



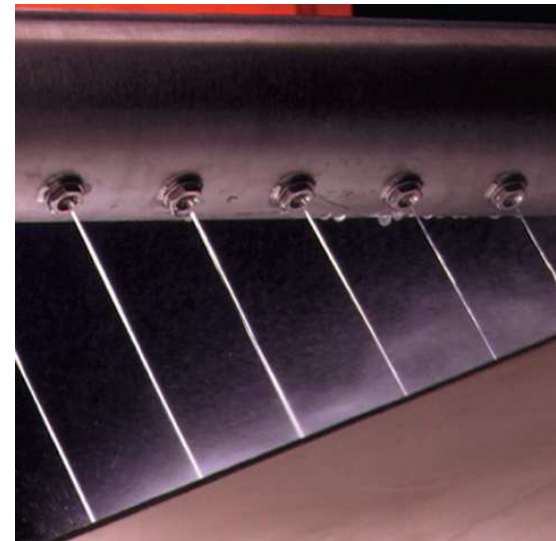
*Recycled Paperboard Technical Association*

# Press Fabric Showering Equipment Selection

# Goals

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- Provide Showering Equipment that will maintain the felts original properties for as long as possible, while being considerate of short and long term costs to the operation.



# Benefits of Proper Shower Selection for Cleaning Press Felts

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- Steady State Operation = Improved runability
- Improved Moisture Profile
- Improved Clothing Life
- Increased tonnage
- Optimal Water Usage
- Improved Press Efficiency
- Reduced Operating costs



# Press Fabric Cleaning

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*What Exactly Do We Need To Know?*

## Contaminants

- What Are the Contaminants?
- How Are Contaminants Distributed? (surface ??)
- How Much Energy Is Required for Removal?

## Felt Info

- Tolerance of Fabric to HP Showering ?
- Fabric Water Handling? (nip vs. suction pipe)
- Seam . Permeability

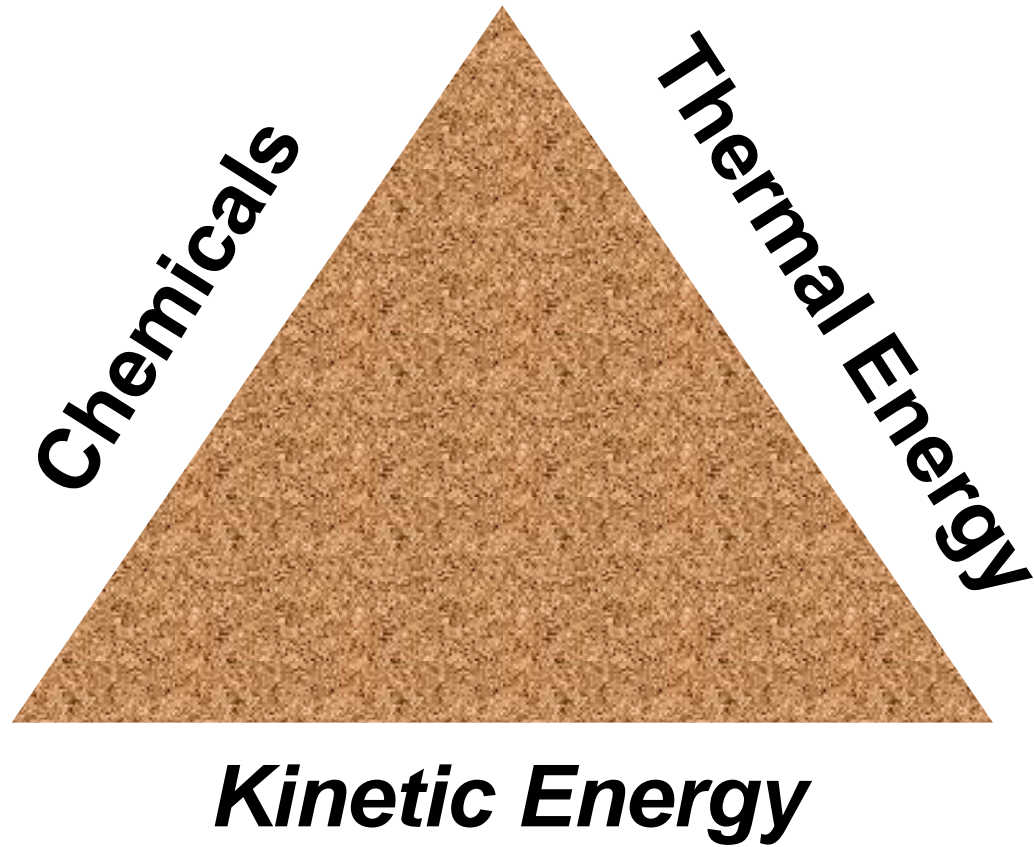
## Water used for cleaning

- Quality (source)
- Ph & Temp



# Cleaning Triangle

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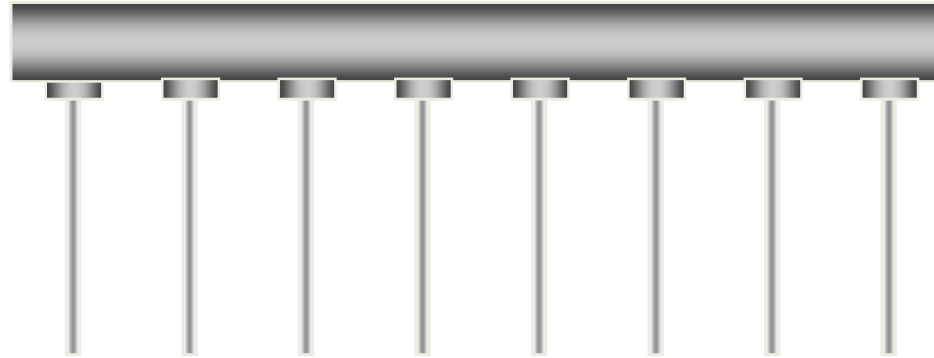


# Two types of showers Designs

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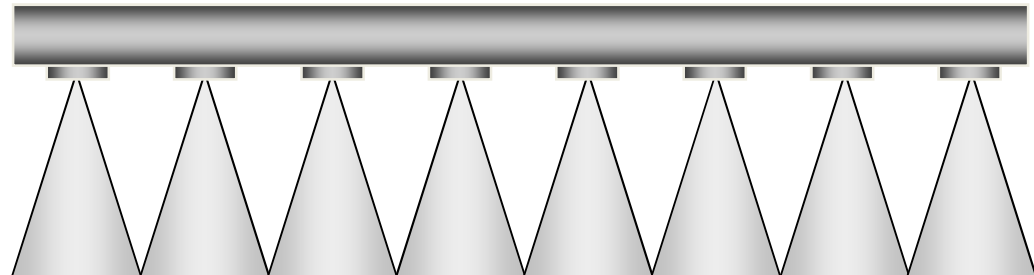
- Needle Jet Showers

- Pressure
- Volume
- Distance (energy)
- Angle (force)



- Fan Showers

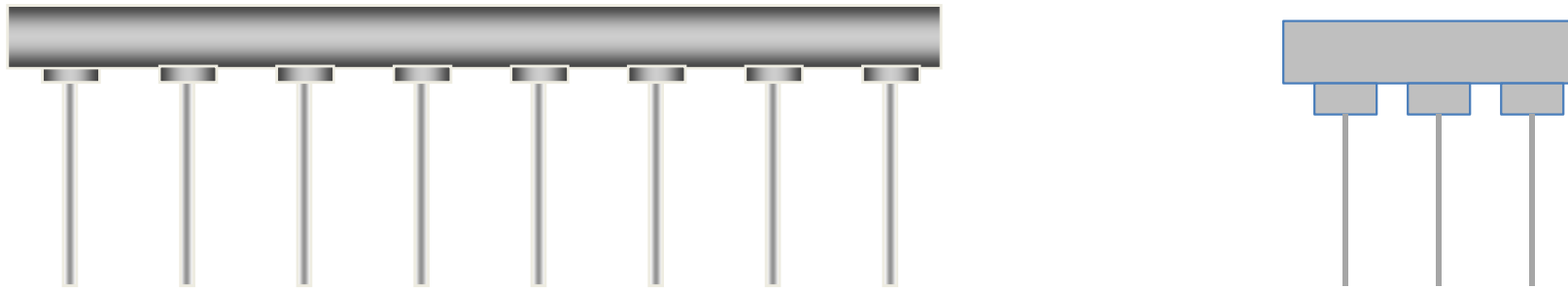
- Volume
- Distance (coverage)
- Distribution



# Needle Jet Showers (High Pressure)

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- Needle jet showers use water as a vehicle to apply **energy / power** to the fabric to dislodge contaminants



They can be full width Nozzles or a traversing head with 1-8 nozzles

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# Needle Jet Shower Considerations

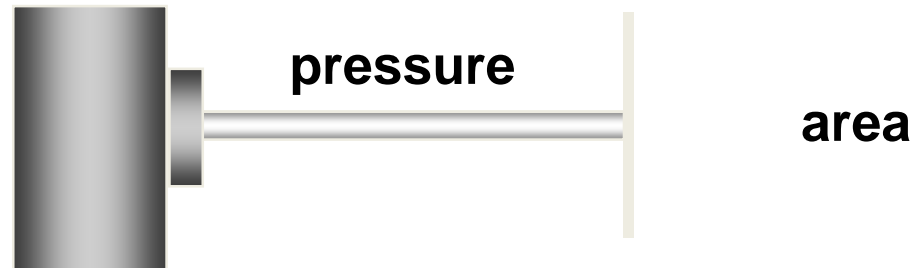
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1. Remove/loosen Contaminants
2. Don't Damage Fabrics
3. “Concentrated” Cleaning

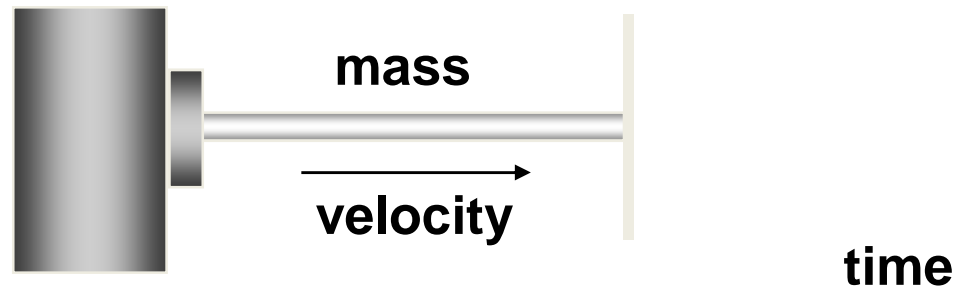


# How Do Needle Showers Work?

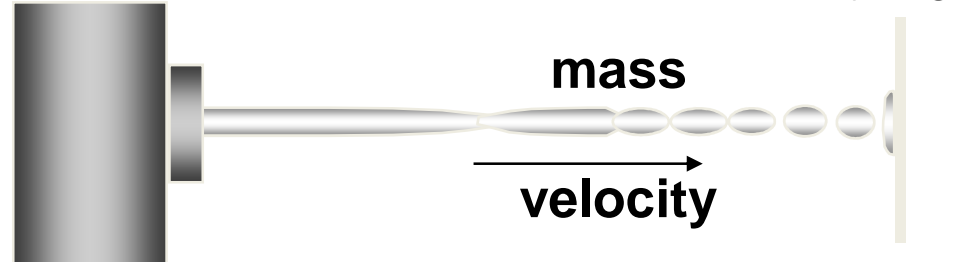
**1. Pressure,  
Force?**



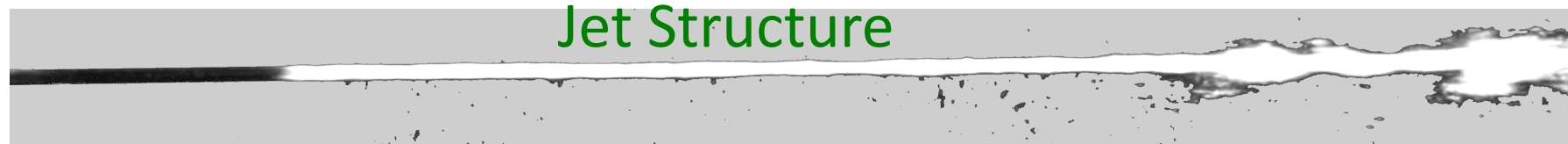
**2. Energy,  
Momentum?**



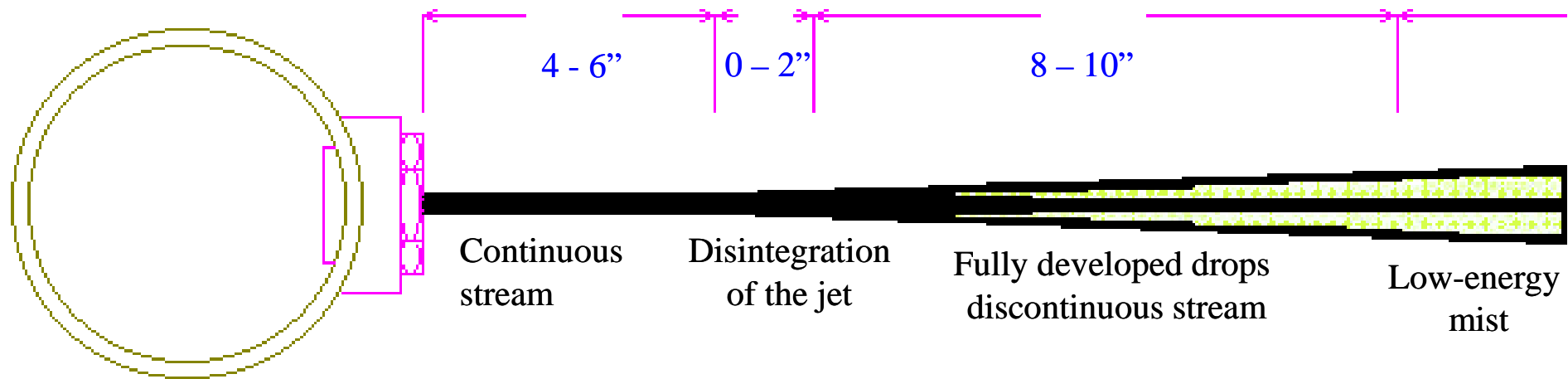
**3. Impulse?**



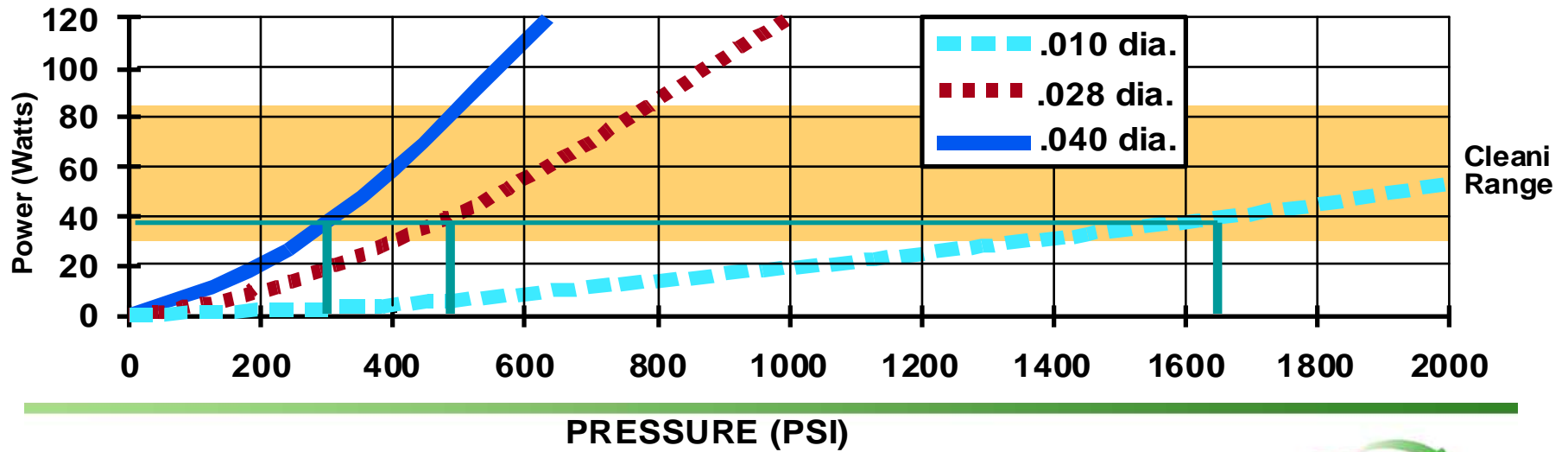
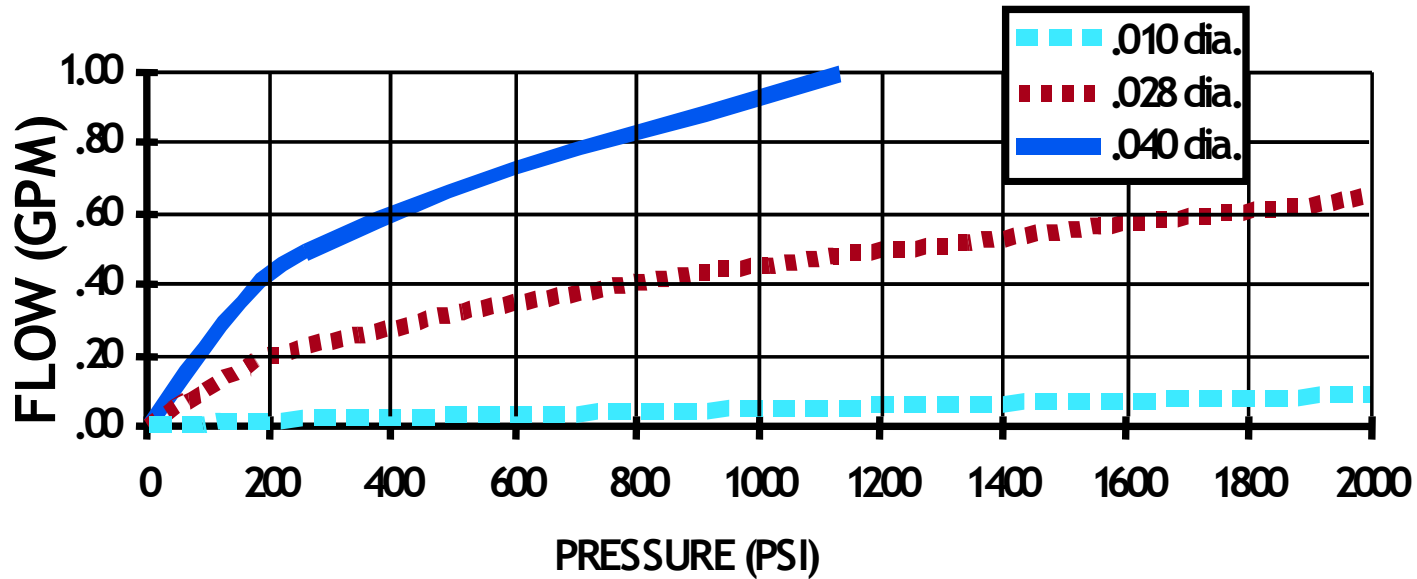
# Showering Distance



- Use region of peak dynamic power
- Peak power occurs anywhere from 6 to 14 inches  
(Dictated by Nozzle Dia, Pressure, and Condition)
- Cleaning Surface or Void



# Nozzle Flow vs. Pressure vs. Energy



# Cleaning with High Pressure Needle Jet Nozzles

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Uniform Coverage(100%) =  
One nozzle impact width/fabric revolution



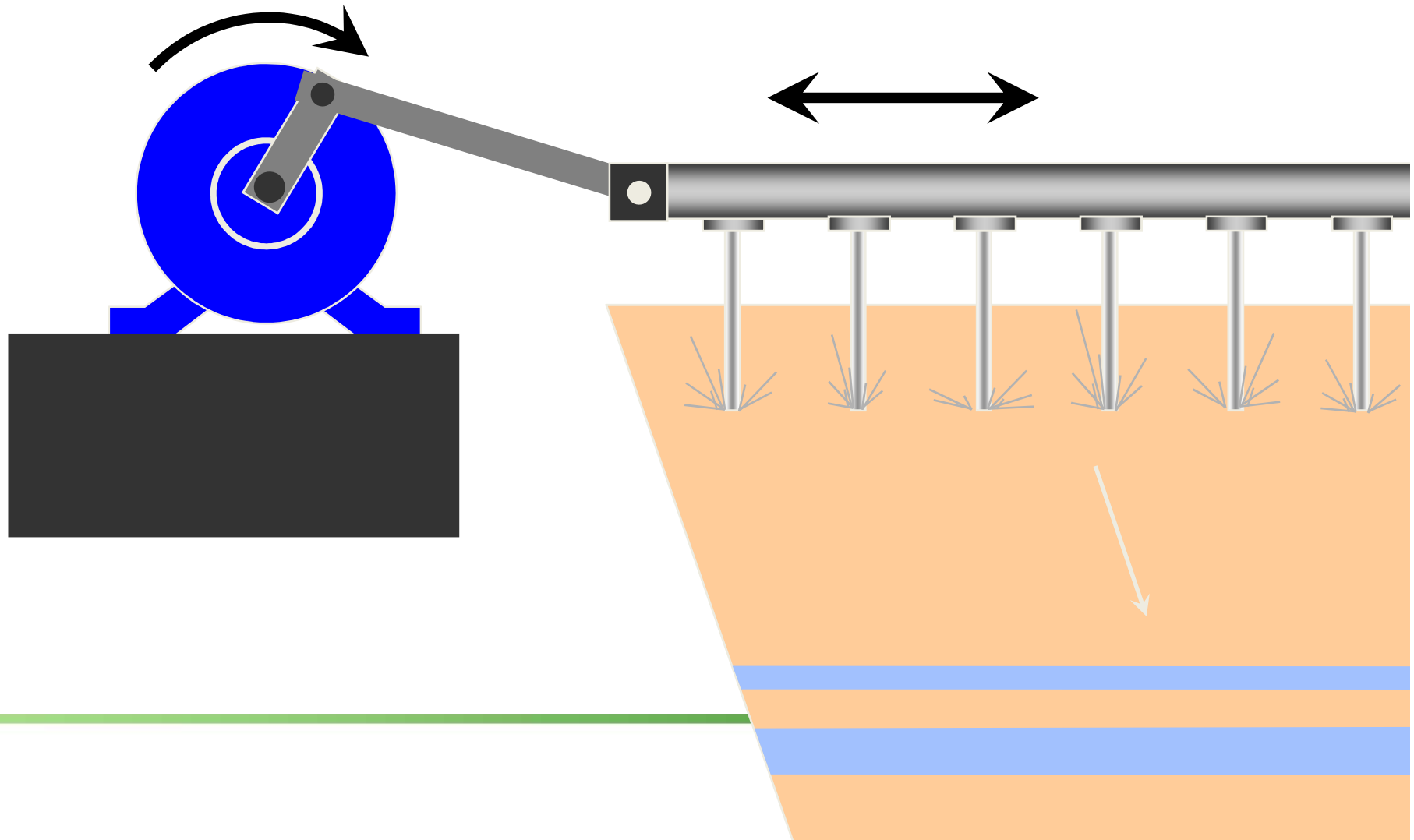
- Oscillator Speed Calculation:

$$\text{Oscillator Speed} = \frac{\text{M/C speed} \times \text{Noz. Dia.}}{\text{Fabric Length}}$$

# Oscillators: Crank Arm

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# Improper Oscillation Speed

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Typical Crank Arms: Uneven Coverage long  
Dwell at Turnaround



# Selecting Proper Oscillator Speed

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## High Speed Oscillation

- Usually Hydraulic or Pneumatic Cylinder
- NOT inherently bad oscillator: selected speed is too high!
- Not homogeneous coverage either

**Bad**

# Best Practice Oscillation

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Low Frequency Oscillation:

$$\text{Traversing Speed} = \frac{\text{M/C speed} \times \text{Noz. Dia.}}{\text{Fabric Length}}$$

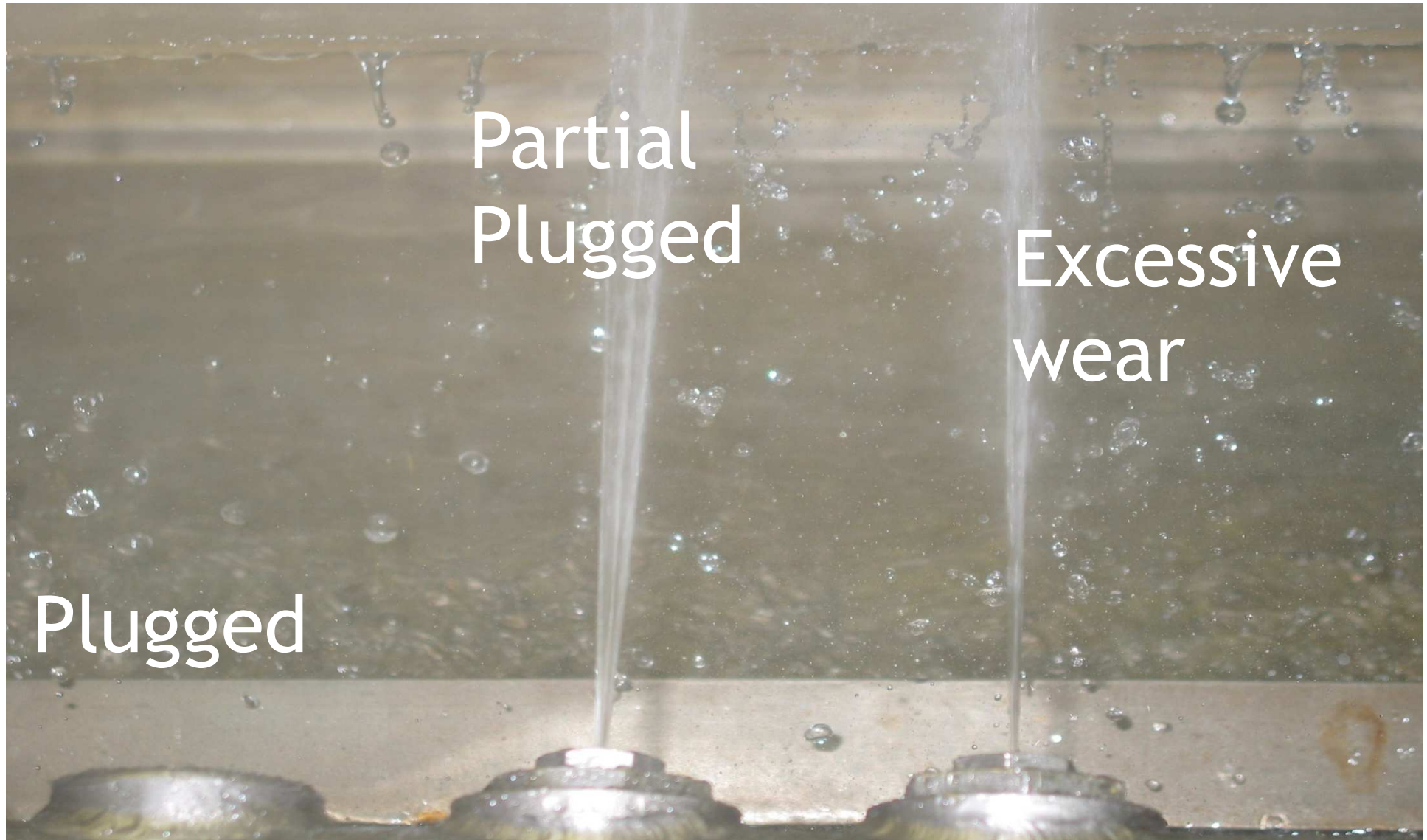


- Synchronize oscillator speed with fabric speed
- Perfect, even coverage



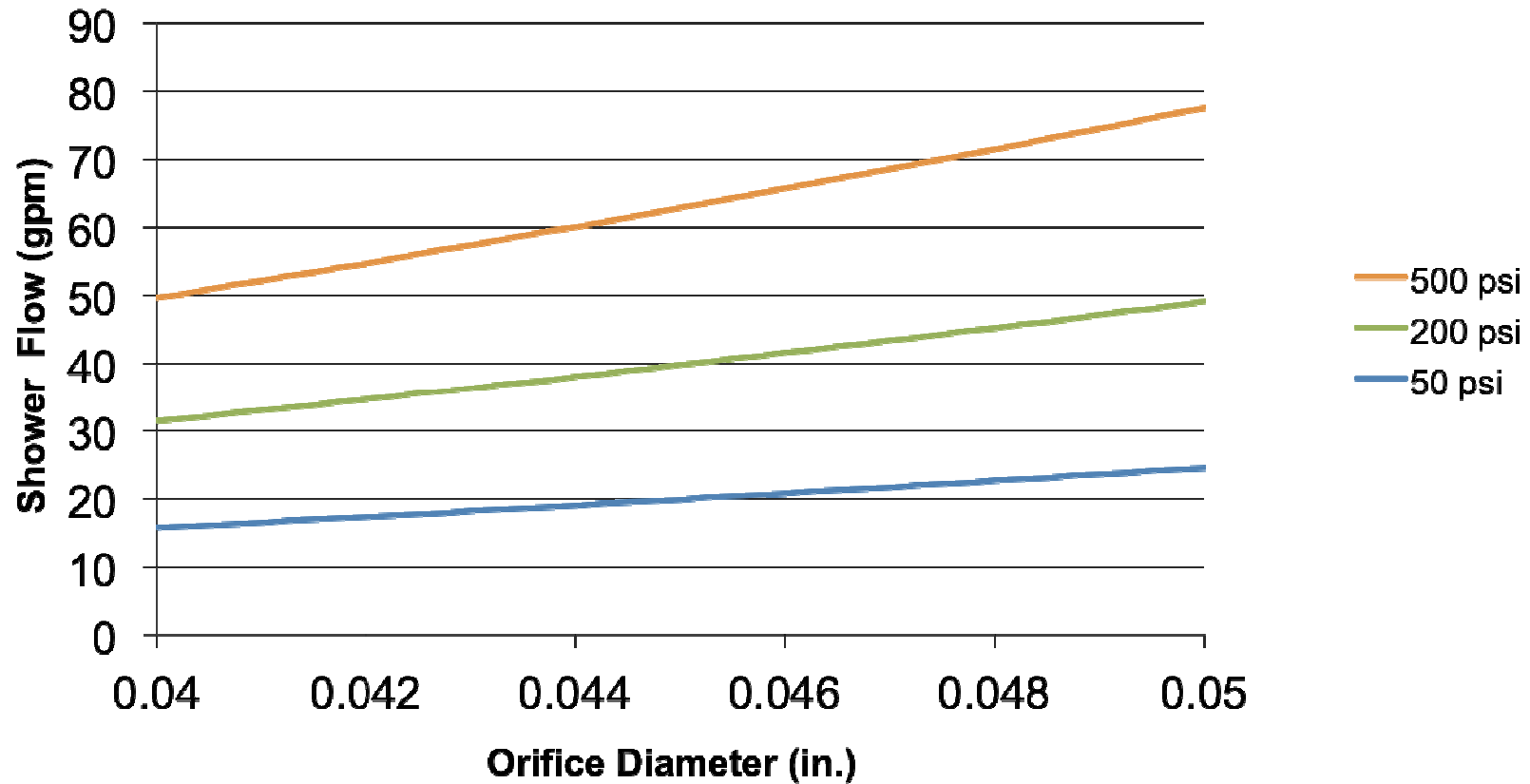
# Condition of Nozzles

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# The Effect of Worn Nozzles

Total shower flows at different pressures



# Worn Nozzles: Example

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365" machine 6" nozzle Spacing

- 61 nozzles, .040" orifice, 200 psi (.41gpm/nozzle)
  - 25 gpm new: \$1551/year pump HP
  - 5% wear: =.042" diameter orifice (.45 gpm/nozzle)
  - 27.5 gpm, \$1711/year pump HP
- 24,000 gallons additional water/week (50 weeks/year)
- 1.2 million gallons additional water/year into the press



# High Pressure Needle Jet Considerations

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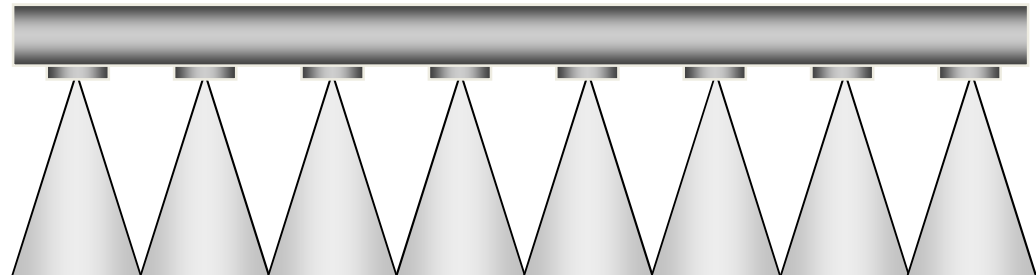
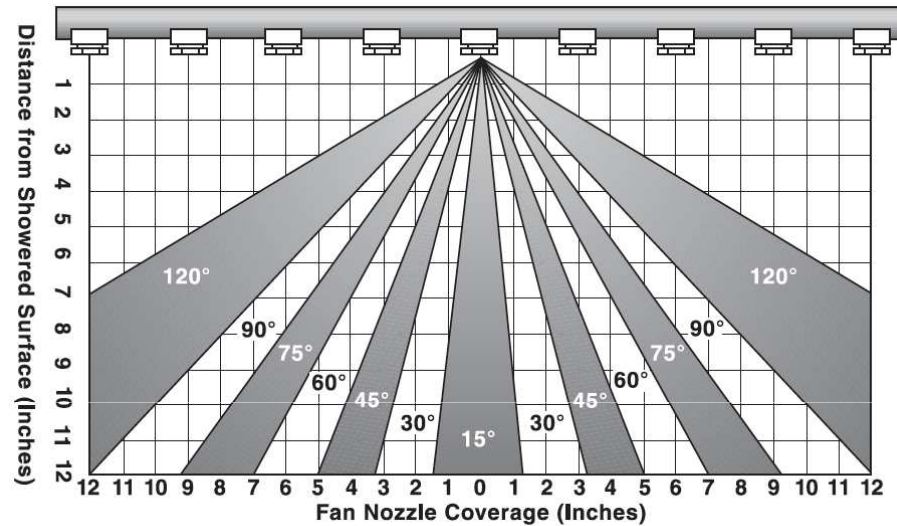
- Location
  - Early after Nip
- Flow
  - Start with best practices, optimize from there
- Orientation
  - Nozzle location in pipe
- Attack angle
  - Chisel or Penetrate( where are the contaminants)
- What portion of nozzle Flow do you need (Felt vs. Rolls)
  - Laminar or scrubbing



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# Fan shower Designs

- Fan Showers
  - Volume
  - Distance (coverage)
  - Distribution



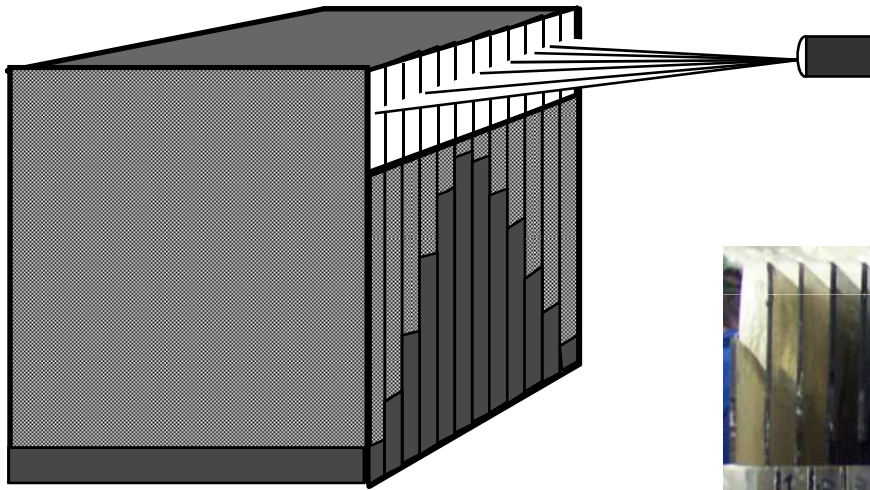
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## Two Types of Fan Nozzle Variation:

- **Flow Distribution**
- **Total Flow Volume**

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# Nozzle Flow Distribution Tester

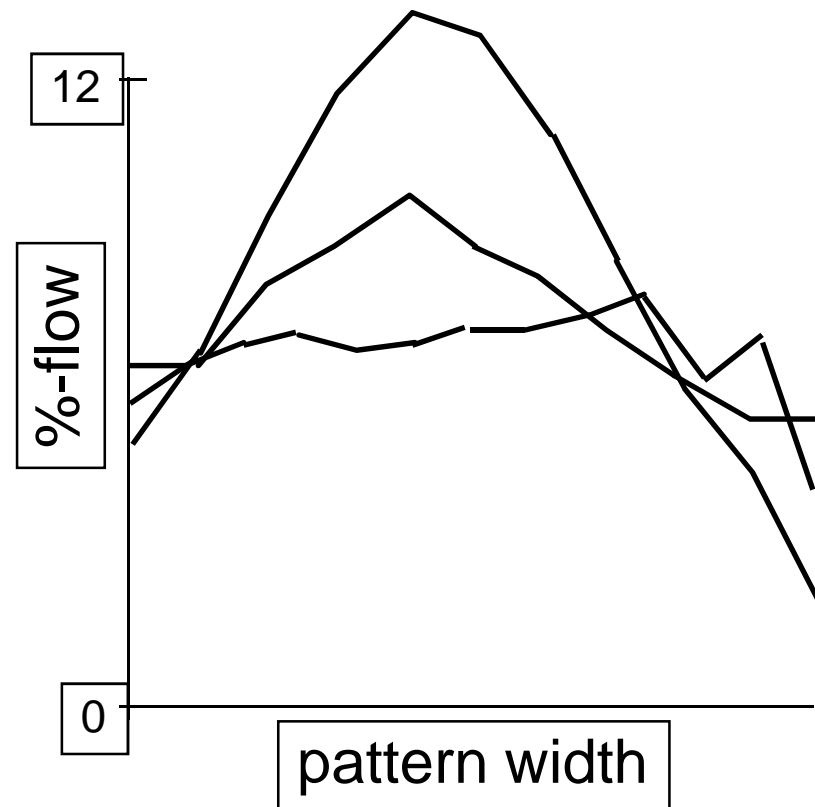




# Nozzle Spray Patterns

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**40 - 45 degrees**  
**.047 - .054 inch orifice**





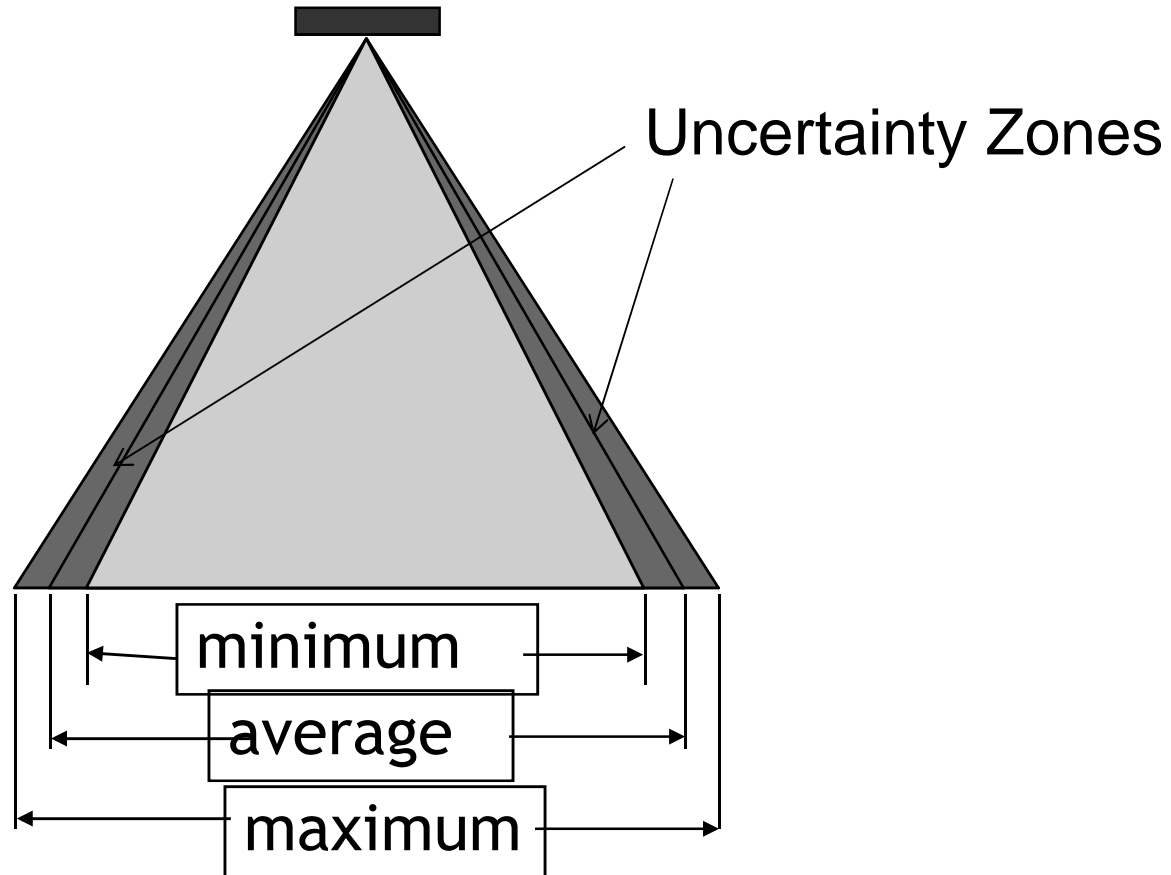
# Nozzle Effective Pattern Width

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- The flow distribution of all fan nozzles vary;  
1% to 4% is the range considered normal

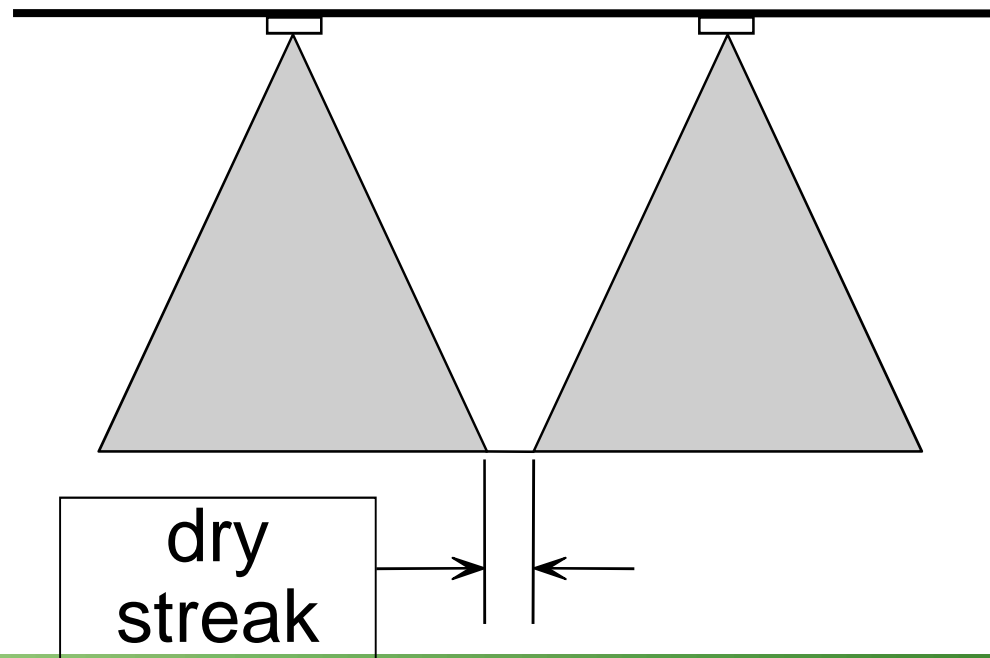
- Pressure
- Surface tension
- Design

Caution Below 30 psi



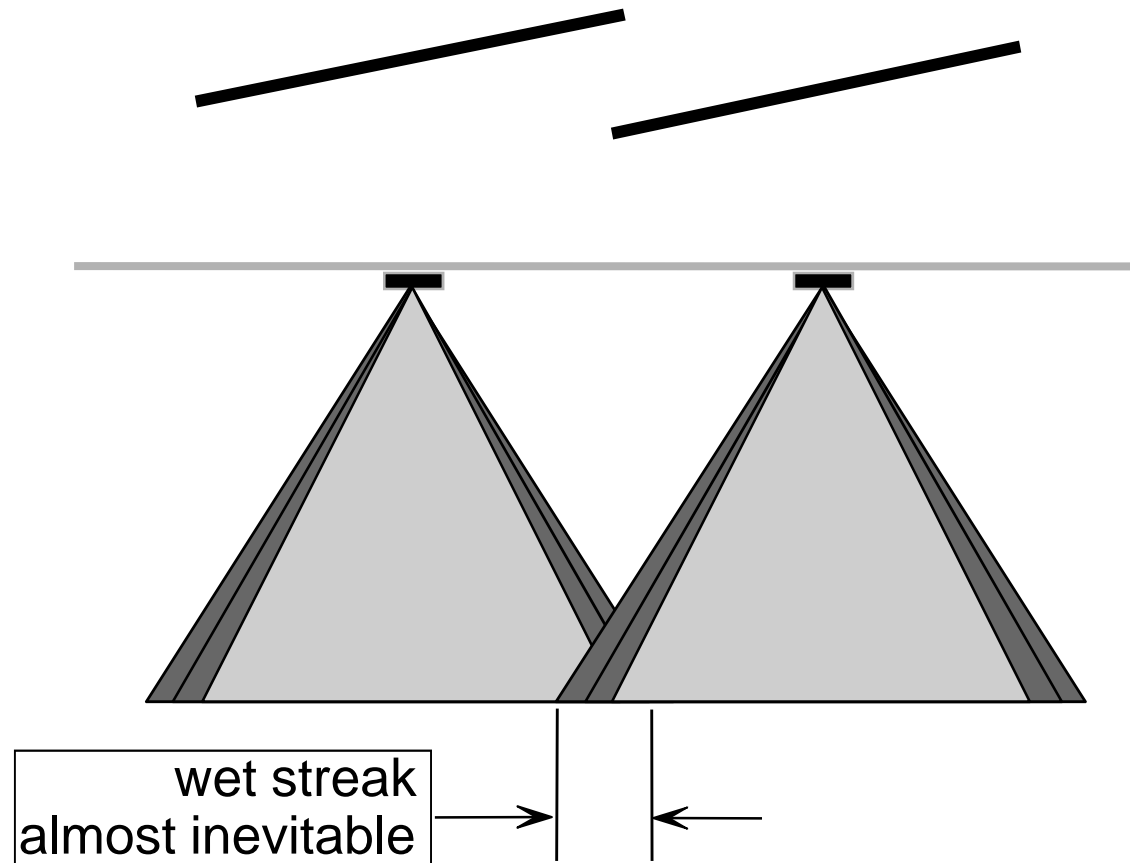
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## Nozzles Spaced for Average Pattern Width

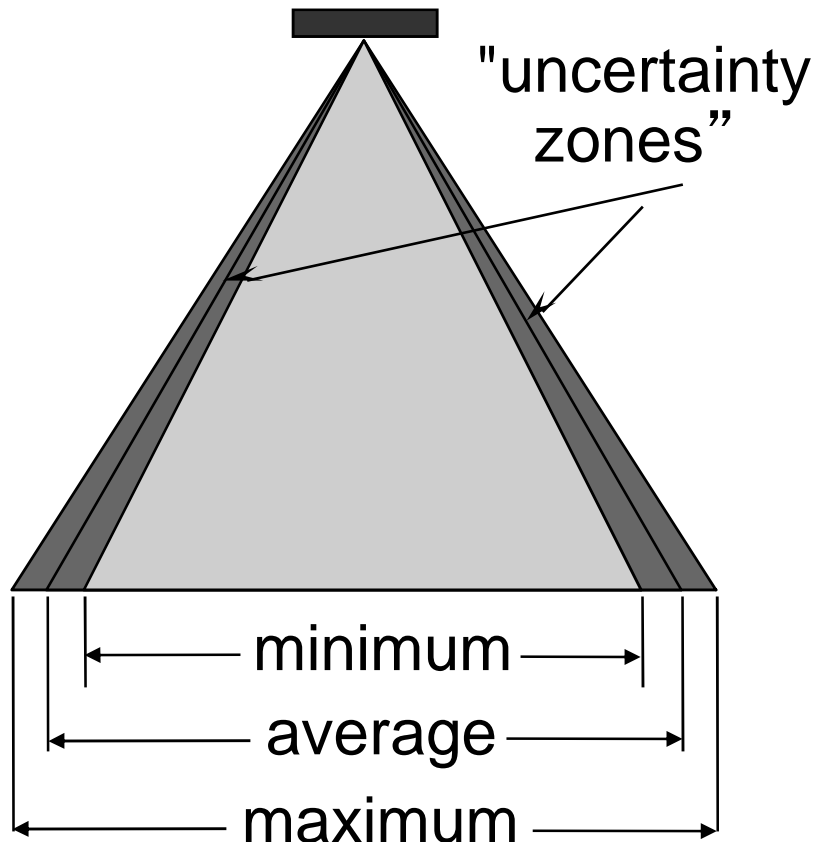


# Nozzles Spaced for Minimum Pattern Width

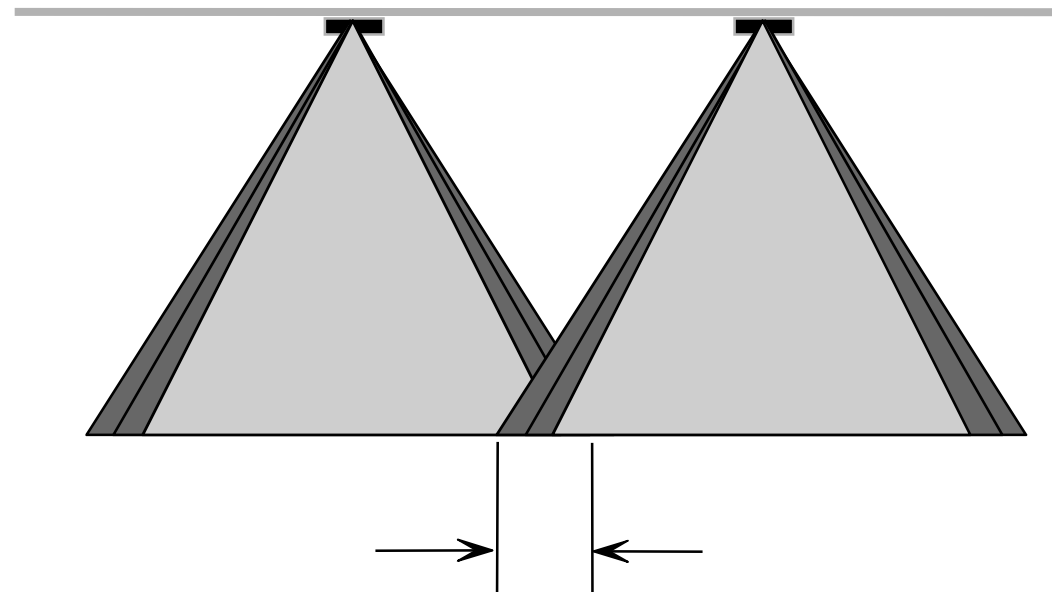
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# Fan Shower Nozzle Spacing



## No Dry Streaks



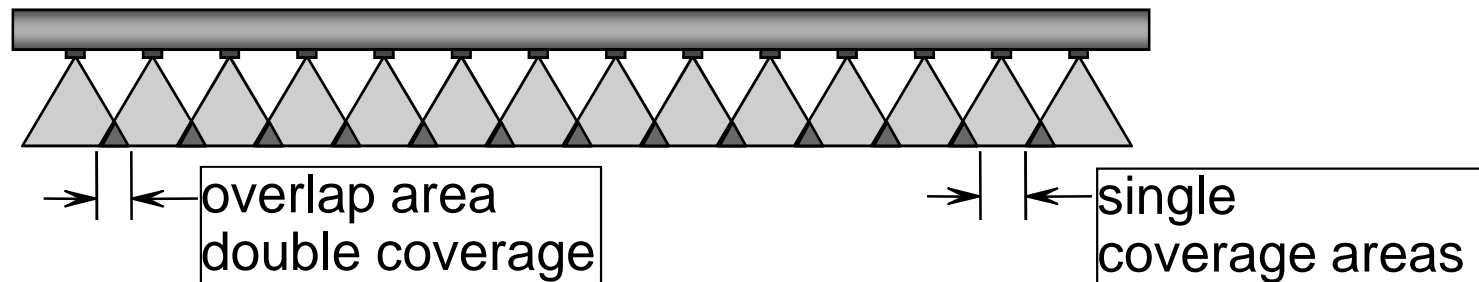
Wet streaks almost inevitable  
But better than a dry spot!

**Overlap Nozzles and  
Oscillate Fan Showers**

# Single Coverage Shower Pipe Layout

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- Overlapped Nozzles
  - Conservative Approach
  - Precludes Dry Streaks
  - Causes Wet Streaks



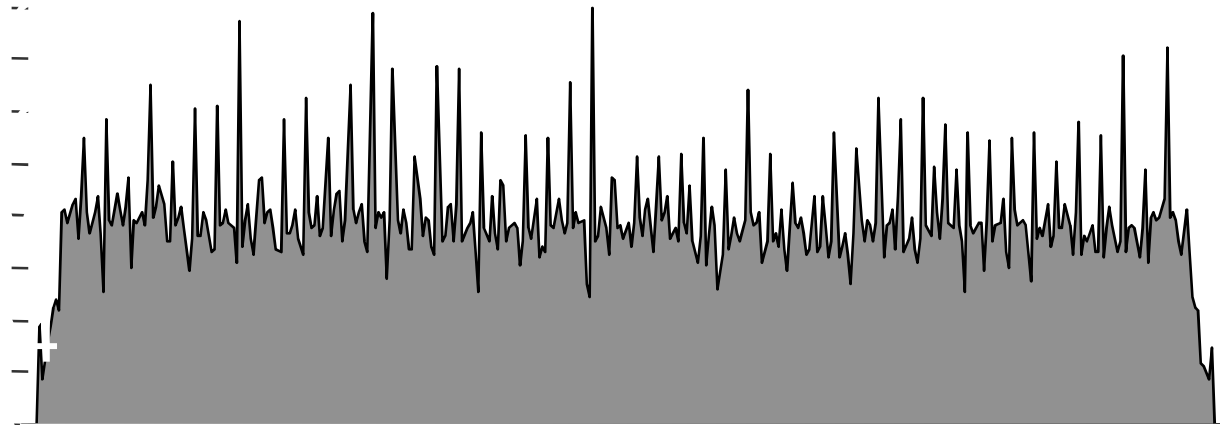
- A proper design spaces nozzles at the minimum effective pattern width

# Machine Width

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## Stationary Shower Distribution

300 in. wide, 45 deg. fan nozzles,  
6 in. centers, 1/2 inch pattern overlap



Peak to peak variation is over 2:1

# Machine Width Oscillated Shower Distribution

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300 in. wide, 45 deg. fan nozzles,  
6 in. centers, 1/2 inch pattern overlap  
12 inch oscillator stroke



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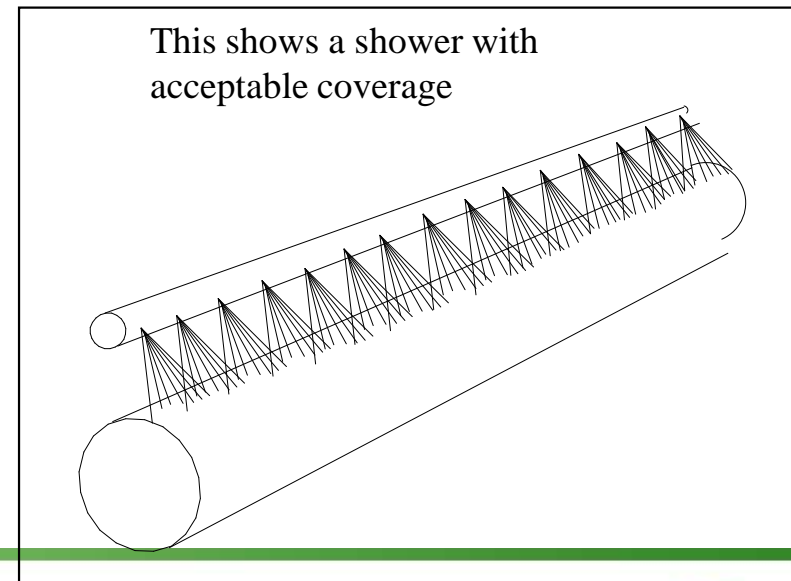
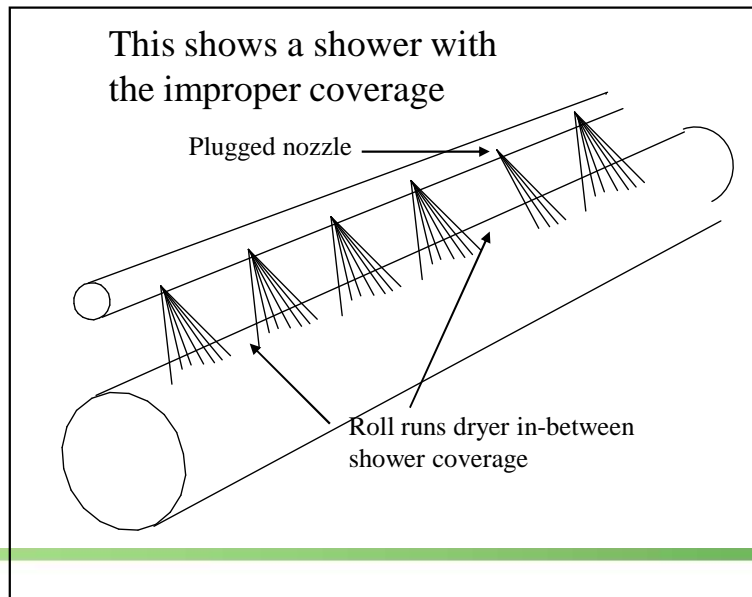
## Uniform Water Distribution on Felts

	Non-Oscillated	Oscillated
Average Flow	.079 gpm/inch	.079 gpm/inch
Standard Deviation	.019 gpm/inch (24%)	.003 gpm/inch (4%)



# Consider Fan Shower Locations

- Make sure the shower is installed in its most effective location as per application
- Ensure 100% minimum coverage, **Design for 200%**
- Adjust distance if required



# Press Section Temperature

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- Expense of sheet dewatering increases down the machine.
- Pressing is the last chance to remove water before evaporation.
  - Express water from sheet to felts/Save-all pans
  - Propagate former dewatering efficiency
- Three dimensions to pressing
  - Time (nip dwell)
  - Pressure (nip load)
  - Temperature (to about 200F)

*What is optimum balance of temperature/energy cost/runability?*

# Press Temperature Effects

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- Limits to Pressing
  - Flow resistance
  - Sheet Compressibility
  - Rewet
- Temperature effects\*:
  - Water viscosity reduced by 10% for 18<sup>0</sup>F sheet temp. increase
  - Fibers softened 5% for 18<sup>0</sup>F sheet temp. increase
  - Surface tension reduced 3% for 18<sup>0</sup>F sheet temp. increase
- ***Rule of thumb: 18<sup>0</sup>F increase in sheet temp. at press yields 1% solids improvement.***

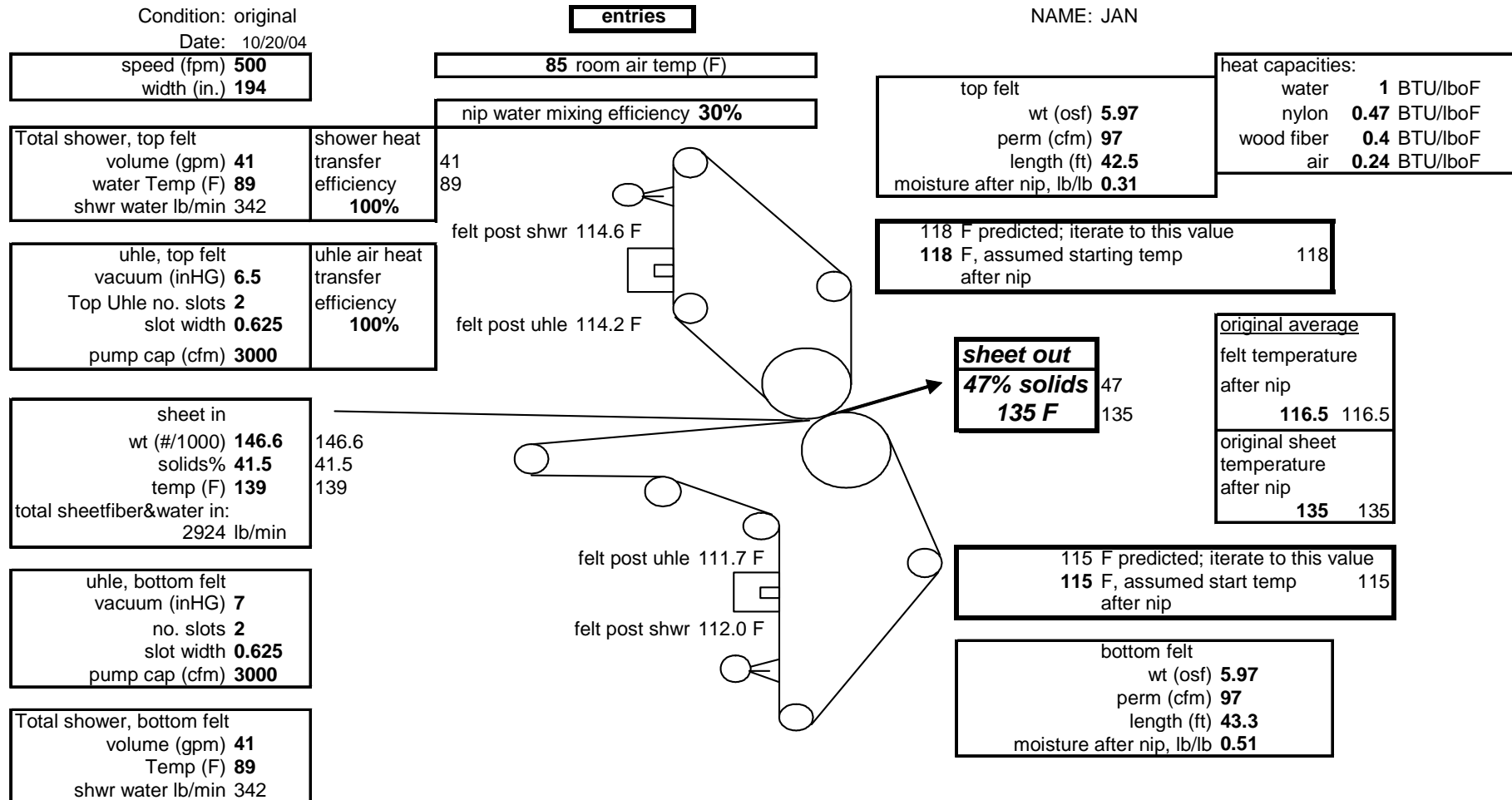
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\*TAPPI Hot Pressing Short Course, Syracuse, 1996



# Press Heat Balance

- *Rule of Thumb:* 1% sheet solids improvement from 18°F temperature increase.



## Example of Felt Heating

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Pulp machine: 500 fpm, 150 lb./1000 ft<sup>2</sup> BW

Double felted second (last) press

	Before	After
Shower gpm	41	21
Shower °F	89	170
<b>Felt temp °F</b>	<b>117</b>	<b>145</b>
Exiting Sheet solids %	47	48
Sheet temp °F	135	140

**Result:** Invest 1500 lb./hour steam to heat felts, Save over 5,000 lb/hour steam in reduced dryer load



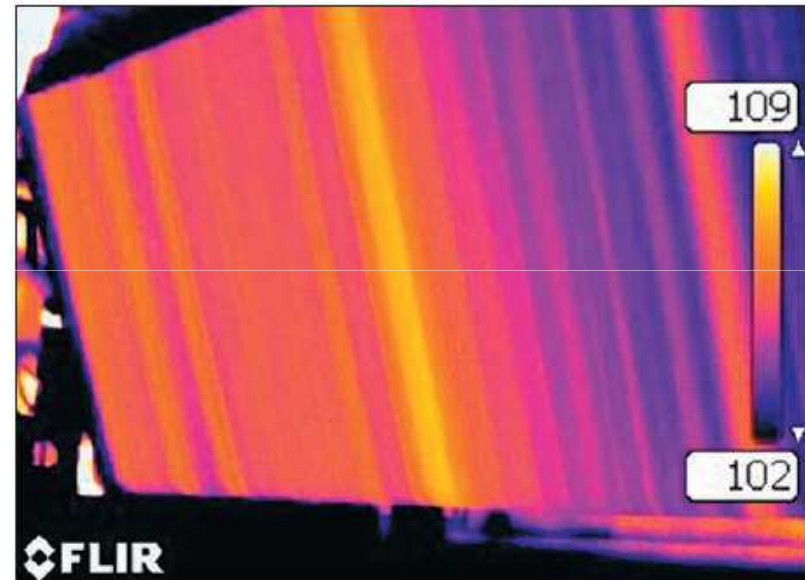
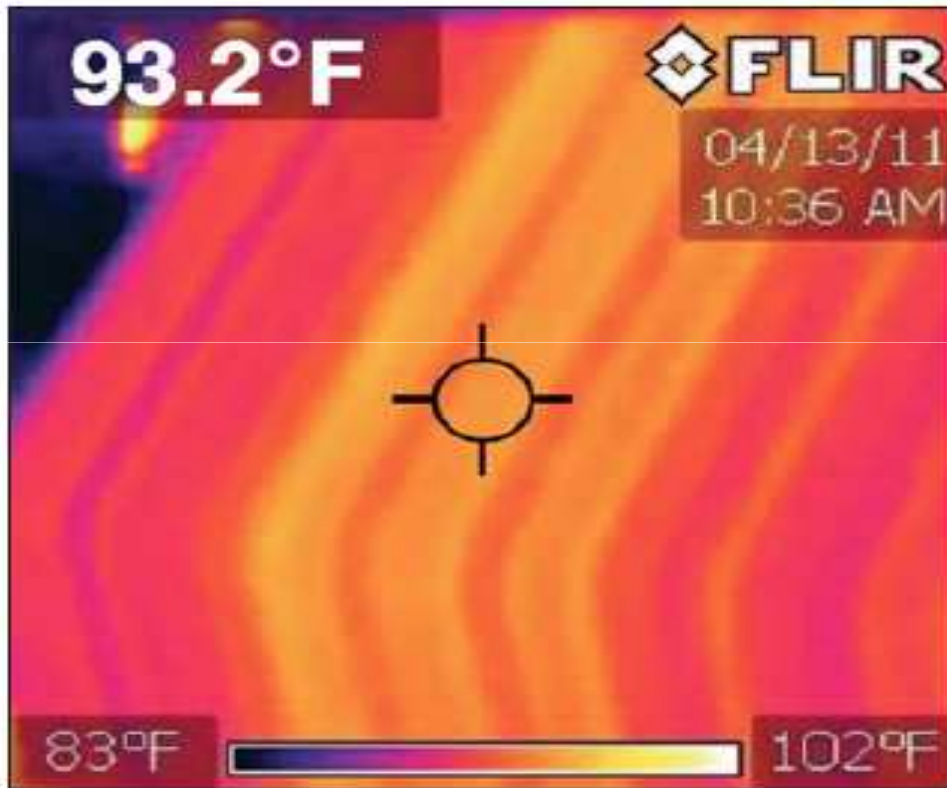
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## Press Fabric Profile Control

- Fabric streaks cause sheet streaks
- Sheet streaks cause over drying
- Fabric streaks can be battled with
  - Uniformly Cleaning all fabrics
    - Eliminating plugged nozzles
    - Oscillating all showers
  - Single jet showers (streak treatment)



# Example of poor lubrication shower. resulting in temperature variations in felts



# Selecting Proper Shower and Nozzles for the Application

- When selecting a nozzle orifice its important to understand the water quality!
- What amount of solids are in the shower water source?
- **DO NOT FORGET ABOUT THE PIPING AND TANKS**

Solids Loading PPM	Application of Water Strained w/ 100 Mesh / in. Screen
0 - 50	= to filtered fresh water
50 - 75	0.040" and larger
75 - 100	0.055" and larger
100 - 200	0.125" and larger
200 - 500	Brush type shower is recommended
500 and up	Purgable nozzles are recommended

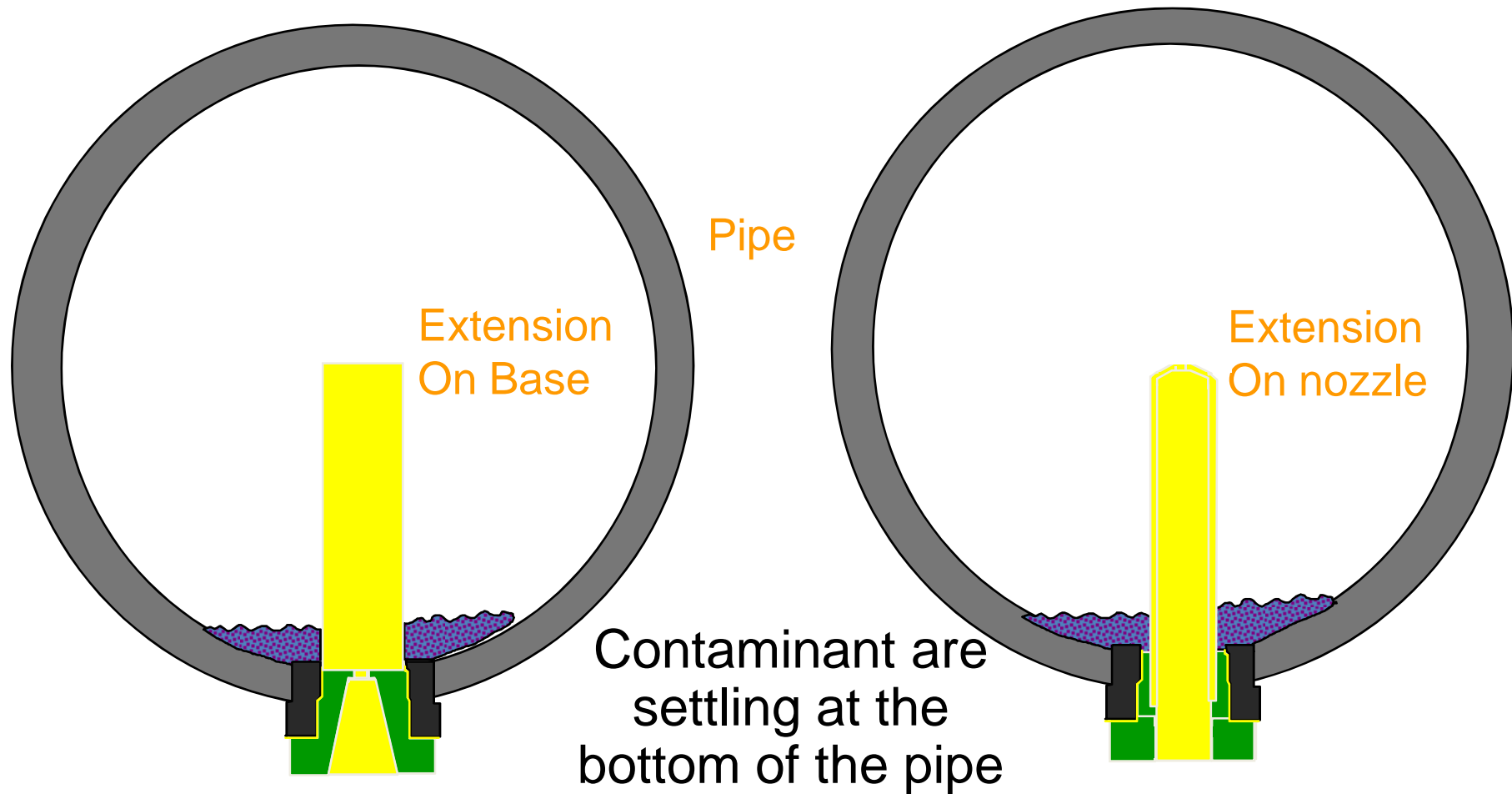




# Nozzle Selection for Conditions

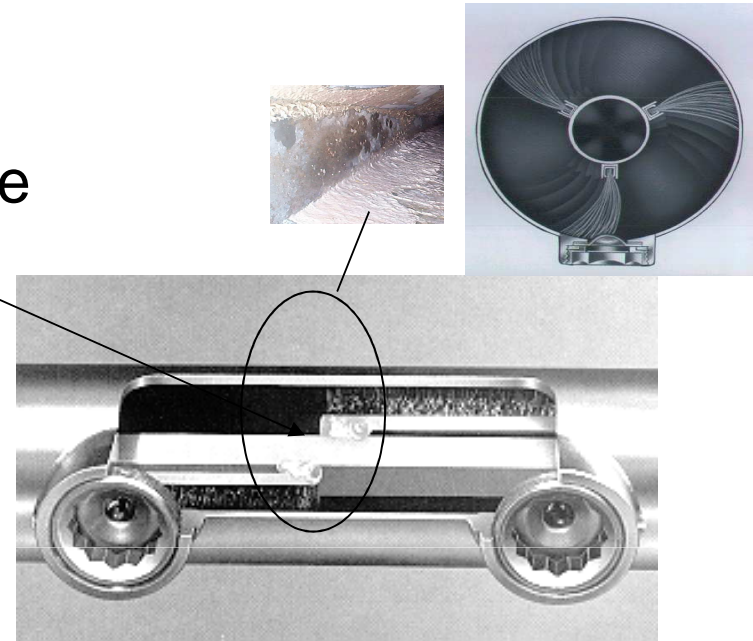
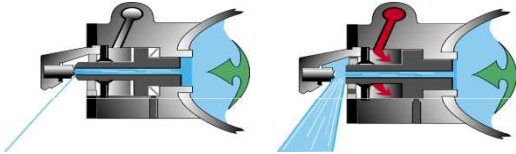
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## Nozzle Extensions



# Selecting your Shower Features

- All Recycled Water showers purge or Brush type.
  - Brush entire pipe not just nozzle.



- Auto brush on timer

-Nozzle Replacement

-Good water velocity in pipes



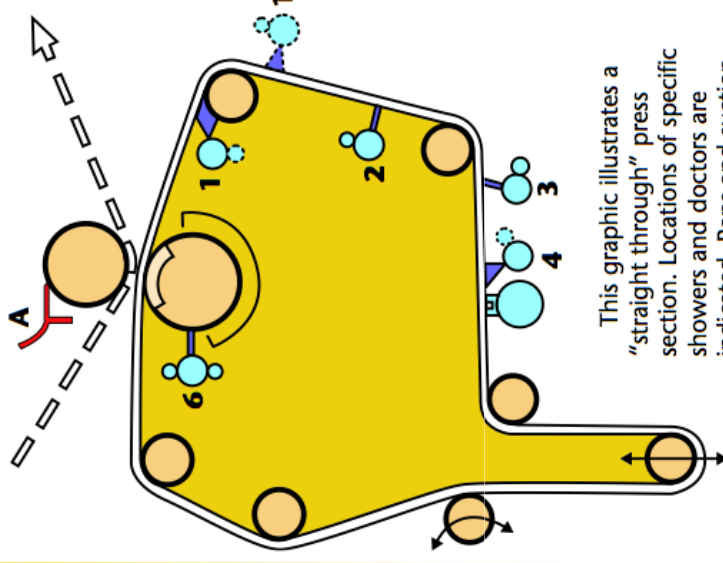
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## Showering Application Considerations

- Use right volume at the right location
- Use an acceptable minimum volume and pressure
- Deliver uniformly onto fabric
- Use the right shower Type and Features for the water Source

## Press Section Showers

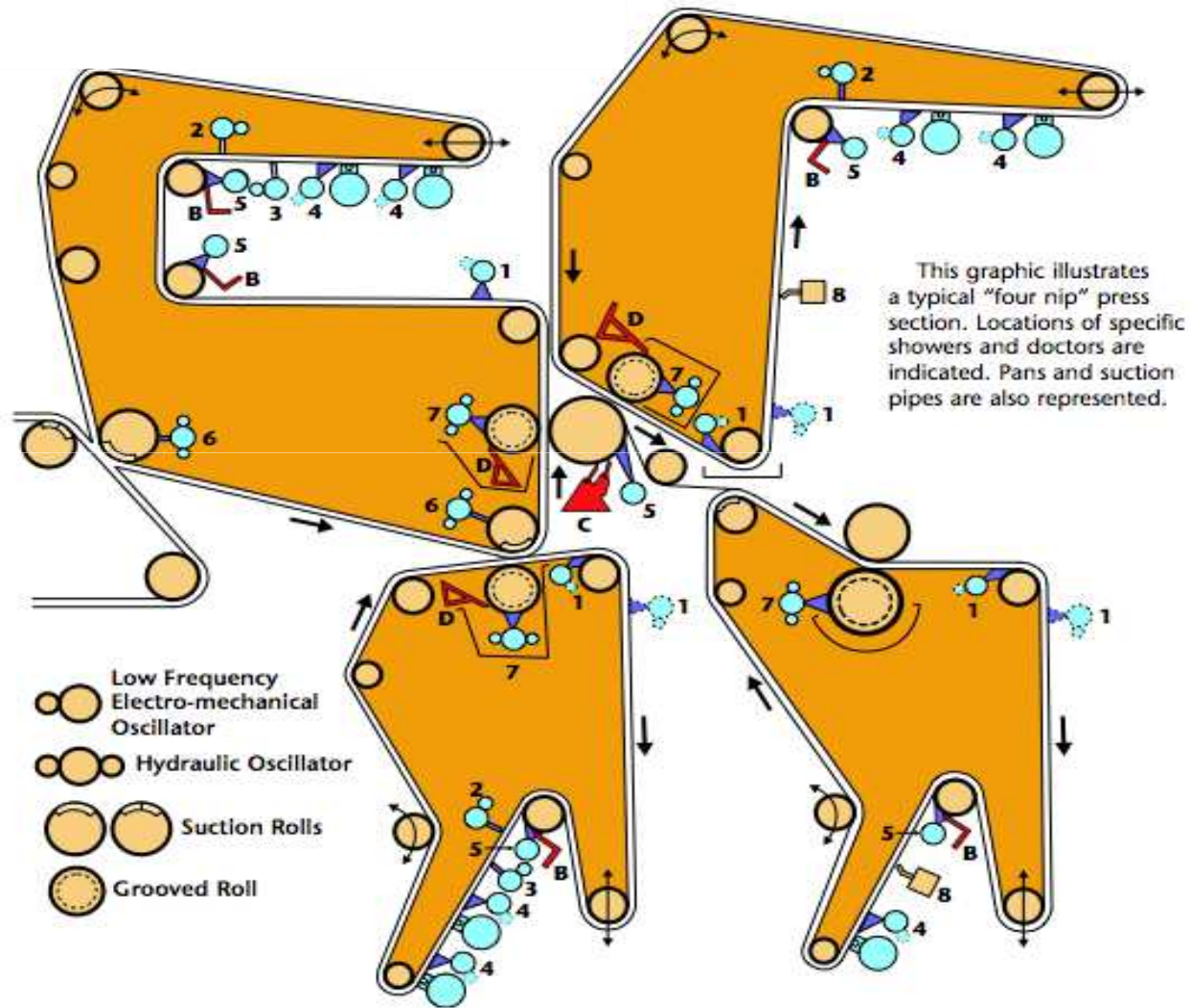
SHOWER LOCATION	APPLICATION	FUNCTION	SHOWER TYPE	OSCILLATION	NOZZLE SPACING	OPERATING PRESSURE	FLOW GPM/in. LPM/cm
1	Flooding	Felt Wetting Chemical Application	Fan	Optional	3 - 6 in. 75 - 150 mm	40 - 60 PSI .3 - .4 MPa	Must be Calculated See Text
2	Inside High Pressure	Void Volume Cleaning	Needle jet	Yes	6 in. 150 mm	200 - 350 PSI 1.4 - 2.4 MPa	.083 - .106 .124 - .158
3	Sheet Side High Pressure	Sheet Side Cleaning	Needle Jet	Yes	6 in. 150 mm	150 - 300 PSI 1.0 - 2.1 MPa	.073 - .099 .108 - .148
4	Uhle Pipe Lube Shower	Wear Surface Lubrication & Sealing	Fan	Optional	6 - 8 in. 150 - 200 mm	20 - 30 PSI .15 - .2 MPa	.05 - .07 .075 - .104
5	Doctor Lube Shower	Doctor Blade Lubrication	Fan	No	6 - 8 in. 150 - 200 mm	30 - 40 PSI .2 - .3 MPa	.05 - .07 .075 - .104
6	Suction Roll Shower	Cleaning	Needle Jet	Yes	3 in. 75 mm	350 - 500 PSI 2.4 - 3.4 MPa	.212 - .250 .316 - .373
7	Grooved Roll Shower Below 1400 FPM 425 mpm	Remove H <sub>2</sub> O from Grooves	Fan	No	3 in. 75 mm	60 - 80 PSI .4 - .6 MPa	.49 - .56 .73 - .83
	Above 1400 FPM 425 mpm	Clean Grooves	Needle/Fan	Yes	3 in. 75 mm	200 - 500 PSI 1.4 - 3.4 MPa	.167 - .250 .248 - .373
8	Traversing High Pressure	Cleaning	Needle Jet	Nozzle Header Traverses	1.5 in. 37 mm Max of 3 Nozzles	150 - 80 PSI 1.0 - 2.1 MPa	5 - 1.5 GPM 2 - 6 LPM Total Flow



This graphic illustrates a "straight through" press section. Locations of specific showers and doctors are indicated. Pans and suction boxes are also represented.



# Typical 4 felted Press

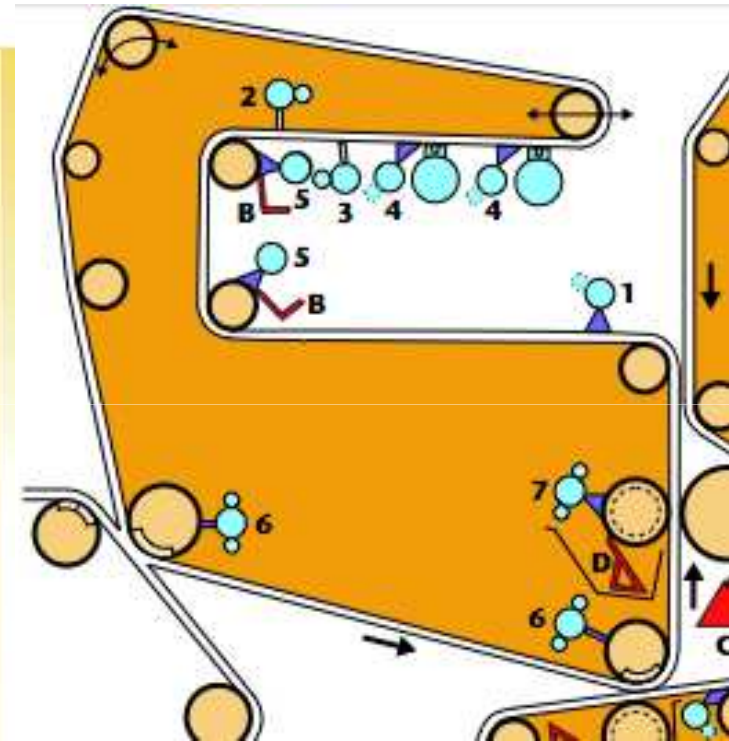




# Pick Up Felt or 1<sup>st</sup> top Felt

## Press Section Showers

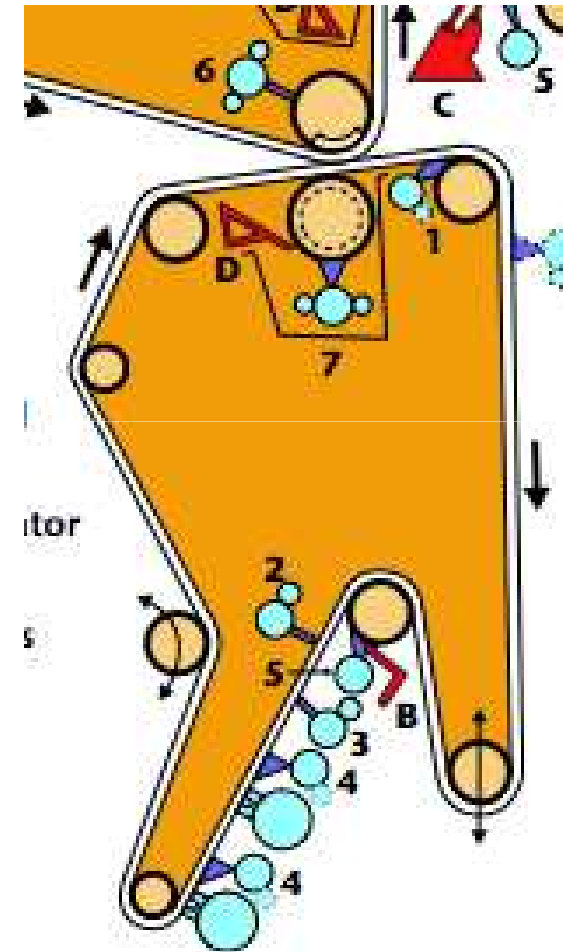
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# 1<sup>st</sup> Bottom Felt

## Press Section Showers

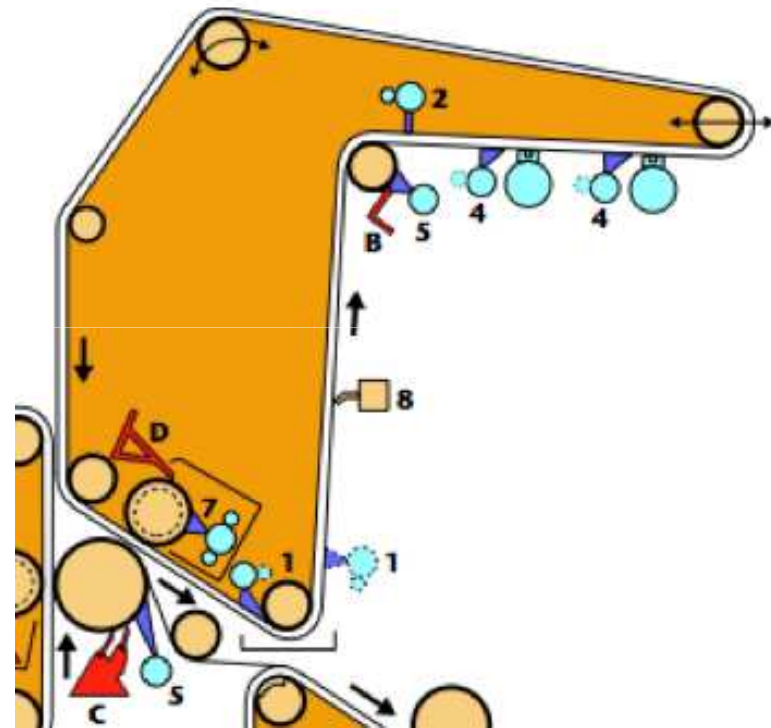
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# 2<sup>nd</sup> Top Felt or 3<sup>rd</sup> Felt

## Press Section Showers

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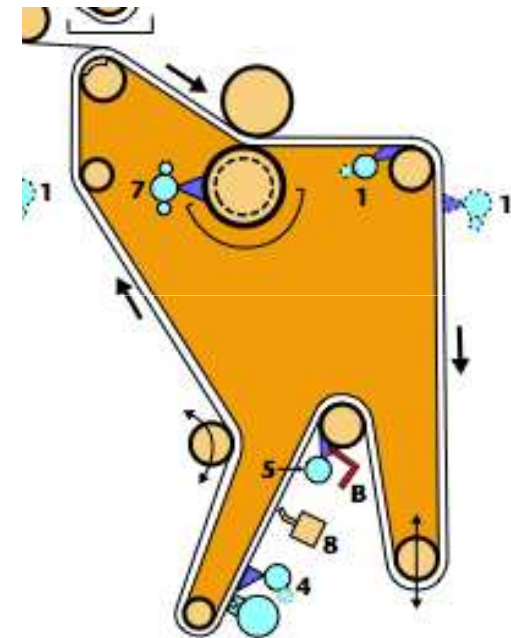




# 4<sup>th</sup> Felt or 2<sup>nd</sup> Bottom

## Press Section Showers

SHOWER LOCATION	APPLICATION	FUNCTION	SHOWER TYPE	OSCILLATION	NOZZLE SPACING	OPERATING PRESSURE	FLOW GPM/in. LPM/cm
1	Flooding	Felt Wetting Chemical Application	Fan	Optional	3 - 6 in. 75 - 150 mm	40 - 60 PSI .3 - .4 MPa	Must be Calculated See Text
2	Inside High Pressure	Void Volume Cleaning	Needle Jet	Yes	6 in. 150 mm	200 - 350 PSI 1.4 - 2.4 MPa	.083 - .106 .124 - .158
3	Sheet Side High Pressure	Sheet Side Cleaning	Needle Jet	Yes	6 in. 150 mm	150 - 300 PSI 1.0 - 2.1 MPa	.073 - .099 .108 - .148
4	Uhle Pipe Lube Shower	Wear Surface Lubrication & Sealing	Fan	Optional	6 - 8 in. 150 - 200 mm	20 - 30 PSI .15 - .2 MPa	.05 - .07 .075 - .104
5	Doctor Lube Shower	Doctor Blade Lubrication	Fan	No	6 - 8 in. 150 - 200 mm	30 - 40 PSI .2 - .3 MPa	.05 - .07 .075 - .104
6	Suction Roll Shower	Cleaning	Needle Jet	Yes	3 in. 75 mm	350 - 500 PSI 2.4 - 3.4 MPa	.212 - .250 .316 - .373
7	Grooved Roll Shower Below 1400 FPM 425 mpm	Remove H <sub>2</sub> O from Grooves	Fan	No	3 in. 75 mm	60 - 80 PSI .4 - .6 MPa	.49 - .56 .73 - .83
	Above 1400 FPM 425 mpm	Clean Grooves	Needle/Fan	Yes	3 in. 75 mm	200 - 500 PSI 1.4 - 3.4 MPa	.167 - .250 .248 - .373
8	Traversing High Pressure	Cleaning	Needle Jet	Nozzle Header Traverses	1.5 in. 37 mm Max of 3 Nozzles	150 - 80 PSI 1.0 - 2.1 MPa	.5 - 1.5 GPM 2 - 6 LPM Total Flow



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# Questions



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