Nip Dewatering
A Press Fabric Perspective

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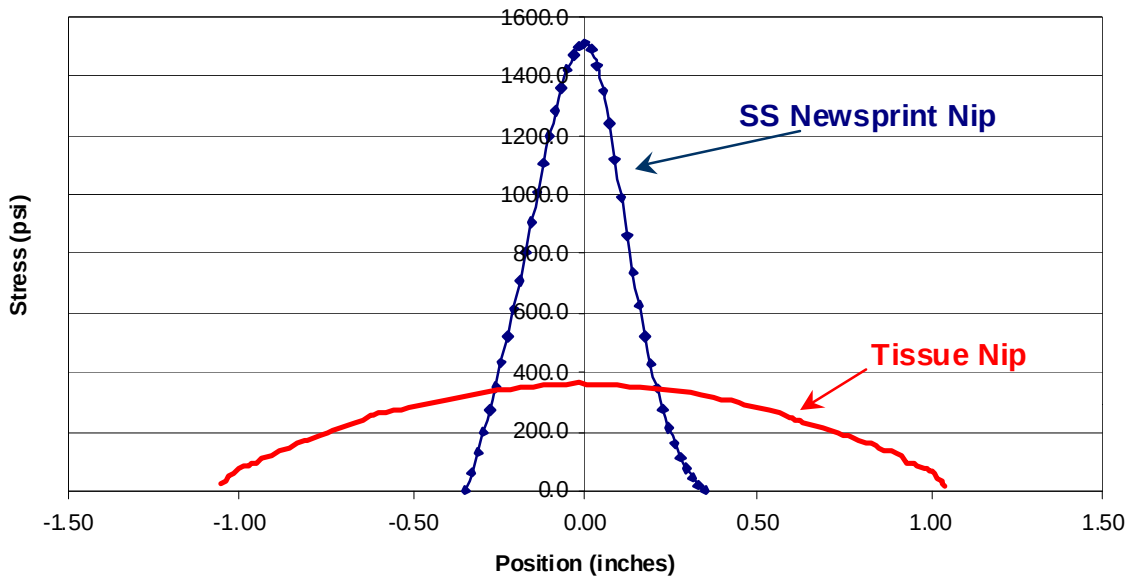
Outline

- Introduction
  - Press Dewatering Principles
  - Nip Dewatering
- The Role of the Fabric in Nip Dewatering
- Fabric Design
  - Parameters
  - Tools

Nip Width and Pressure



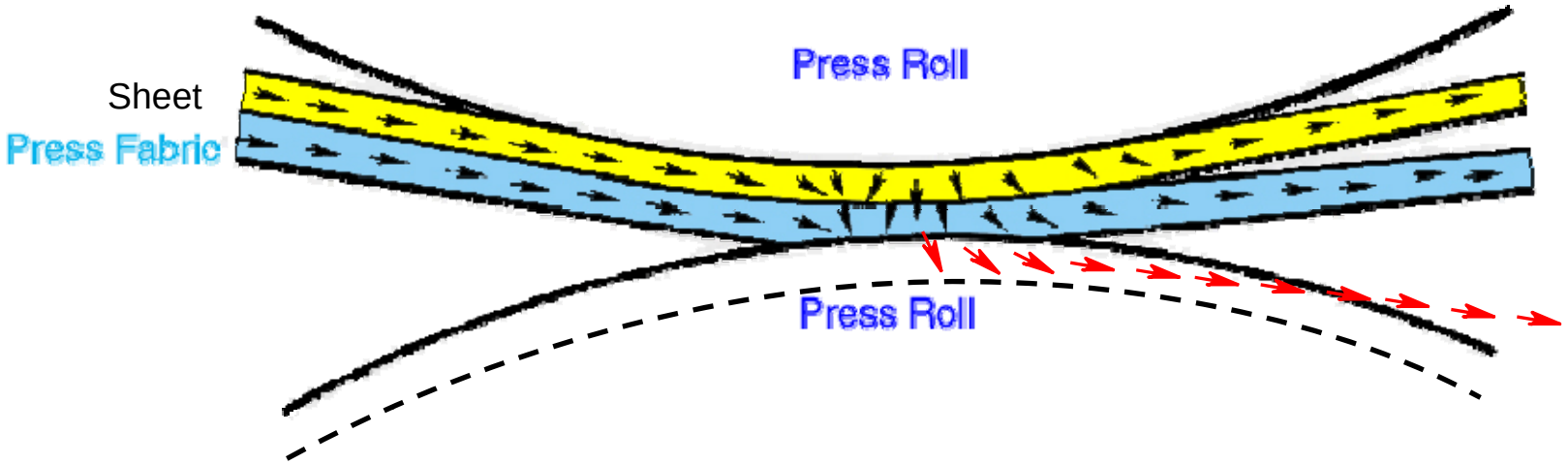
- $P_{NIP} = P_{mechanical} + P_{hydraulic}$
- $P_{mechanical}$
  - Press load
  - Nip width (roll covers, felt)
- $P_{hydraulic}$
  - Felt void volume
  - Water content

Press Dewatering: Basic Physics

- Water movement occurs only with pressure differential
- Pressure must be higher in sheet than felt
- If hydraulic pressure exists, saturation must exist
  - There must be a continuum of fluid
- Therefore, to achieve fluid movement:
  - Voids must exist in the felt, OR
  - Voids must exist “beyond” the felt (slots/grooves in roll), OR
  - Water must flow in MD or CD (felt is permeable in every direction), OR
  - The sheet explodes (crushing)

TAPPI people resources solutions

Pressing and Felts



Press fabric function

- Accept water from sheet
- Other stuff (impart finish, convey sheet, transmit power)

Nip dewatering

- Independent flow exits out of the nip
- Water passes through felt out of nip

Pressure and flow depend on

- void volume
- Compressibility
- permeability

Nip Dewatering vs. Uhle Dewatering

- Water is expressed form the sheet into the felt at the press
- Water is given up by the felt
  - At the nip (water volume beyond saturation passes through the felt)
    - Water goes *through* the felt
    - Permeability is very important: flow resistance
    - Compressibility and void volume determine saturation point
  - At the uhle box (water carried from nip to uhle box)
    - Water enters sheet side of felt and exits from same side
    - Void volume determines capacity of felt
    - Permeability determines air flow → uhle dewatering efficiency
- Nip dewatering benefits
  - Improved press solids (more efficient pressing)
  - Profile improvements (more even pressing)
  - Cleaner felts (better “flushing”)

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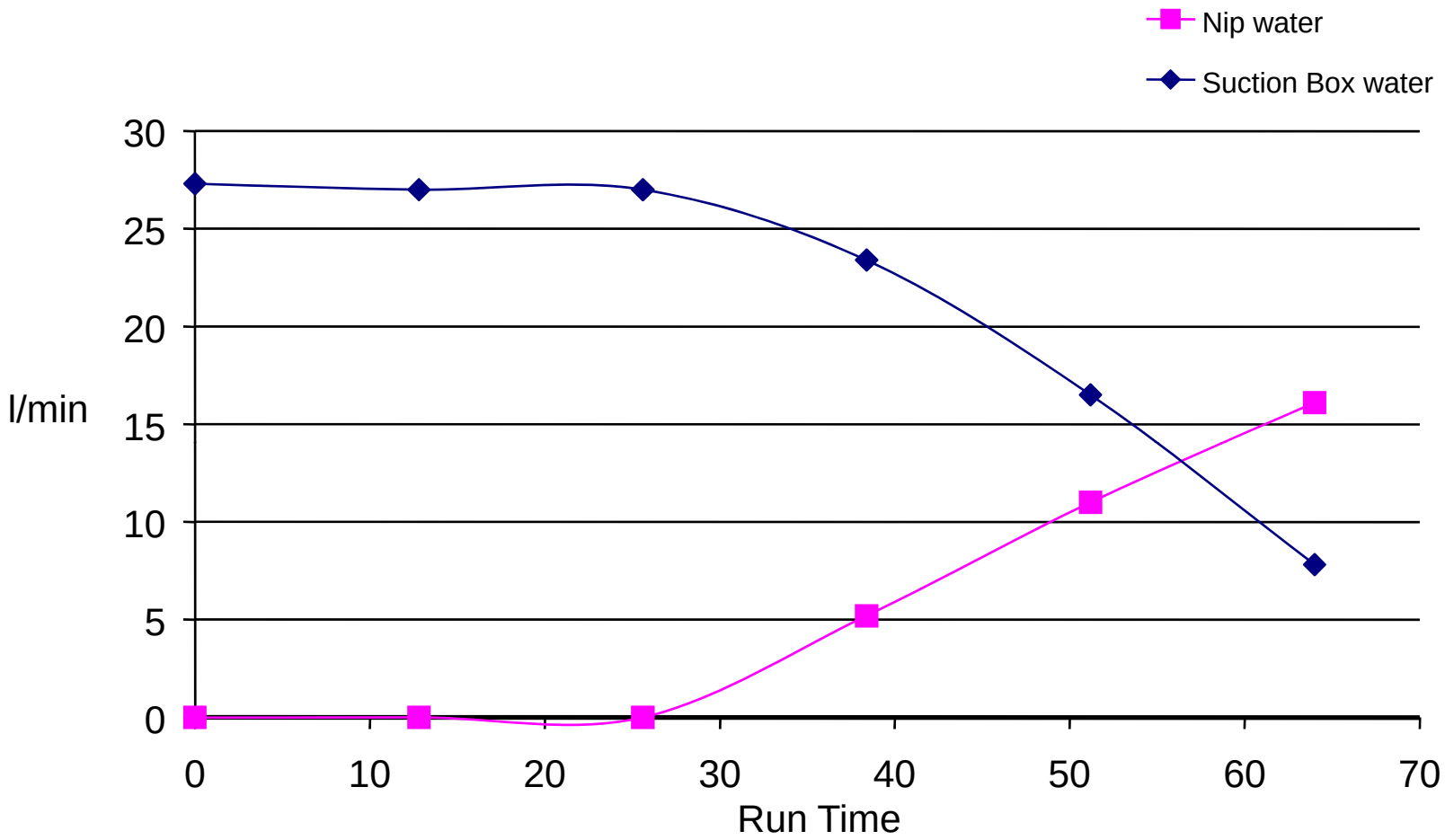
Felt Water Balance Over Life



- Felt compressibility, permeability, and void volume all change over life

Felt Design Objectives

- Steady State Pressing
  - Achieve some saturation point in the nip early in felt life
    - Enough water to achieve hydraulic pressure
    - Little enough water to avoid crushing
  - Maintain some uhle flow
    - Help clean fabric and prevent filling
    - Control felt water balance

How Much Water?

- Optimal water content for nip dewatering depends on
  - Felt
  - Sheet
  - Belt/Roll venting
  - Nip Load
  - Nip Profile
  - *Is unique to every press*
- Uhle systems can moderate water to the nip
  - Too much → nip rejection, crushing
  - Too little → sub-optimal nip dewatering

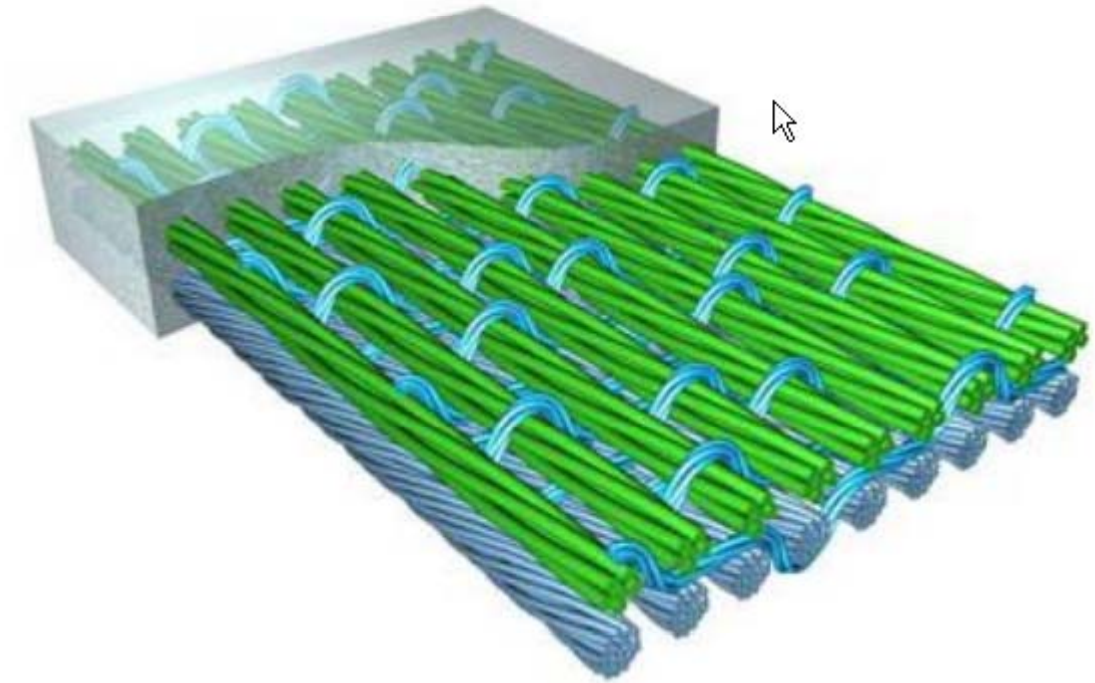
Felt Design and Nip Dewatering

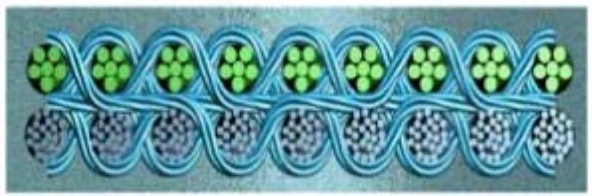
- There are three options to enhance nip dewatering with felt design.
  - Balance life and startup performance

1. Reduce permeability and void volume
   - Retard uhle dewatering
   - Enhance nip saturation with minimal void volume
   - Densified conventional styles
   - Usually poor life
2. “Soften” compressibility of felt
   - Maintain permeability → allow through flow
   - Minimize mid-nip void volume → achieve saturation easier
   - Unconventional structures in base to control mid nip performance
3. Maintain permeability and control void volume to reduce saturation volume
   - Conventional web structures to control permeability
   - “Crossless” base structures for void volume and compression control

1. Densified Fabric

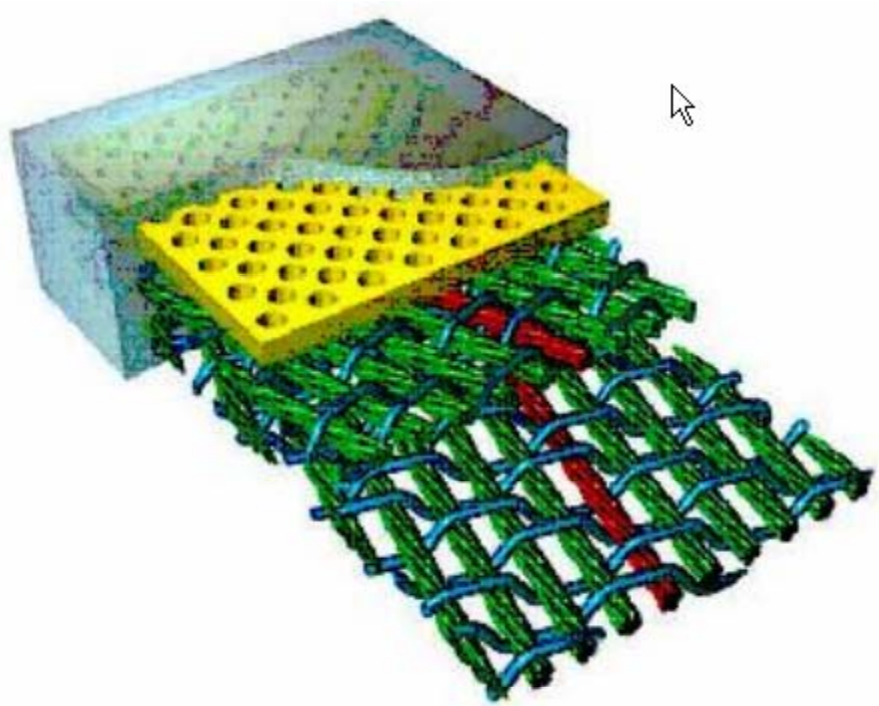
- Very dense web
- Reduced perm, reduced void volume
- Decent startup
- Poor life

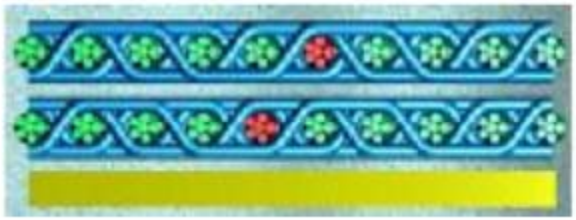




Enhanced Compression

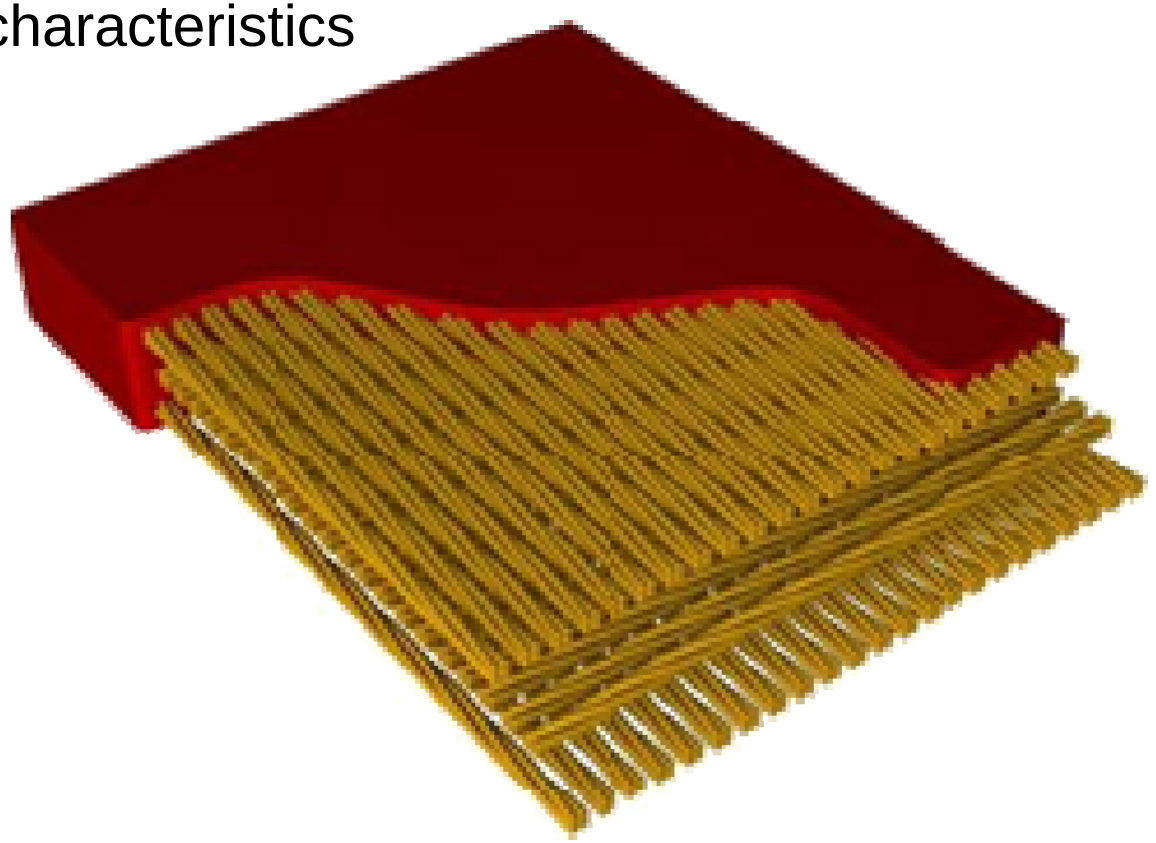
- Viscoelastic layer in felt
- Good permeability, controlled compressibility





Controlled Void Volume

- Controlled base fabric void volume
- Good compression characteristics



Cleaning

- Why do nip dewatering felts clean better?
- Uhle felts → water in and out from same side
- Nip dewatering felts → water flows through felt
  - Structure flushed better

Felt Design Summary

- Objectives
  - Optimize pressing efficiency
    - Startup
    - Over felt life
  - Maximize life
- Tools
  - Felt structure
    - Batt
    - Base
    - Other
  - Control
    - Permeability
    - Compressibility
    - Void volume (free and mid nip)

Thank You