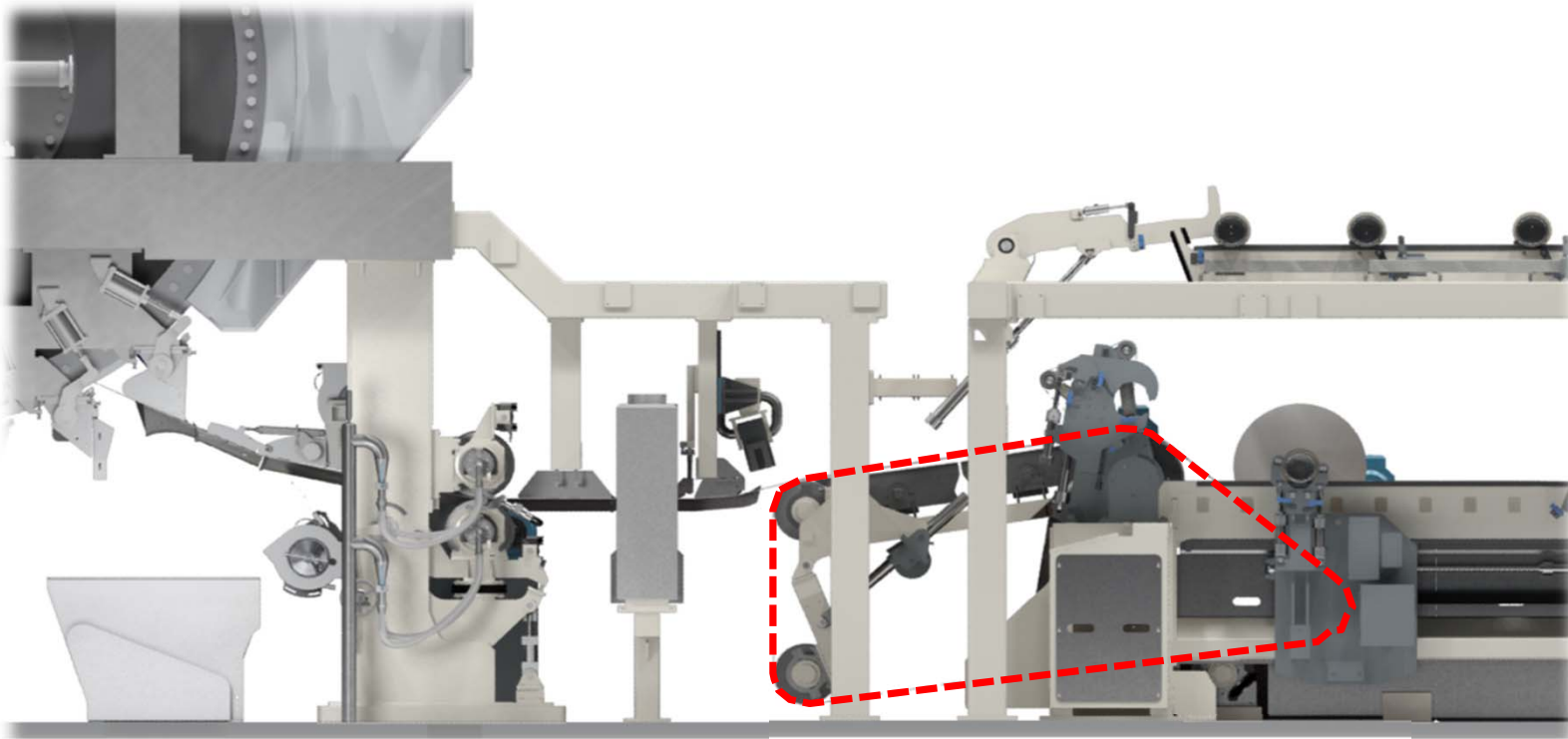
2006 Patent – Belted Sheet Support with Jumbo Roll Windup Support



Belted Reel

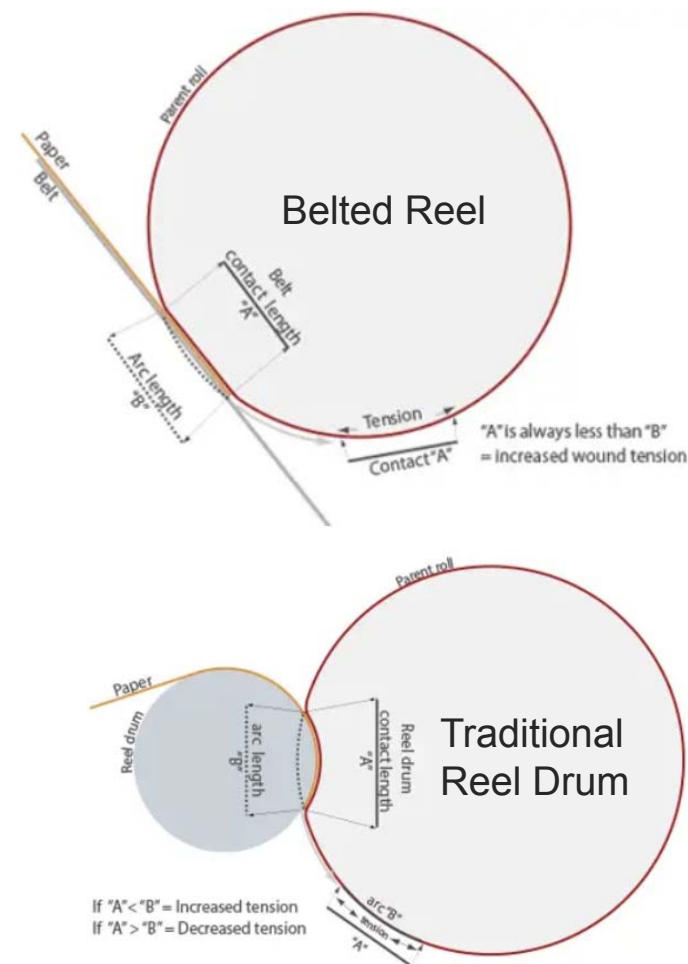
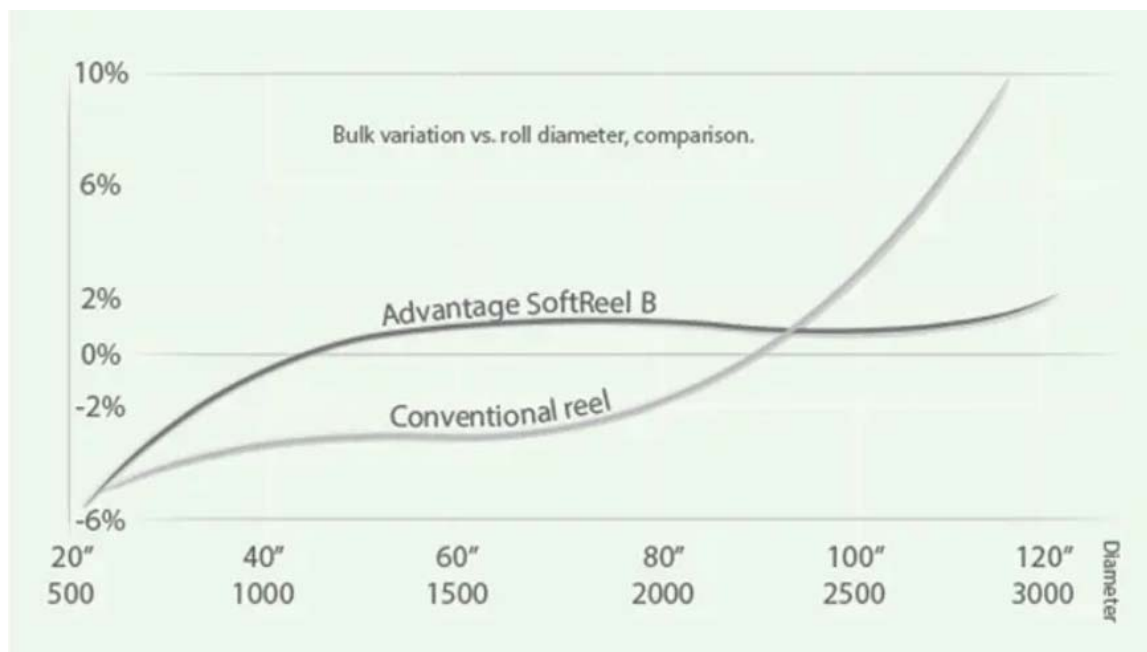


Belted Reel



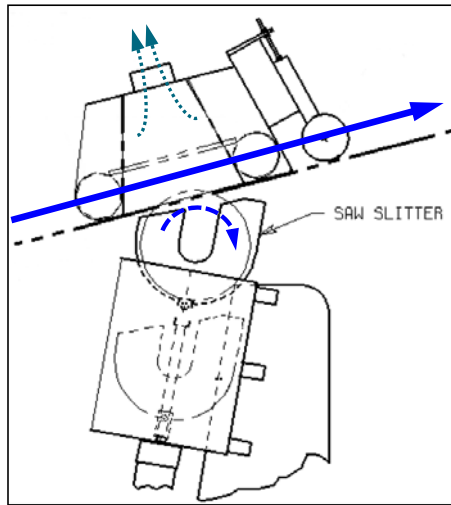
Permeable fabric/belt

Bulk Variation vs Roll Diameter



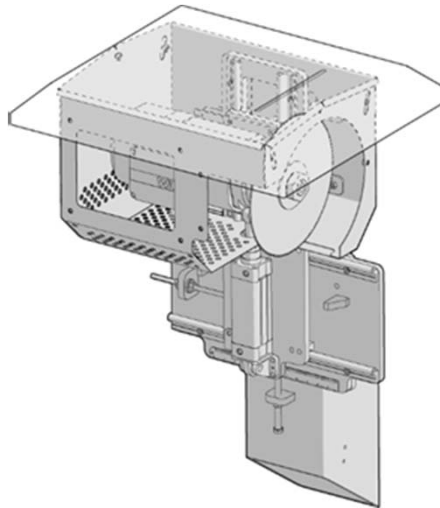
On Machine Slitting

Eliminates Need to Rewind



Saw

- Low Initial Cost
- Rotating Blade – With Sheet
- Faster than Web Speed
- Rips Fibers – Stretches Edge
- Not Used for Narrow Edge Trim

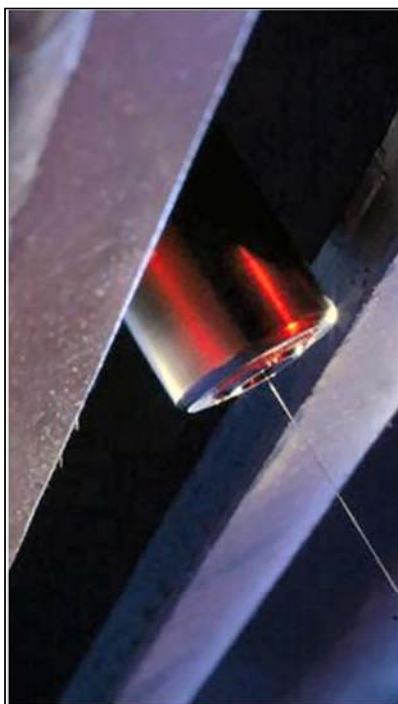


Waterjet

- Higher Installed Cost
- Redundant Nozzles Available
- High Pressure, Narrow Jet
- Severs Fibers, Clean, Less Dust
- Used for Edge Trim

On Machine Slitting

Safety



- Always Be Careful Near Machinery
 - Keep It Well Guarded
 - Lock It Out !
- Saw Blades Can Spin Up to 3600 rpm
- Good Waterjet Streams Are NOT Visible
 - 0.004" – 0.005" Diameter -- (0.1 mm)
 - Pressures:
 - 3,500 – 25,000 psi
 - 24 – 172 MPa
 - Also Used to Cut Concrete and Metal
 - Humans Are Not as Durable !



Common Turn-up Types

Gap with Bubble Variations



Bubble



Bubble with Glue



Tail Turn-up with Glue

Common Turn-up Types

Waterjet



Other Types of Turn-ups

- Double-Sided Tape
 - Consumables
 - Some versions feature blow-off cover to aid with dust on tape
- Paperband Tape
 - Consumables
- Narrow to a Tail
 - Time



Why Are Efficient Turn-ups Important ?

Time is Money (Production)

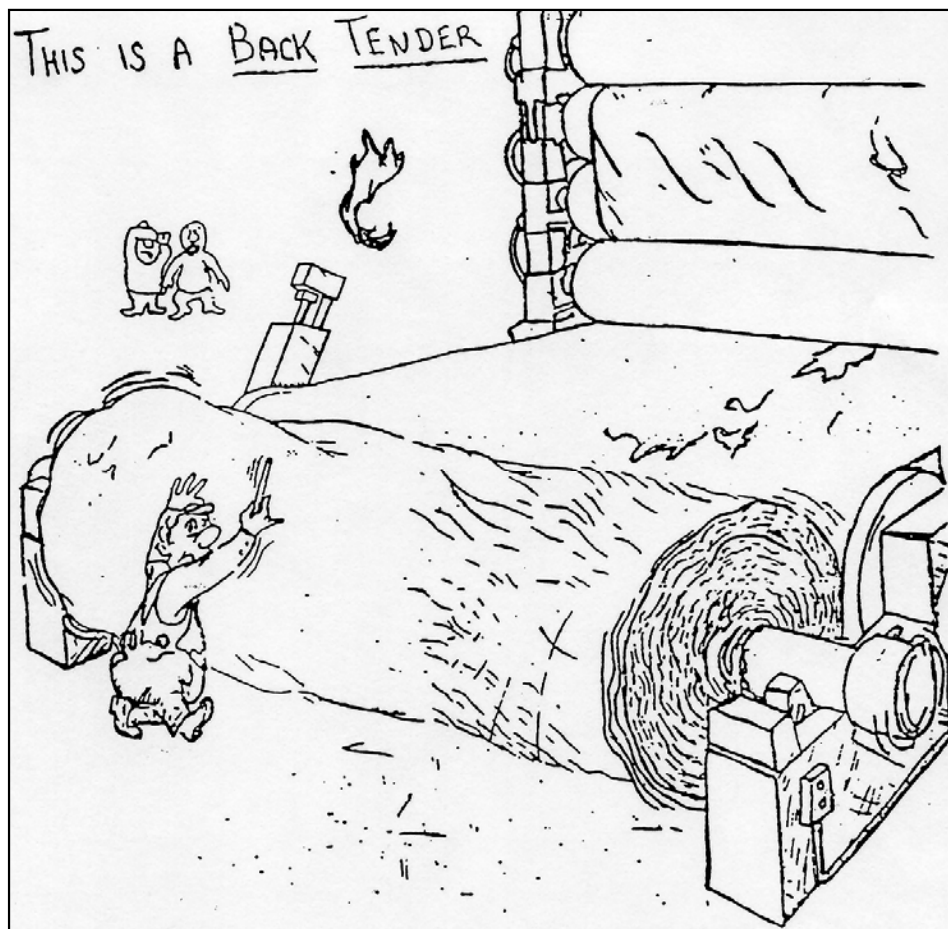
Turn-up Efficiency	90%	99%
Turn-ups / Day	56	56
Successful Turn-ups / Day	50.4	55.44
Missed Turn-ups / Day	5.6	0.56
Time Lost per Miss (min)	2.0	2.0
Time Lost per Year (350 Days), hrs	65.3	6.53
Additional Turn-ups / Year		1764
Time Saved from Efficiency Increase, hrs		58.7
Time Saved from Efficiency Increase, days		2.4

Why Are Short Turn-up Times Important ?

Time is Money (Production)

Turn-up Process Time	10 sec	2 sec
Turn-ups / Day	56	56
Successful Turn-ups / Day (99%)	55.44	55.44
Time Lost During Turn-ups per Day, min	9.2	1.8
Time Lost per Year (350 Days), hrs	53.6	10.5
Additional Production from Faster Turn-ups, hrs	--	43.1
Time Saved from Efficiency Increase, hrs		58.7
Total Production Saved, hrs		101.8
Total Production Saved, days		4.2

Paper Losses At The Reel



Beginners' Guide to Papermaking: 'Jake' Jacobs

Paper Losses At The Reel

Do Not Ignore Safety!

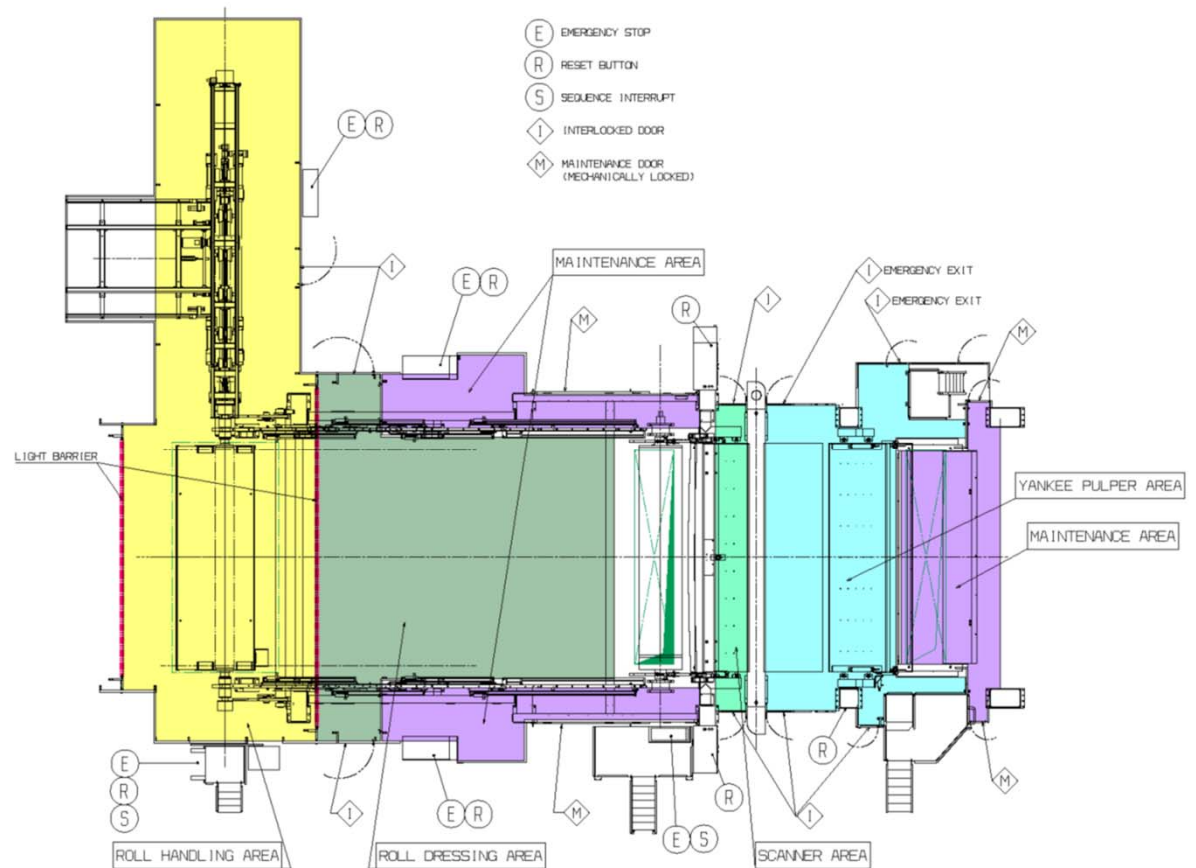
Safety Leads to Quality and Efficient Production

Safe Operating Access (SOA)

Different **zones** ensure safe working environment in the dry end

Guards, fences and nets prevents access to potential hazards

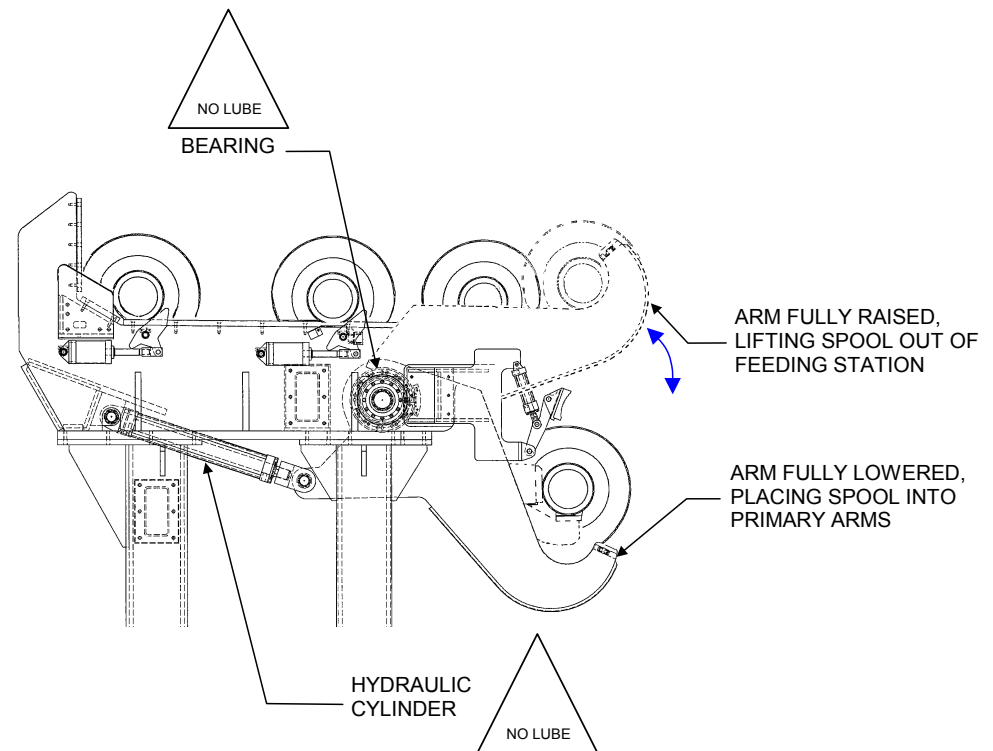
Interlocked gates allows access to working areas in a safe way



Paper Losses At The Reel

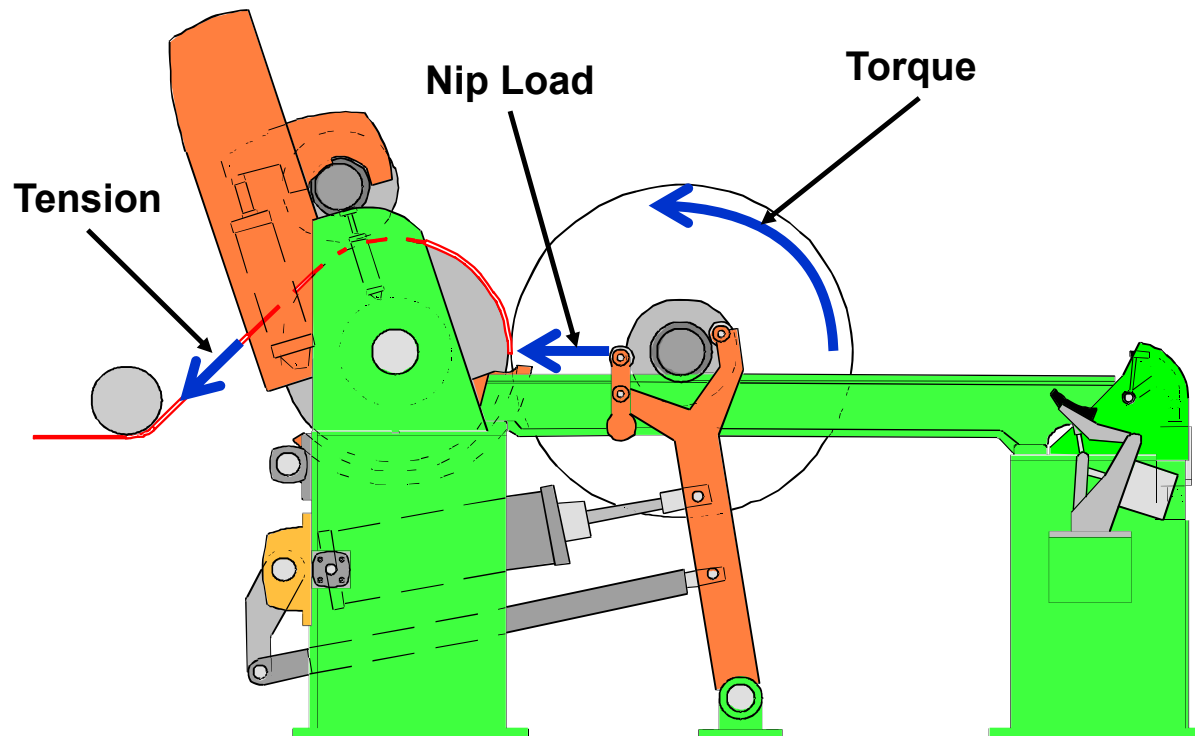
Do Not Ignore Maintenance! Example Shown....

- Proper Maintenance will Reduce Unplanned Downtime
- Monthly maintenance
 - Inspect all cylinders for operation and leaks. Repair kits are available. See supplier datasheets.
- Quarterly maintenance
 - Inspect equipment for worn parts and replace them as necessary.
- Annual maintenance
 - Check alignment of the lowering arms. Refer to Machine Manual. "Maintenance Procedures".
 - Inspect bearings/bushings for wear and replace as needed.



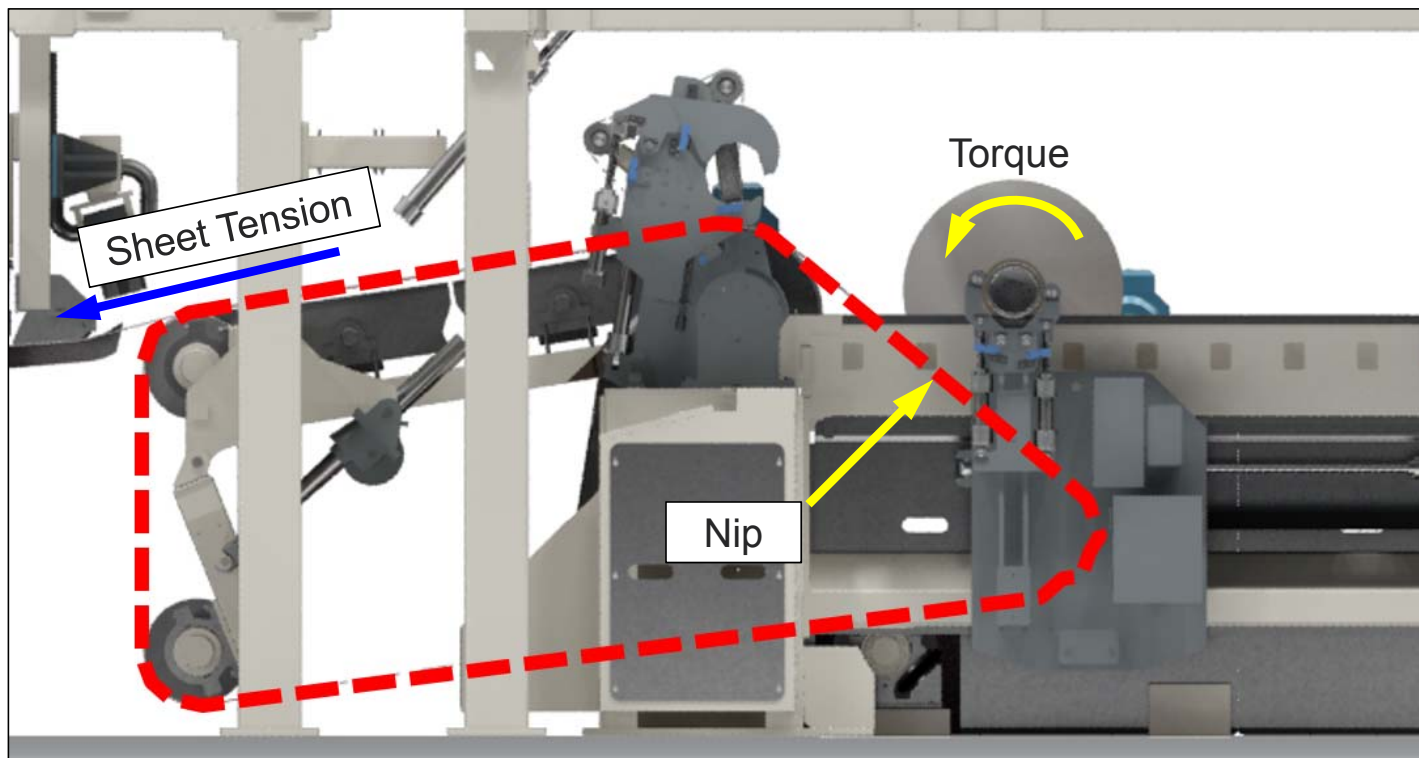
Winding Tools

Tension, Nip, Torque



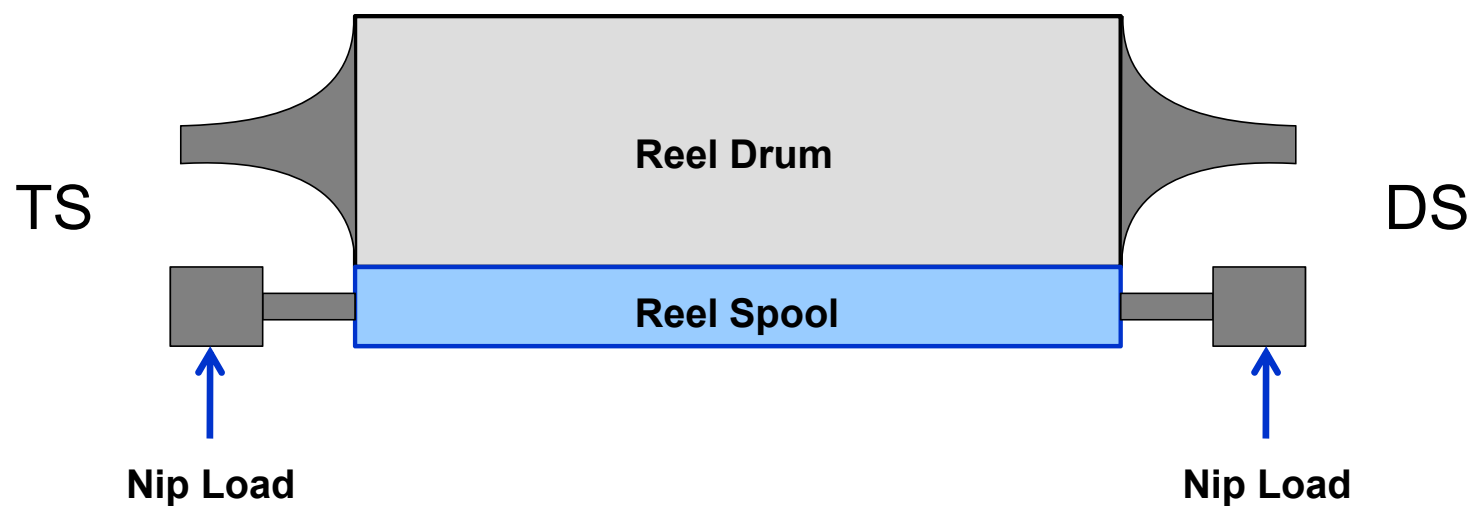
Winding Tools

Tension, Nip, Torque



Reel Nip Loading

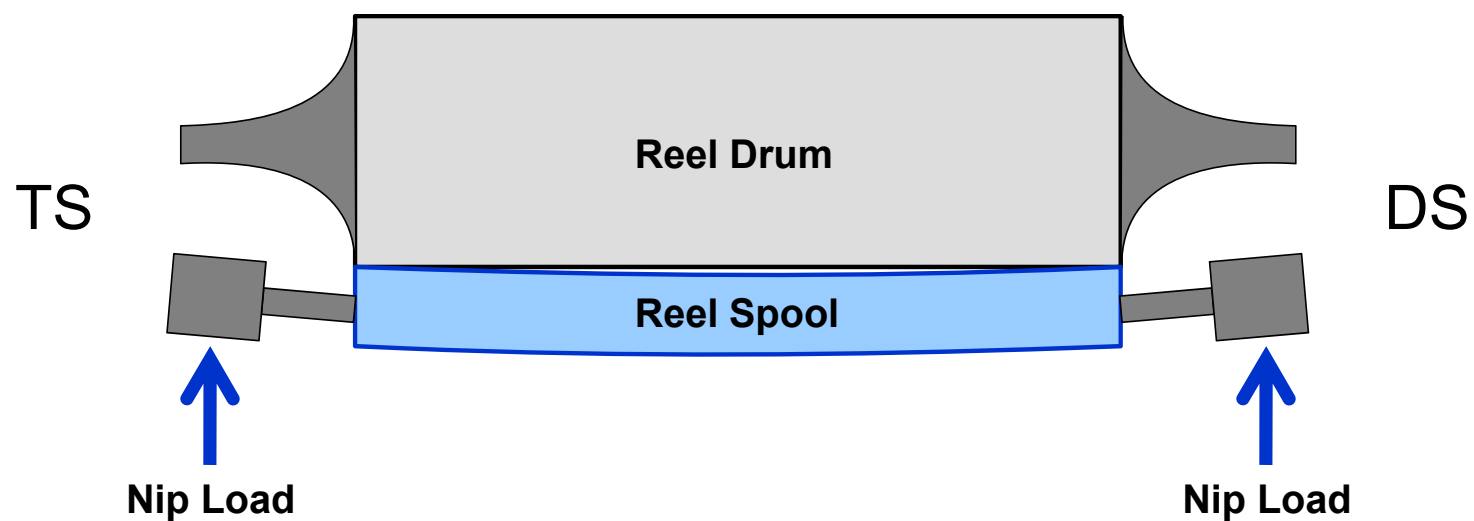
Uniform Nip Load



Viewed from Above Reel

Reel Nip Loading

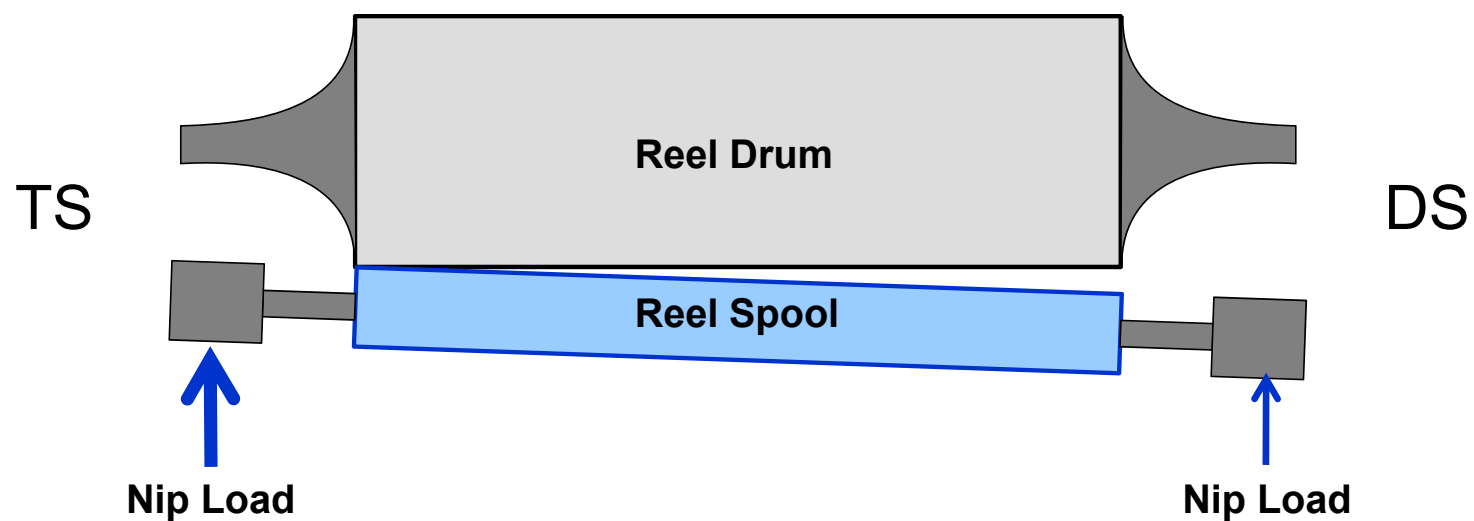
High Nip Load – Tending and Drive Side



Viewed from Above Reel

Reel Nip Loading

High Nip Load – Tending Side Only



Viewed from Above Reel

Sheet Spreading

Spreader Bar or Spreader Roll

Reduces the risk of wrinkles and separate sheet after slitting

by increasing tension in the sheet in cross-direction

Spreader bar

Stationary bowed pipe

Adjustable angle

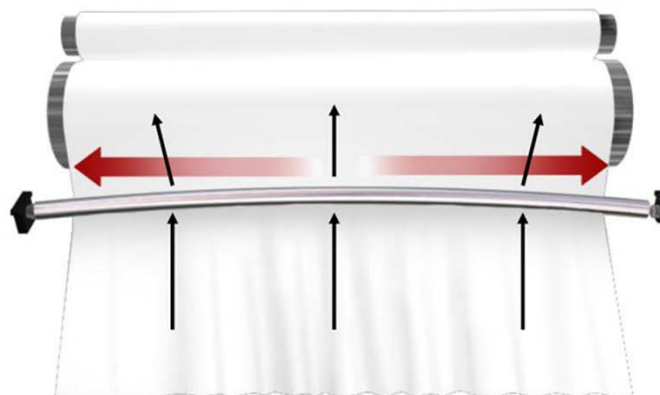
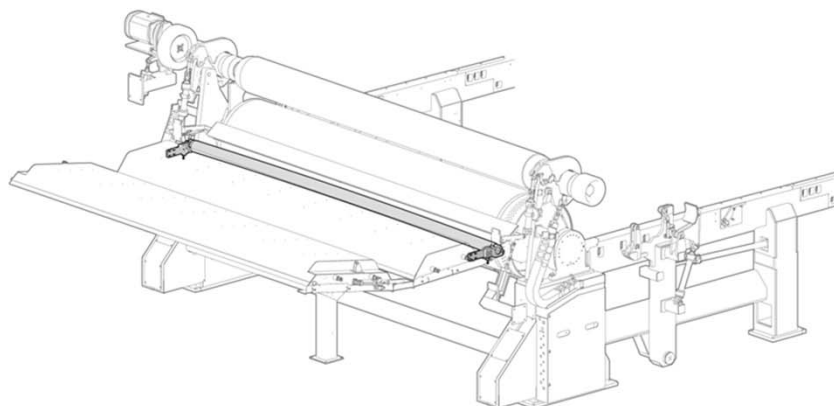
Spreader roll

Motor driven turning roll

Less friction → Less dust

Rotating → Less buildup

Adjustable speed and angle



Real Issues !

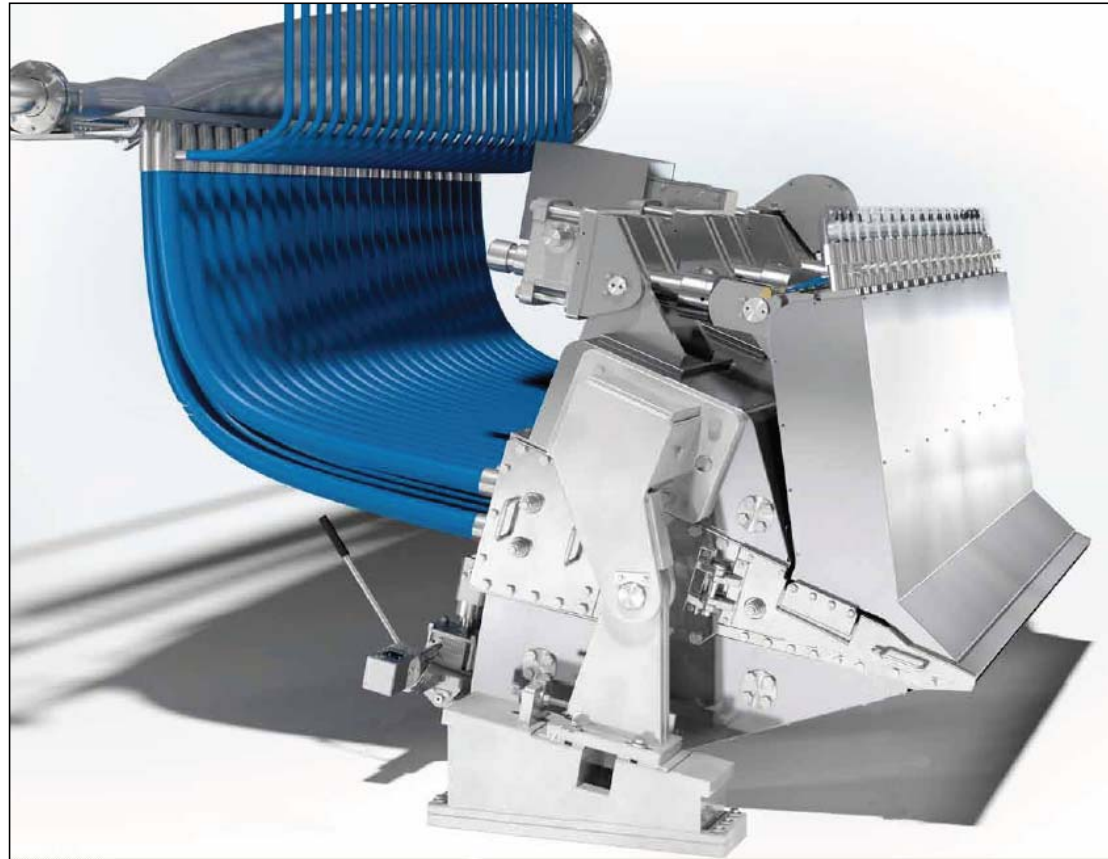
(Not Necessarily *REEL* Issues...)



Top Secret
Dry-End Tools
Found Only Here

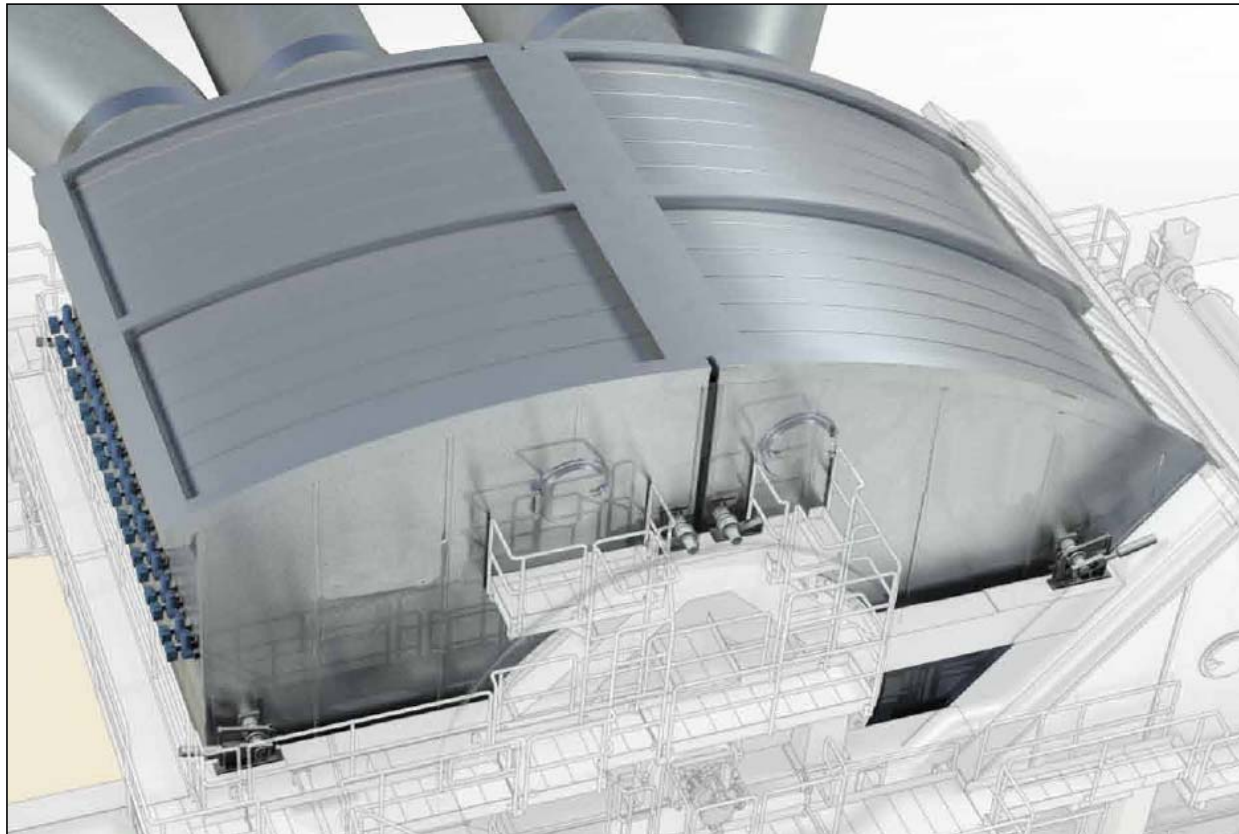
Reel Basis Weight Control

Headbox (Dilution Control, Slice Profile)



Reel Moisture Control

Steambox, Yankee/TAD Hoods, Dampers, etc.



Reel Caliper Control

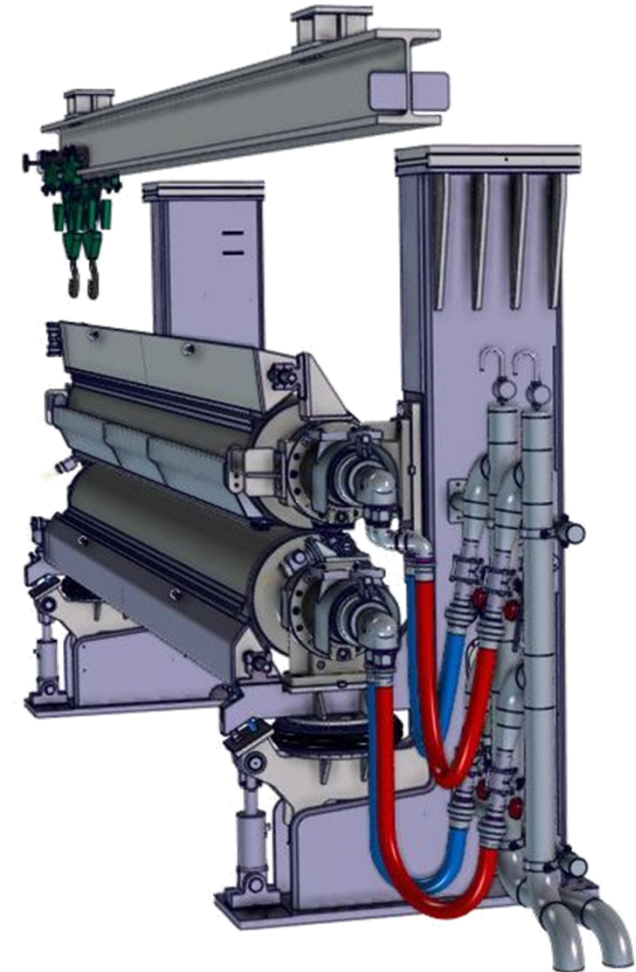
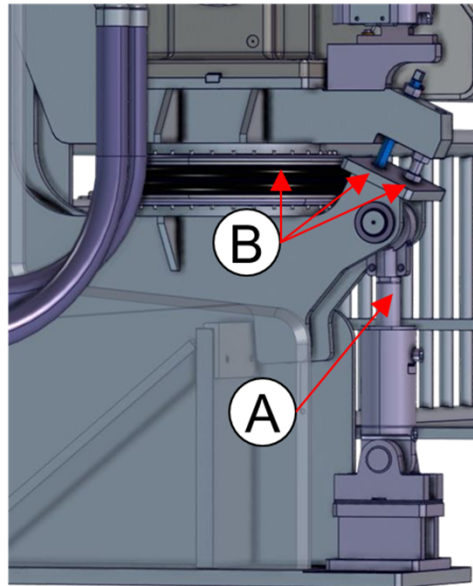
Calender, Profiling

A. Open/Close hydraulic function

Open and close nip at sheet break. A fast open/close function to minimize settling time after a break

B. Pneumatic bellows for Nip load

Pneumatic bellows for Nip load control.
Mechanical stops to minimize stroke when the nip is opened by the hydraulic function.
Always in load control.



Reel Caliper Control

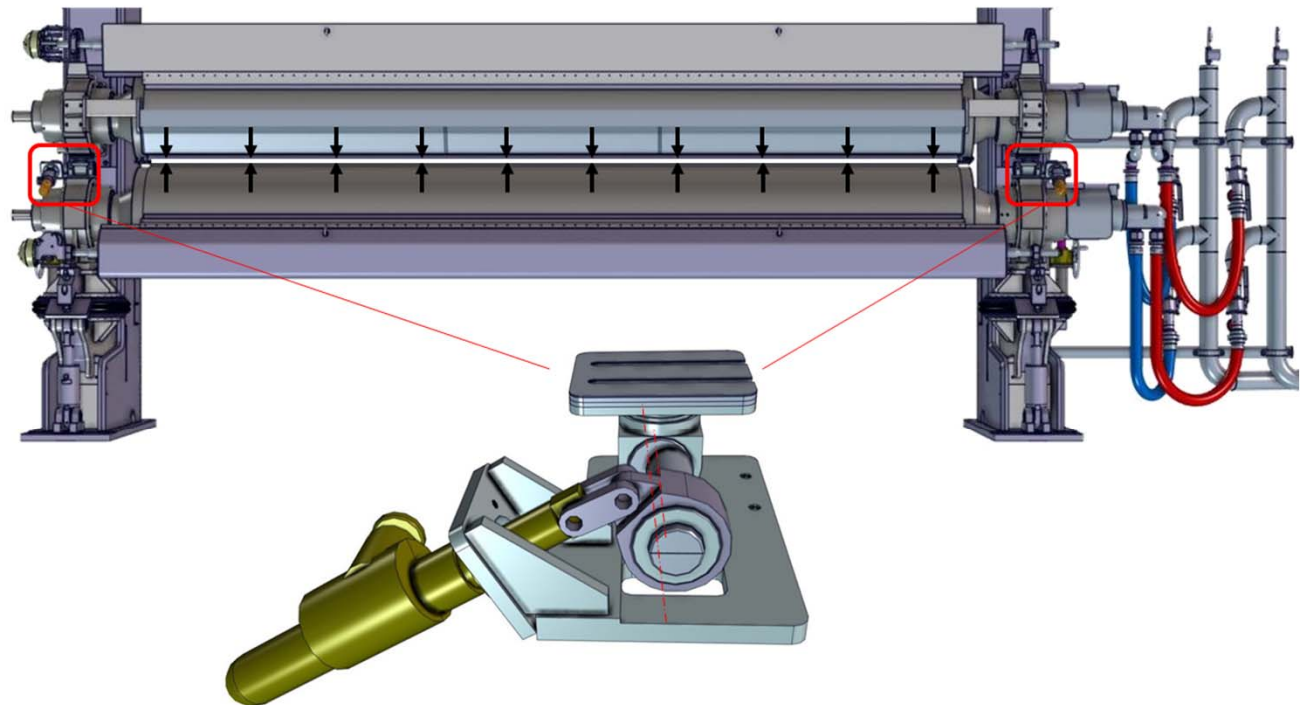
Calender, Gap Control

Gap control allow the rolls to operate with a small opening in the nip.

The distance between the rolls are set with the mechanical stops in both sides of the Calender.

Best for low linear load

Skewing might be needed



Paper Losses After Reeling



Top Damage and/or Sampling



Paper Left on Spools

Paper Losses After Reeling

Just an Inch off the Top...

Assume (51) Rolls Wide; 500 Sheets / Roll of 2-ply Bath



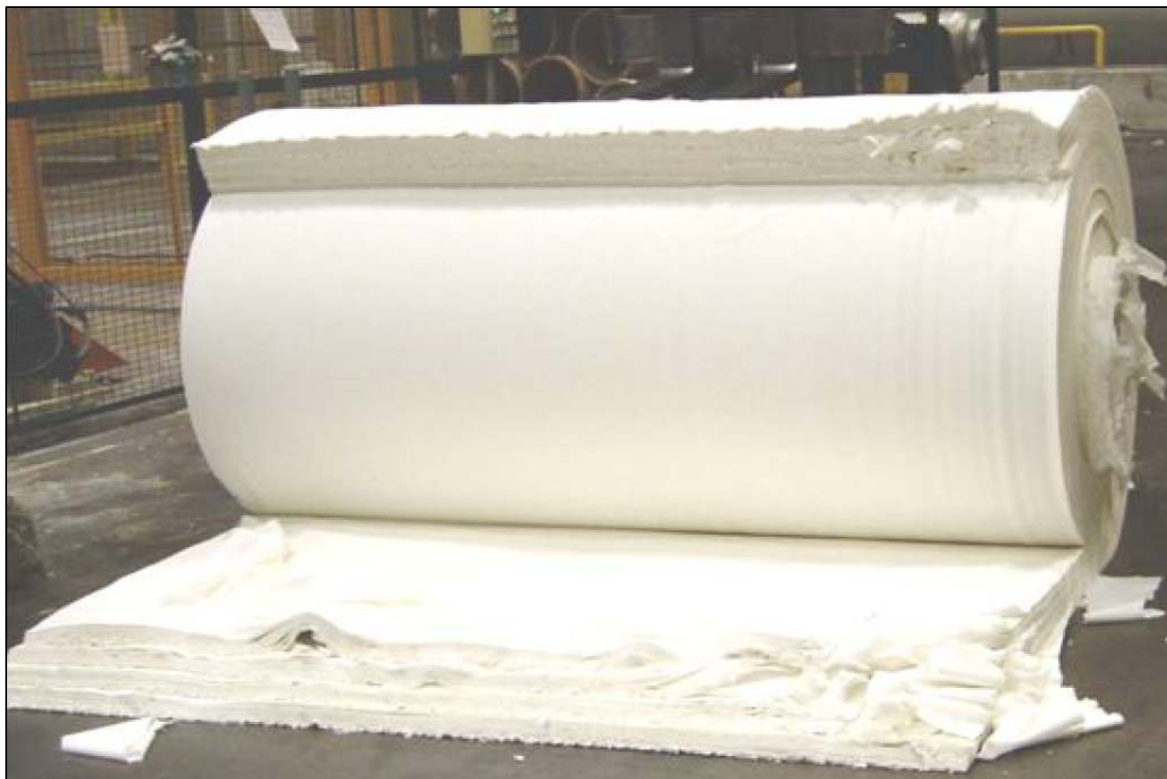
- Diameter = 110"
- Width = 208"
- Length = 10,380 ft

Rolls = 1,410 lost



How About Slabbing the Whole Roll?

Assume (25) Rolls Wide, 500 sheets/roll; 2-Ply Bath



- Diameter = 110"
- Core = 17.5"
- Width = 108"
- Length ~ 280,800 ft

18,720 Rolls lost

Improper Handling?

(1) 110" Diameter X 108" Wide Roll – 1.5" Clamp Damage



Assume (27) Rolls Wide; 500 sheets/roll; 2-Ply Bath; ~15,500 ft:

1,116 Rolls lost

Improving Dry-End Performance

Learning Objective

- Participants Can Now:
- Better Identify Runnability Problems and Opportunities for Improvement On the Dry End of the Paper Machine
- Develop One or More Solutions for Each

Improving Dry-End Performance

Any Questions?

**Thanks for Your
Attention !**

Thank You!



Tissue 201: Improving Dry-End Performance

Presented By:

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Co-Presented By:

Shawn Hougas

Valmet Inc. – North America

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Case Study

- **Converting has issues running the DS Rolls**
 - Overall converting efficiency (OCE) dropped from 92% to 83%
 - From sheet breaks, the resulting slabbing, rethreading time, etc.
- **You get called to converting and through observation, find:**
 - The edge is floppy when running
 - They need to slow down to run all rolls without breaks, lowering OCE
 - The issue is consistent through roll – outside to inside
 - There are no noticeable edge cracks, pinholes or other obvious defects
 - It occurs on all machines running this grade & all rolls from tissue machine
- **The Pressure is on....**
 - Looks like it is coming from your machine

Case Study

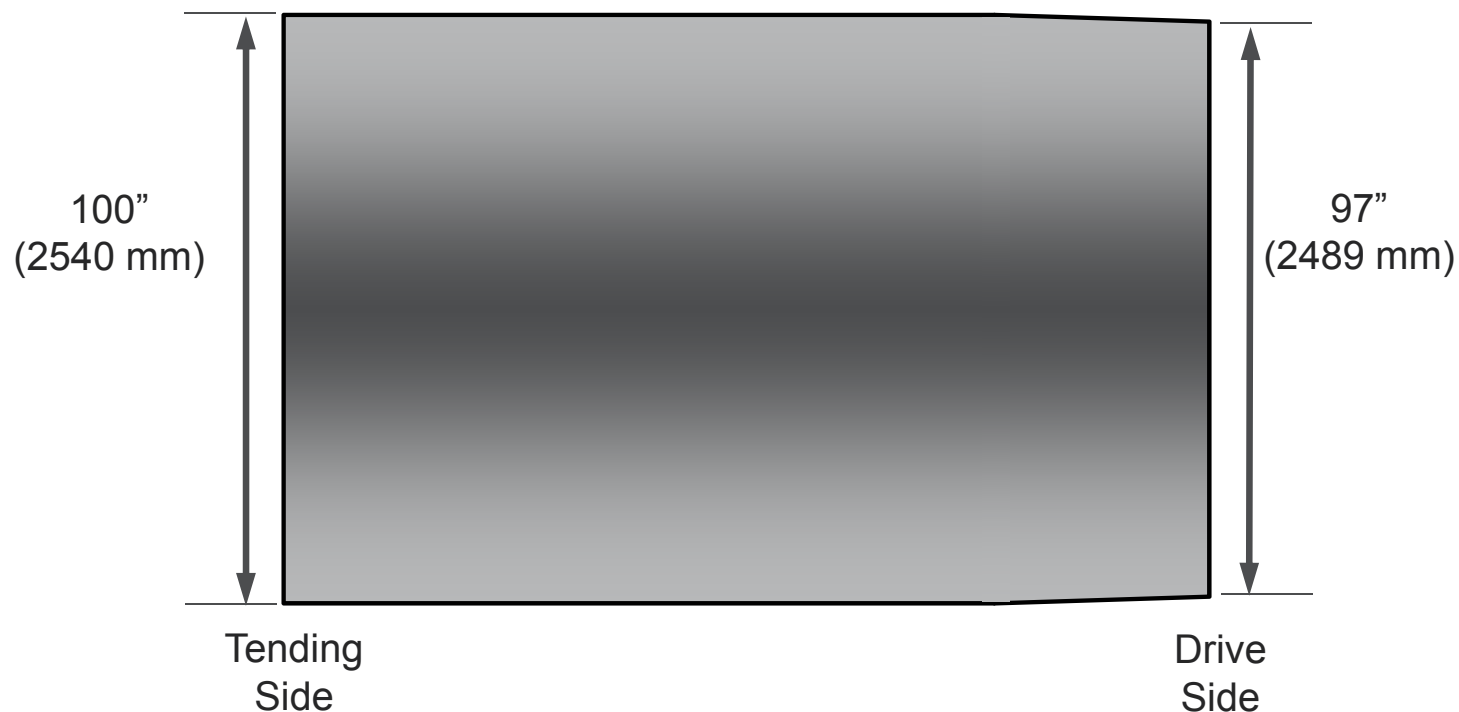
Back in the Machine Room...

- **You start looking at the reel**
 - It's the place where you can get the closest look at the sheet
 - on the parent roll
- **You measure the roll diameters, ends & center**
 - They are not the same
 - The drive side is 3" (75 mm) smaller than the tending side on each roll
 - You quickly determine the small side of the roll is the bad edge in converting!



Case Study

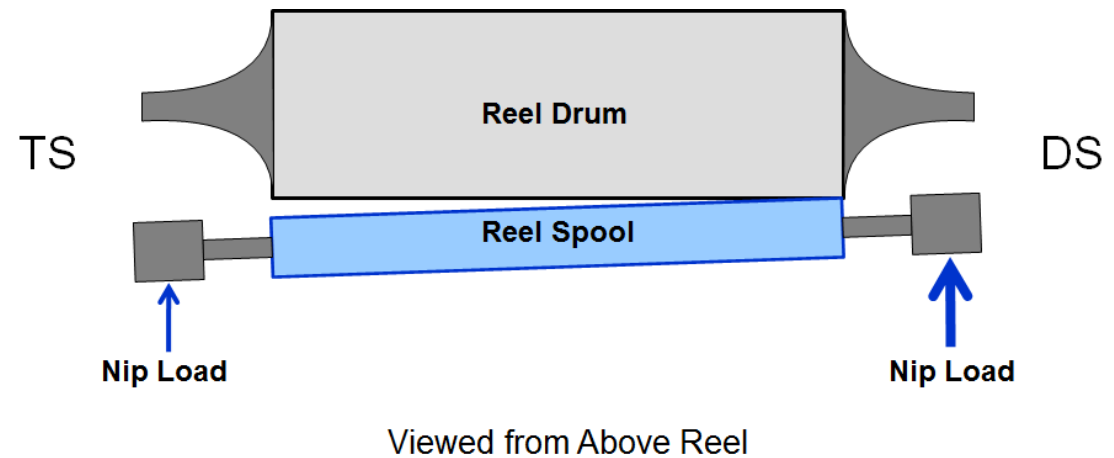
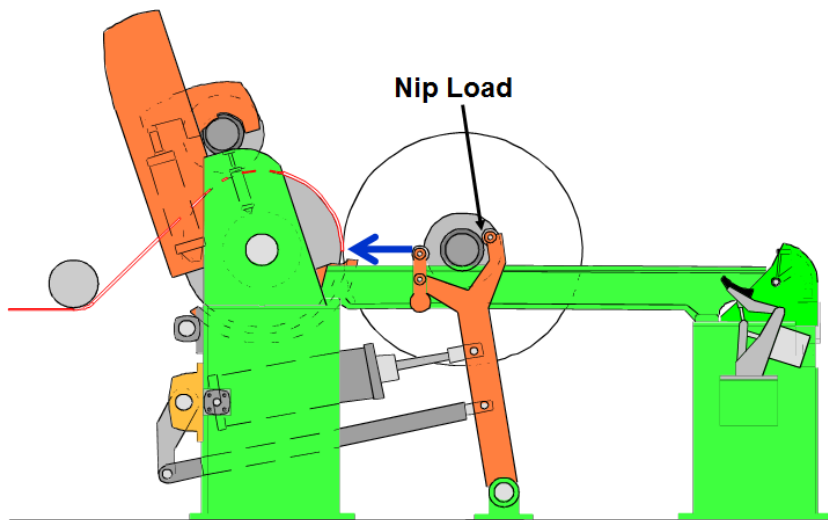
Based on this information,
What areas do you look at to solve this problem ?
(What can cause this caliper difference?)



Case Study

Possible Causes:

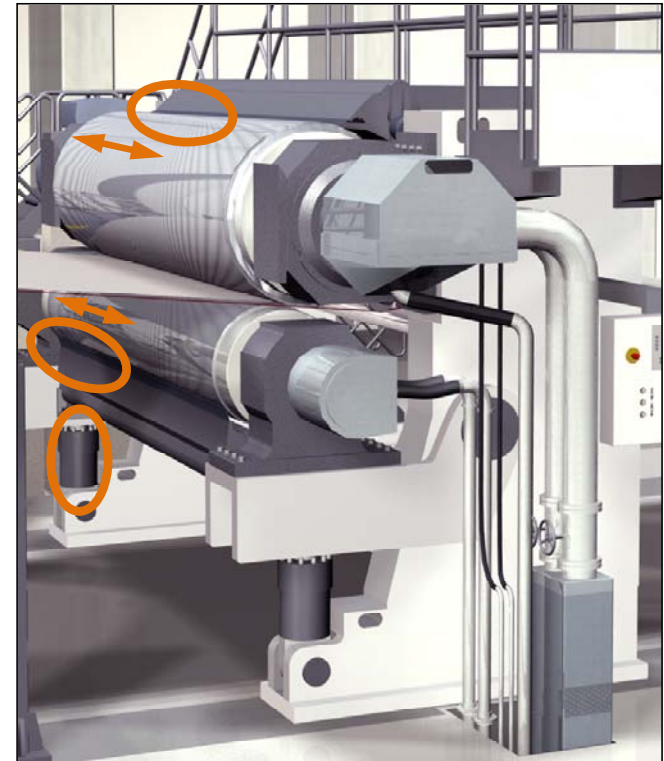
- Secondary arm loading issue
 - Check alignment, wrong setting, mechanical/controls malfunction, roller condition..



Case Study

Possible Causes:

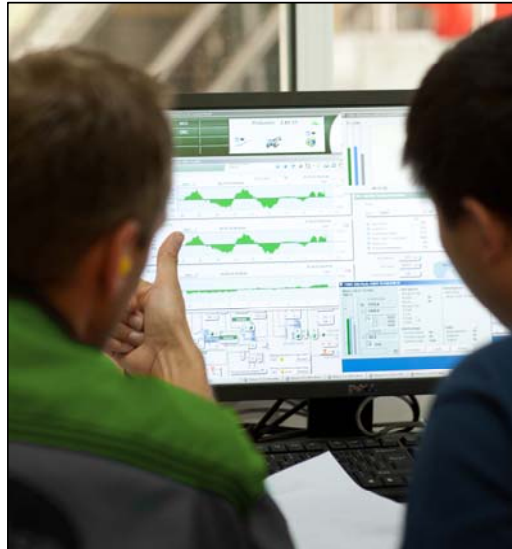
- Calender loading issue end to end: TS vs. DS
 - Check with nip impression
 - Mechanical / Skewing issue?
 - Roll Profiles?
 - Controls?
- Calender heat issue:
 - Doctor fit or internal temp control issue
 - Check with pyrometer (preferably contacting)



Case Study

Possible Causes:

- Moisture issue, Wet streak
 - Check CD profiles (& instrumentation)
 - Felts, Steamboxes, showers, Headbox, Hood/Dampers, Pressure Roll nip, ...

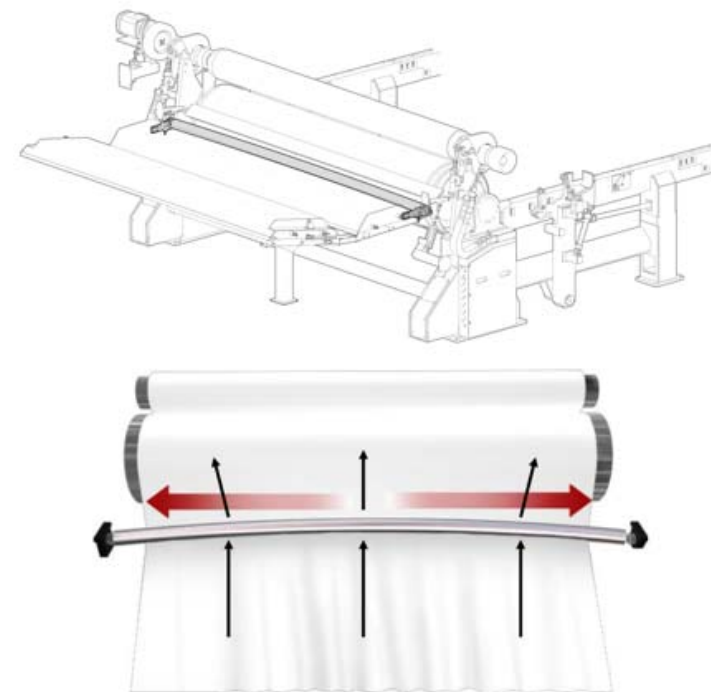
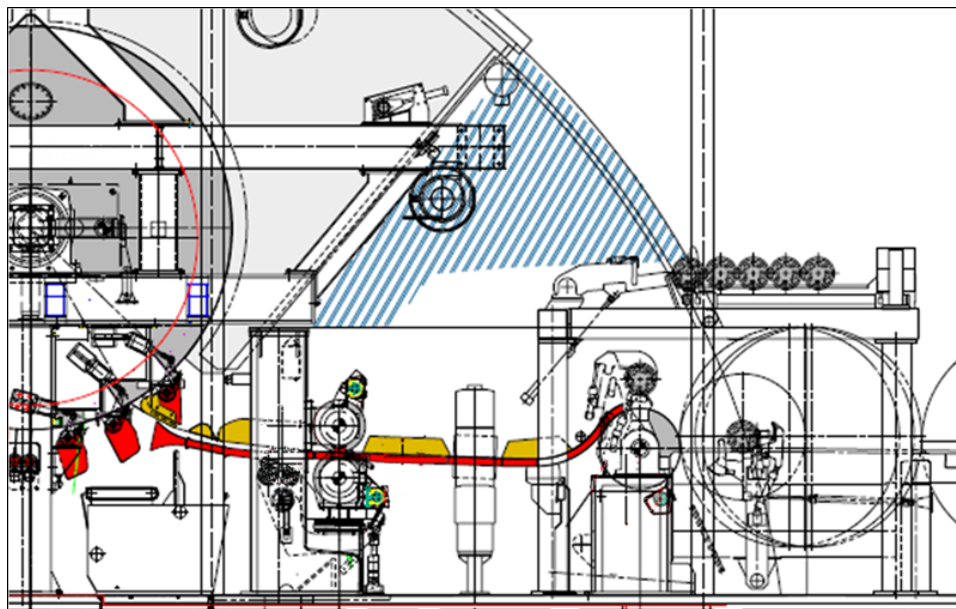


- BW issue
 - Check CD profile (& instrumentation)
- Yankee Doctor Issue
 - Check for misalignment, build-up, sheet path deviations, air currents w/Yankee, ...

Case Study

Possible Causes:

- Foil or reel spreader alignment – stretching sheet
 - Check for gross misalignment, build-up, sheet path deviations



Case Study

Possible Causes:

- End to end turn-ups, threading?
 - Possible, but...
 - Should even out over roll build due to air and wrinkles
- Roll handling ?
 - Possible, but...
 - Unlikely all drivers/AGV's have the same issue



Graphic courtesy of Bolzoni-Auramo

Thank You!



Tissue 201:

Improving Dry-End Performance

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