An effective cleaning and conditioning program will help maintain PMC’s designed characteristics and assist in providing efficient and economic clothing life while minimizing operational costs.

By Steve Cole

Modern paper machine clothing is manufactured with a specific set of design and quality specifications for each paper machine’s performance requirements. Such specifications, i.e. surface characteristics, open area, void volume, permeability, smoothness, etc. are engineered to achieve specific goals in the papermaking process.

The need to implement an effective PMC cleaning program has become increasingly crucial in recent years. This change is primarily due to increasing levels of recycled furnish, faster machine speeds and accompanying technology, elevated sheet quality requirements, and the desire for longer fabric life.

Forming fabrics must be kept free of contaminants in order to maintain surface characteristics, adequate open area, and to prevent sheet marking.

Press felts must be cleaned, conditioned, and lubricated in order to maintain void volume, caliper and prevent wear; thus enabling the felt to take water and be de-watered uniformly throughout its operational life.

Finally, dryer fabrics must be cleaned in order to maintain their permeability and prevent sheet streaking due to non-uniform drying profiles and sheet drop-offs in vacuum assisted transfers, uniruns and single tier dryer runs.

Fabric cleaning is accomplished by mechanical (showering) or chemical means. An effective cleaning system can employ both methods on a continuous and/or batch basis and is designed to prevent unwanted side-effects such as streaking and fabric damage due to plugged shower nozzles or improper operation of high pressure showers.

Note: The following are excerpts from a compilation of cleaning guidelines available as PDF files you can download from Weavexx’s website: www.weavexx.com/weavexx/serviceSupport/technicalLibrary.aspx.

The PDFs are intended to provide the papermaker with general guidelines and recommendations on choosing, implementing, and operating cleaning programs for forming fabrics, press felts and dryer fabrics. This information is a result of numerous years of collaborative efforts within the Xerium
organization. Any information regarding chemical cleaning agents should be verified with a chemical supplier.

FORMING FABRIC CLEANING
Each forming fabric is designed with a specific set of characteristics to suit a particular paper machine. Regular and efficient cleaning of the fabric will maintain these characteristics and thereby assist in achieving an efficient and economic fabric life.

Fabrics can be cleaned by mechanical or chemical means and frequently by a combination of both. The cleaning can be continuous or for short periods at regular intervals. It is also usual to clean the whole fabric with chemical solvents during machine shutdowns.

Chemical Cleaning
Continuous chemical cleaning is possible by using a metering pump feeding into the water supply, but it can be very expensive. It is more usual to program the cleaning into one or two intensive periods during each shift. It is recommended to use a fabric coating if the contamination is proving particularly troublesome.

It is common to chemically clean the fabrics at machine shutdowns, and a number of different methods for applying cleaning agents are available including:

- A gravity fed shower
- A felt applicator saturated with solution
- An application roll mounted under the return roll
- A spray from hand held pump tank units
- A foam generator to achieve a thorough exposure to the chemicals

The method chosen should be compatible with the type of chemical used.

In all cases, the machine is run at crawl speed and the solution applied until the fabric has been well saturated for 20-30 minutes. It is then given a shower rinse at normal machine speeds.

Cleaning Chemicals
Cleaning chemicals fall into three main groups: Acid-based; Alkali-based; and Organic-based (see Table 1).

### Table 1.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>STRENGTH</th>
<th>CONTAMINANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACID BASE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>10-20%</td>
<td>General Cleaner - Rosin size, Mineral deposits. As Hydrochloric acid. Note: Either acid can be combined with a suitable detergent to act as a wetting and foaming agent. CAUTION: Use chemicals in accordance to the manufacturers’ directions. Chemicals may pose health risks, damage risks or the risk of fire.</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td><strong>ALKALI BASE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>Up to 10%</td>
<td>Pitch, Rosin, Mineral deposits, Stock or Fibers, some Latex</td>
</tr>
<tr>
<td><strong>ORGANIC BASE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerosenes</td>
<td>Usually 100%</td>
<td>Asphalt and Tar</td>
</tr>
<tr>
<td>Xylene, Toluene</td>
<td>Usually 100%</td>
<td>Pitch, Latex, Bitumen</td>
</tr>
<tr>
<td>Trichlorethylene</td>
<td>Usually 100%</td>
<td>Usually spot treated</td>
</tr>
<tr>
<td>Methyethylketone</td>
<td>Usually 100%</td>
<td></td>
</tr>
<tr>
<td>Proprietary Cleaning Agents</td>
<td>As directed by manufacturer</td>
<td>Various</td>
</tr>
</tbody>
</table>

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.

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.

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.

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

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.

**DRYER FABRIC CLEANING**
All dryer fabrics are contaminated to some degree during their service life. This contamination may reduce machine runnability and adversely affect paper quality while adding to your overall energy and fabric costs — problems that are often made more severe by increased machine speed. All dryer fabrics should be periodically cleaned so that their original properties are retained as long as possible and their value is optimized.
Some of the more common consequences of dryer fabric contamination are:
- Sheet moisture profile unevenness
- Sheet instability, particularly near the edges
- Inferior heat transfer and paper marking caused by dryer fabric surface deposits
- Heat transfer reduction caused by deposits left on the cylinders

• Plugged vacuum rolls
• The transfer of deposits from the dryer fabric to the paper
• The increased dryer fabric cost that results when running time (fabric life) is reduced by plugging

**Types of Contaminants**

Dryer fabric contaminants come primarily from the furnish (virgin pulp and recycled fibers) and its additives and from coating or size press chemicals. Cleaning should proceed only after identifying the type and degree of contamination of your particular fabric.

Tests have shown that even a small amount of contamination can cause pronounced reduction in dryer fabric permeability. Pronounced contamination is common after size presses and coating positions. In these cases, it is not unusual for dryer fabrics to be completely plugged.

Dryer fabric contaminants divide into four groups:

1. **Dust**
   - Short cellulose fibers.

2. **Organic substances not cross-linked**
   - Pitch.
   - Asphalt, tar, wax (often from recycled furnish).
   - Size from CMD size press, starch and casein types.
   - Bearing oil and grease.
3. Cross-linked organic substances
   - Wet strength resins.
   - Latex based coating chemicals (SBR, acrylic, and others).

4. Non-organic substances
   - Alum, calcium carbonate, kaolin, titanium dioxide, rust and scale.

<table>
<thead>
<tr>
<th>CONTAMINATION</th>
<th>CLEANING METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose fiber, fillers.</td>
<td>Air shower</td>
</tr>
<tr>
<td>Cellulose fibers, coating and size press chemicals, pitch.</td>
<td>Water shower (high pressure)</td>
</tr>
<tr>
<td>Pitch, asphalt, rosin size, cellulose fibers, alum, clay, titanium dioxide.</td>
<td>Steam shower (high pressure)</td>
</tr>
<tr>
<td>Size press chemicals (water soluble).</td>
<td>Hot water (low pressure)</td>
</tr>
<tr>
<td>Grease, oil, size, wax, latex, asphalt.</td>
<td>Chemicals (low pressure)</td>
</tr>
<tr>
<td>Cellulose fibers and surface contaminants such as stickies, wax and latex.</td>
<td>Brush</td>
</tr>
</tbody>
</table>

**Types of Cleaning Methods**

Recycle-based furnish increases contaminants such as tar, asphalt, latex, waxes and plastics.

Dryer fabric cleaning can be performed *intermittently* during paper production — at a sheet break (full speed) or during a stop at crawl. High pressure showering with air or steam and cleaning with a brush can also be performed *continually* during paper production. Cleaning with chemicals and large volumes of water should be done during a shutdown.

**Air Showering**

A regular, periodic air shower is best for cleaning high permeability dryer fabrics that are plugged with fiber dust or loose dirt. The air shower is often insufficient for removing resins and sticky particles from low permeability dryer fabrics. Low perm dryer fabrics require water or steam showering.

So that loosened dirt does not circulate in the dryer hood, high pressure air showers should be placed so that the dirt can be directed toward the exit duct in the dryer hood or down into the pit.

Cleaning is much better when a short distance is used between the nozzle and the fabric. At long distances, the air jet loses energy. For space and safety reasons, distance should be 1¼ to 2 inches (30 to 50 mm). When air pressure is raised, permeability increases. Low pressure [example: 29 PSI (0.2 MPa)] results in poor cleaning.

**Figure 2.**

To avoid unnecessarily large air consumption, a nozzle diameter of 7/64 inch (2.5 to 3.0 mm) is recommended.

Air showering results have been shown to be comparable regardless of whether the shower was directed against the paper side of the sheet or against its back side. However, this does not hold true when showering with water or steam. Remember, when installing your air shower, locate a position where the dust can easily be removed from the dryer section.

Credits: Edward O. Barber

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