PRESS FELT CLEANING AND CONDITIONING

Increasing machine speeds, challenging press technologies, new pulp types and new chemistries all increase the demand on press felts. Optimum felt and press section runnability depends on maintaining “like-new” felt characteristics for a longer period of time. This can only be accomplished with an effective conditioning program.

The type and use of a felt conditioning system has a profound effect on the runnability of the felt and the press section of the paper machine. The first step in an effective felt conditioning program is an in-depth analysis of the felt contaminants present. Based upon this analysis, an optimum felt conditioning program involving both a mechanical and a chemical approach can be developed. Mechanical conditioning includes the use of various showers and vacuum boxes. Chemical conditioning utilizes the components of the mechanical conditioning system to apply chemicals to the felt for contaminant removal.

During pressing, water that contains solids, fines, and other contaminants is removed from the sheet and transferred to the felt. The types of components found in the analyses of wet felts depend upon the wet end chemistry and final sheet characteristics of a system. Solids that are not removed and accumulate in the felt are called fill-up. Over 10% fill-up is considered a heavily filled condition.

An optimum felt conditioning system utilizes both mechanical and chemical means to keep felts open and all felts should be conditioned from start-up throughout life. There are a great range of mechanical and chemical methods available for cleaning a felt. It is possible and advisable to tailor the methods used to the type of felt contaminants, machine geometry and operating conditions that exist in an individual press section. Selection and application of the proper method will pay important dividends in reduced clothing costs, higher quality production and overall higher operating efficiencies.

An effective felt conditioning system accomplishes the following:

1. Detaches foreign objects imbedded in the felt either chemically or mechanically.

2. Dilutes or suspends solids through the application of sufficient water.

3. Removes solids and water through a suction system.

MECHANICAL CONDITIONING

Mechanical conditioning of felts involves the use of various showers and Uhle boxes to form an effective cleaning system. Although specific recommendations such as the volumes of water necessary, the types of showers used and the types of Uhle boxes used vary somewhat with paper grade, here are some general guidelines that apply to all machine setups.

The most widely used of all cleaning methods is the full-width shower followed by a full-width suction box. This system forms a simple yet effective mechanical cleaning system and should be located so that felt conditioning is accomplished prior to contact with sheet side felt carrying rolls.

Showers

The primary functions of felt showering systems are to lubricate and clean felts. Adequate water pressure and volume are essential to satisfactory shower performance. Generally, total water usage per felt should be 5-8 gallons/minute/1000 running square feet of felt.

All shower nozzles should be self-cleaning or shower inserts should be used to filter shower water. Particles like sand, silt and fines which are small enough to pass through the nozzle orifice are still generally too large to be impacting the felt with a high force. A good rule of thumb is to apply water sufficiently filtered to prevent particles larger than 100 microns from contacting and abrading the felt.

There are four basic types of felt showers:

1. Flooding Shower - Low pressure, high volume shower that flushes loose particles and maintains the evenness of the water distribution in the felt. Should be placed after the high pressure shower and before the suction box. Most effective at removing contaminants when used in conjunction with the nip of an inside felt carrying roll. Requires adequate vacuum to remove water volume. Generally used in tissue applications and on bleed-thru prone fine paper pickup felts. See Table 1.

2. Lubricating Shower - Low pressure, low volume shower used to apply a thin lubricating film of water to the felt prior to contact with a suction box to reduce wear and friction and act as a seal for the suction box. Apply the fan spray into the nip of the suction box with an overlapping coverage. See Table 2.

3. Chemical Shower - Low pressure, low volume shower used to apply chemicals to the felt. Most effective at removing contaminants when used in conjunction with the nip of an inside felt carrying roll. For maximum efficiency/dwell time, this shower should be placed as close to the sheet-felt split and as far from the suction box as possible. See Table 3.

4. High Pressure Shower - High pressure, low volume. Dislodges contaminants from the felt. Most efficient when placed close to a supporting roll. See Table 4.

High pressure cleaning of felts is best accomplished with an oscillating needle jet at controlled pressures. Proper oscillation of the high pressure shower to assure uniform felt coverage is essential to an efficient felt conditioning system. Improper shower oscillation can result in a streaky felt appearance. Some sections of the felt do not receive showering and become filled while other sections of the felt receive partial or uniform showering. See also page 5.
Correct shower oscillating speed can be calculated as:

$$R = \frac{S}{L} \times t$$

where R = Rate, S = Speed, L = Loop length of the felt, t = Jet thickness on the felt (nominal 0.07”)

An oscillation fail safe protection system is recommended to prevent stationary needle showering and the resultant damage to the felt.

SHOWER POSITIONING - Typical Multi-roll Press

Figure 1 shows a cleaning shower set up for a typical multi - roll press. Note that the positioning of the showers is subject to individual preference. The machine configuration, ease of access and amount of cleaning required will tend to dictate the exact positions.

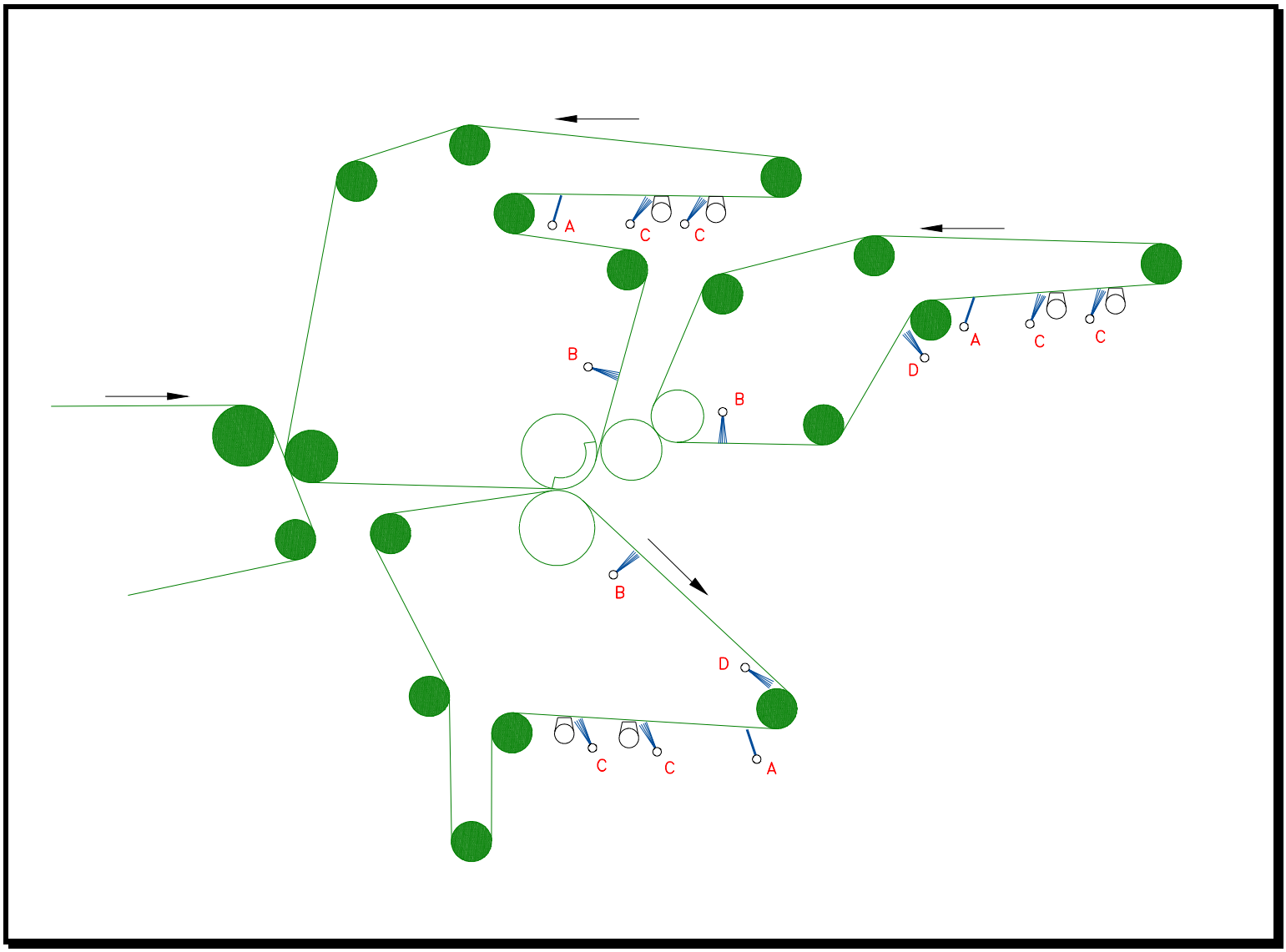

Figure 1

Recommended shower locations on a typical multi - roll press.

(A) High pressure shower.
(B) Chemical shower.
(C) Lubricating shower.
(D) Flooding shower / Flooded nip shower (optional).

Table 1: Flooding Shower Guidelines

Type:	6” centers, 70-100° fan shower, overlapping spray, fresh water
Placement:	Roll side, into the felt roll nip
Temperature:	Stock temperature or higher
Volume:	As necessary up to maximum shower water usage per position of 5-8 gallons/minute/1000 running square feet of felt
Pressure:	30-50 psi

Table 2: Lubricating Shower Guidelines

Type:	6” centers, 90-120° fan shower, fresh water
Placement:	Sheet side, into Uhle box/felt nip
Temperature:	Stock temperature or higher
Volume:	4-9 gallons/minute/100” of felt width
Pressure:	30-50 psi

Table 3: Chemical Shower Guidelines

Type:	6” centers, 70-100° fan shower
Placement:	Sheet side, maximum dwell time
Temperature:	Stock temperature or higher
Volume:	10-50 gallons/minute/100” of felt width
Pressure:	30-150 psi

Table 4: High Pressure Shower Guidelines

Type:	Oscillating, 12” stroke, 6” centers, .040” orifice, fresh or clarified water
Placement:	Sheet side[1], 4-8” from the felt surface, from 30^0 into the run to 30^0 with the run[2]
Temperature:	Stock temperature or higher
Volume:	4-10 gallons/minute/100” of felt width
Pressure:	100-400 psi sheet side, 400-600 psi roll side

[1]Roll side is acceptable on very lightweight felts - $\leq$ 3.3 oz./sq. ft.
[2]Distance, angle and pressure to be determined by the desired objectives for the shower.

Needle showers should be set up based upon the following criteria :

- For Penetration to clean the felt interior (energy maintenance to the felt interior).
  - Pressure should be high - 200 to 450 psi.
  - The Distance from the felt should be less than 4 inches.
  - The Angle should approximate the shear angle with the felt run.

- For Cleaning the felt surface (rapid energy dispersion at the surface of the felt).
  - The Pressure should be low - 100 to 200 psi
  - The Distance from the felt should be 7 to 8 inches.
  - The Angle should be into the run.

- Other
  - Too reduce sheet stealing the shower angle should be with the felt run.
  - Too reduce blowing the shower angle should be perpendicular or into the felt run.

Vacuum Systems

Without a well designed vacuum system, which will remove all the shower water applied, definite press inefficiencies can result. Suction/vacuum boxes, which are normally employed for the dual purpose of dewatering and cleaning, rely on the passage of air through felt to transfer the water to the vacuum and on the scraping action of the leading edge of the second strip. Problems can usually be traced to inadequate air flow (lack of vacuum) and dwell time which become more important with increased machine speed.

One of the most common problems found with vacuum systems today is the use of one source of vacuum for a variety of vacuum devices. Uhle boxes need individual sources of vacuum to prevent imbalances in the press section. Vacuum boxes should generally be operated in a range of 8-15” Hg. A minimum air flow of 15 CFM/sq. in. of open area is needed for most modern felt designs with 15-20 CFM/sq.in. preferred.

A Uhle box dwell time of .002-.004 sec is the minimum required for de-watering the felt ; uhle boxes used primarily for cleaning the felt can have shorter dwell times. Figure 2 can be used as a quick reference guide for determining the total slot width necessary. Maximum width/slot should be 0.75

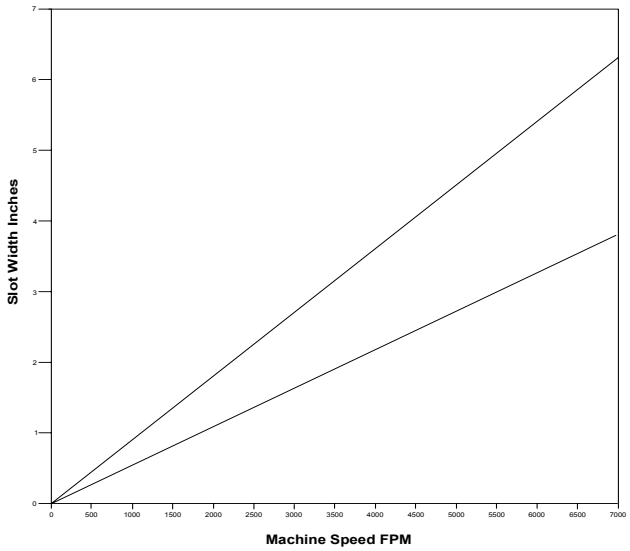

Figure 2 :

Minimum and Maximum Values for Total Slot Width

CHEMICAL CONDITIONING

The first step in any felt conditioning program should be to gather information concerning the contaminants present. Proper selection of chemical cleaning agents depends upon a number of variables and for best results a laboratory felt analysis and evaluation is recommended. Chemical precipitates found in the press section are inorganic as well as organic. The organic or hydrophobic types include rosin size, wet strength resin, pitch and hydrocarbon oil. Inorganic precipitates include clay, calcium carbonate, titanium dioxide and alum.

Generally speaking, chemicals for cleaning felts are applied using either a continuous or a shutdown cleaning method. Continuous cleaning effectively keeps the felt open during its run rather than relying on the more difficult job of cleaning a plugged felt. Recommendations for continuous and shutdown cleaning are given in Tables 5-9. **CAUTION : Chemicals can pose health and damage risks ; consult your chemical supplier for proper usage**.

Table 5 - Formulations for Continuous Cleaning

Formula	Reagent Concentration	Detergent[1] Concentration	Shower Rate GPM/100"
A	Water Only	0.02-0.04%	8-20
B	Muriatic, Sulfamic, or Sulfuric Acid to give pH of 3.0-5.0[2]	0.01-0.02%	5-10
C	Soda Ash to give pH of 8.0-10.0	0.01-0.02%	5-10
D	Caustic Soda to give pH of 11.0	0.01-0.02%	5-10

[1]Use a nonionic biodegradable detergent
[2]Always add acid to water, **NEVER ADD WATER TO ACID**

Table 6 - Continuous Cleaning Recommendations for Common Materials

Filling Materials	Wool/Nylon Felts	100% Nylon Felts
Alum, Carbonate, Clays, Titanium Dioxide, Paper Stock, Asbestos Cement, Latex	B	B
Rosin Size[1], Wax, Grease	A	A
Pitch	C	C
Wet Strength Resin	Consult resin manufacturer before selecting acid or alkaline cleaning.	
Tars, Asphalts	Concentrations of 0.02-0.04% high flash point water miscible solvents can be used but only in compliance with OSHA and EPA regulations.	

[1]Shutdown cleaning more effective

Table 7 - Formulations for Shutdown Cleaning
(Mix water and chemicals to make 50 gallons)

Formula	Reagent	Reagent Amount	Detergent[1]
1	Water Only	--	1 quart
2	Muriatic Acid[2]	5 gallons	1 pint
3	Sulfamic Acid[2]	40 pounds	1 pint
4	Soda Ash	8 pounds	1 pint
5	Caustic Soda	40 pounds	--

[1]Use a nonionic biodegradable detergent.
[2]Always add acid to water, **NEVER ADD WATER TO ACID**

Table 8 - Shutdown Cleaning Recommendations for Common Materials

Filling Materials	Wool/Nylon Felts	100% Nylon Felts
Alum, Carbonate, Paper Stock, Asbestos Cement	2 or 3	2 or 3
Titanium Dioxide, Clays	2 or 3 followed by 4	2 or 3 followed by 4
Rosin Size	2 followed by 4	2 followed by 4
Pitch	4	5
Wax	1	1
Wet Strength Resin	Consult resin manufacturer before selecting acid or alkaline cleaning.	
Tars, Asphalts, Grease	High flash point water miscible solvents can be used when in compliance with OSHA and EPA regulations.	
Latex	High flash point water miscible solvent can be combined with 10 gallons muriatic acid, 1 quart of detergent and water to make 50 gallons when in compliance with OSHA and EPA regulations.	

Table 9 - Procedure for Shutdown Cleaning

Description	Wash	Rinse
Machine Speed	Crawl	Crawl
Press	Unloaded	Loaded
Uhle Boxes	Off	On
Showers	Off	On
Application	Shower	Shower
Running Time (Minutes)	20	5

CONCLUSIONS

Optimizing the press section conditioning system will improve the felt and press section runnability. The optimization procedure begins with a detailed analysis of the current situation. Have the felt contaminants evaluated by a lab and audit the current conditioning system. Using the above guidelines, design a mechanical and chemical conditioning system, which is tailored to the specific needs of the press section.