EXPERTIP

Category	DRYING
Keywords	Dryer fabric, cleaning, conditioning, contamination control

Cleaning and Conditioning of Dryer Fabrics

With the widespread use of recycled fiber and additives in the furnish, the potential for contaminants ("stickies", ink, and dirt) to make their way to the dryer section has increased. Quite often, these contaminants do not make their presence known to you until they are exposed to the high heat and humidity in the dryer section. This makes dryer fabric cleanliness an increasingly important issue.

Perm's a problem

Over time, contamination build-up can have drastic effects on runnability. Contaminants are unwelcome guests as they block up the "pores" in the fabric, lowering the air permeability (perm). The blockage keeps heated air from easily passing through, which has negative and expensive consequences. Considering that you normally keep your dryer fabrics on for a year or more before replacement, you don't want to pay the additional cost of wasted energy or for more frequent cleanings just to keep the fabric running.

Each dryer fabric is designed to provide specific perm capabilities. The perm should be maintained within a given range throughout the fabric's entire life for maximum performance. This all points to the need for you to have a solid, repeatable regimen for cleaning and conditioning dryer fabrics – especially if you're using recycled fiber in your furnish.

Cleaning Systems

Knowing the type of make-up of the contaminants that are present on your machine is an important first step in determining a cost-effective method of cleaning and developing an effective cleaning regimen.

There are several fabric cleaning and conditioning systems available today. Generally speaking, these can be grouped into three categories:

- Chemical (batch wash)
- Shower (steam, air, or water)
- Mechanical (friction)

CHEMICAL CLEANING. Many papermakers are successful using a chemical for cleaning contaminants that are not water-soluble (adhesives, waxes, glues, and resins) from dryer fabrics. The chemical is applied with the machine in crawl speed and after a shutdown so that the dryers have had a chance to cool, but still warm enough that the contaminants are still pliable. Typically, a high volume/low pressure fan shower is used to apply the chemical, followed by a warm water rinse to achieve a neutral pH.

The cleaning and conditioning chemicals are determined by the furnish involved and the contaminants being treated. As an example, fabrics on a machine producing recycled boxboard or recycled newsprint (both of which might contain high concentrations of stickies, ink, and glue) can be effectively cleaned with an alkaline solvent. However, fabrics on a machine producing an alkaline coated freesheet may require application of an organic solvent followed by a surfactant rinse to remove coating material from dryer fabrics.

There are certain precautions you should take when applying cleaning and conditioning chemicals to your dryer fabrics. Modern dryer fabrics are constructed primarily of polyester (or a high-temp material such as PPS). These materials are susceptible to chemical degradation if not closely monitored. Table 1 (Dryer Fabric Material Properties) shows the main materials used in dryer fabrics and their relative properties.

To avoid damage to your dryer fabrics during chemical cleaning, you should follow these steps:

- Turn off the steam supply.
- Allow your dryer cans to cool to less than 140° F (60° C).
- The chemical you apply should be used exclusively (don't mix with other chemicals) and applied as instructed by the chemical supplier.
- The maximum reaction time (time before rinsing) should be 10–15 minutes.
- Make sure all doctor blades are unloaded or open. This will allow the chemical to soak on the cans and better penetrate both sides of the dryer fabric as the section is on crawl speed.
- Following the application of the chemical, the fabrics should be thoroughly rinsed with clear water until the pH is close to neutral.

SHOWER CLEANING. The most widely used cleaning systems today utilize some form of a shower – stationary, oscillating, or traversing -- to remove contaminants from the surface of dryer fabrics. The shower consists of a nozzle (or group of nozzles) that inject water, steam, or air onto the dryer fabric. The showers operate at either low or high pressures, depending upon application.

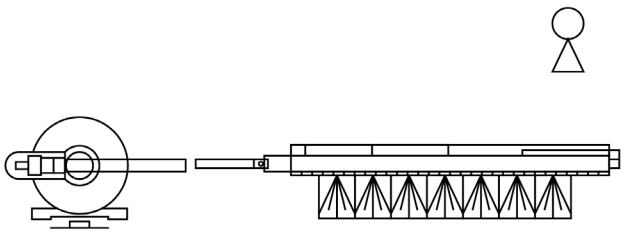
Stationary showers have their nozzles in fixed positions across the fabric width. Even though the shower has no moving parts, it still needs routine maintenance to keep functioning properly.

Table 1

Dryer Fabric Material Properties (5 = excellent, 1 = poor)

	Heat Resistance	Hydrolytic Stability	Acid Resistance	Alkalic Resistance	Wear Resistance	Strength
Polyester	4	2	4	2	4	5
Acrylic	4	4	4	3	2	3
Nomex®aramid	5	5	3	4	3	3
PEEK	5	5	5	5	4	4
PPS	5	5	5	5	2	4
PCTA	3	4	4	3	2	3

Figure 1



Oscillating showers (Figure 1 modified after [1]) are mounted in the return run in a dryer position and consist of two pipes attached to an electromechanical crank-arm unit (oscillator). One of the benefits of this type of shower assembly is that the inner pipe, which contains the needle jets and fan showers, can easily be removed from the fixed outer pipe for maintenance. Nozzle placement and spacing is determined by many factors, including machine/fabric speed and length, as well as the space limitations within the section. A disadvantage is the potential for streaking, particularly as the fabric gets older and/or contamination accumulates.

Traversing head showers [5] (Figure 2) are the most flexible from an operations standpoint. They typically consist of two or three heads with at least one being a water nozzle jet to wash the fabric, trailed by an air nozzle to dry the fabric and avoid streaking. An advantage of traversing head showers is that they can be used continuously or intermittently, and can be programmed for an extra cover function or for spot-cleaning only.

There is a trend today, especially on machines using recycled fiber in the stock, towards the use of Ultra High Pressure Shower (UHPS) systems. These showers operate much like the traversing shower mentioned above, but at very high pressures (250-600 bar, 3600-8700 psi) which is accomplished by using much smaller nozzles (reduced water consumption). This ultra high pressure can damage the dryer fabric, but provides many distinct advantages if properly setup and maintained. The most effective UHPS systems include a vacuum system to capture contaminants removed and transport them from the machine. This prevents further deposits on the sheet, dryer cans, doctor blades, and guide rolls. These systems also have a totally enclosed cleaning head with air knives to prevent mist and overspray that could otherwise mark the sheet [5] (Figure 3). The major suppliers of UHPS design these systems for easier maintenance, by mounting the shower apparatus on a traversing beam with doors in the dryer hood that allow the shower to be removed from the hood environment for maintenance and/or cleaning. Several designs are constructed with a self-cleaning station, where a brush and spray nozzles are used to keep the cleaning head and nozzles clean and unclogged. As with all cleaning systems, placement of the UHPS is of great importance. Most manufacturers recommend cleaning the dryer fabric against a return roll because the roll "opens" the fabric - allowing more thorough cleaning [5] (Figure 4). Cleaning away from a roll reduces the cleaning efficiency, as the fabric deflects as a result of the high water pressure. This deflection absorbs much of the energy resulting in less cleaning efficiency. Careful considerations must be taken concerning shower setup, including nozzle spacing as well as nozzle distance from the fabric.

Figure 2

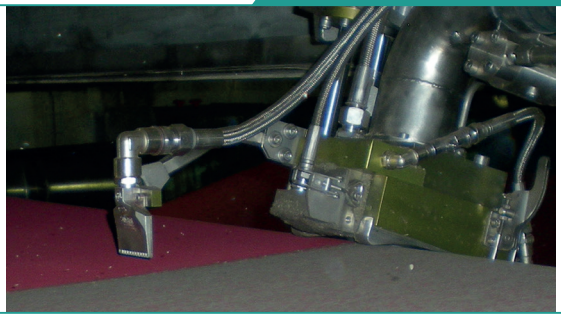


Figure 3

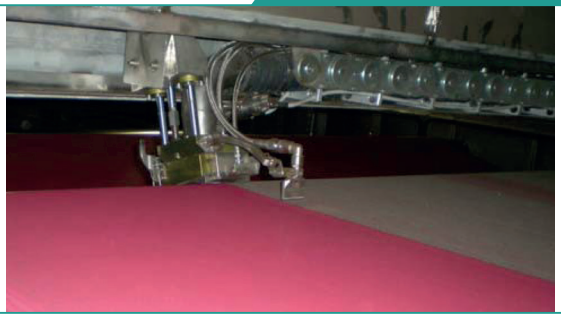
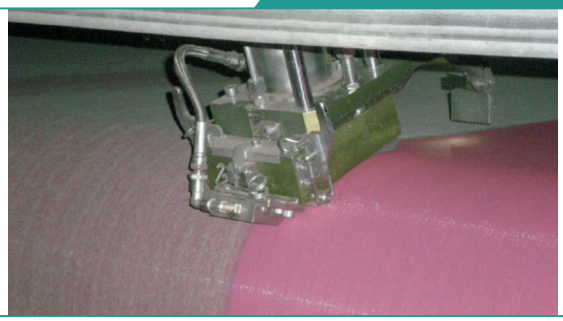


Figure 4



MECHANICAL CLEANING. Mechanical cleaning is the lowest cost method for cleaning dryer fabrics. The two most common mechanical cleaning methods include the use of rotating brushes and chain mesh to scrape heavy contaminants from the surface of the fabric (Figure 5). You should closely monitor these mechanical systems to prevent excessive abrasion to the dryer fabric's surface, which could lead to premature failure.

Figure 5

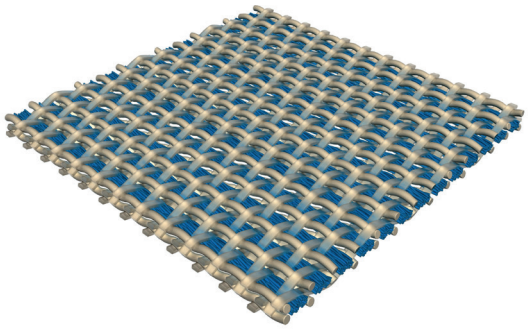
Dryer Fabric Design Helps With Cleaning

With the migration from multifilament designs to all monofilament dryer fabrics, many weave patterns today create a smoother surface and/or higher contact area to promote easier cleaning.

The ideal fabric will have a low void area to minimize the space in which contaminants can lodge, and fewer interlacings where contaminants can hide. The construction should be 100% monofilament.

When the application calls for a low permeability design (e.g., in the first dryer sections where the risk of contamination is the highest) some fabric suppliers incorporate spun yarn or cabled monofilament "stuffers" in the CD (Figure 6). This may be effective in lowering permeability, but has the potential to increase contamination buildup. They can also act as a wick to absorb moisture, oil, and other non-paper particles. In these cases, the dryer fabric should have an "all monofilament" construction so that it is easier to clean.

Figure 6



Modern dryer fabrics can incorporate extruded contaminant-resistant polymers in the monofilament to give the fabric excellent release properties. AstenJohnson came up with its first innovation to improve fabric cleanability years ago: replace the large flat surfaces where contaminants can build up on the fabric with yarns having micro-grooves creating a lot of smaller contact areas (Figures 7,8). Smaller contaminants land, but detach easily. The "valleys" in the grooves create channels so that cleaning water or chemicals can get below the contaminants and float them away. This design was patented and became known as Smart Surface Technology® (SST).

Figure 7

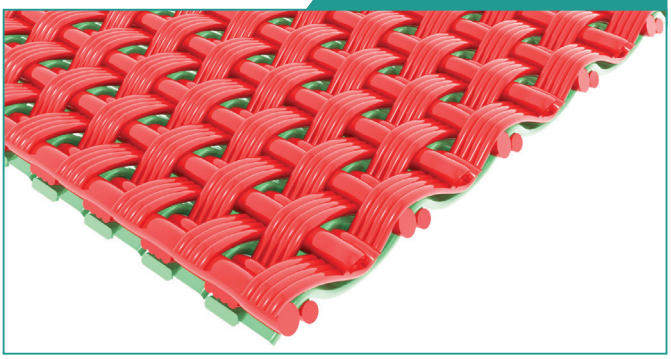
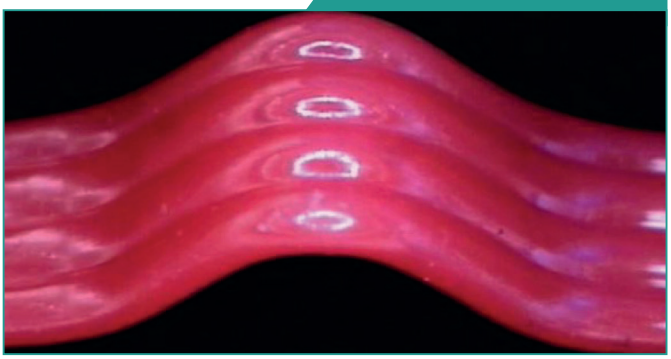


Figure 8



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And, if you have suggestions about other topics you would like to receive an ExperTip on, we would love to hear from you!

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