

Continuous cleaning of dryer fabrics

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Users can choose from three different methods to clean dryer fabrics, depending on the paper grade being manufactured and the type of contaminant.

Today's high-speed papermaking machines call for highly engineered dryer fabrics. A number of fabric designs have evolved in recent years, and these are tailored to the speed, width, steam pressure, and humidity of the machine's dryer section.

Three properties of dryer fabrics critically affect the cleaning of a fabric: weave pattern, air permeability, and type of yarn used to construct the fabric.

The weave pattern in a dryer fabric can be single, double, or triple layer; air permeabilities can range from 50 ft³/min to 800 ft³/min; and the yarns used to weave the fabric may consist of spun, multifilament, or monofilament fibers or some combination of them. These differences in dryer fabric design dictate different cleaning solutions.

Why dryer fabrics need to be cleaned

The savings realized by keeping dryer fabrics clean and conditioned to design permeability quickly pays for the cost of installing cleaning and conditioning systems.

In the dryer section, fabrics are selected to yield maximum life at optimum production rates without adversely affecting the quality of the paper being manufactured. One critical requirement in meeting these goals is to maintain the design permeability throughout the useful life of the fabric.

The rate at which a dryer fabric becomes contaminated or "filled" depends on its design, the position on the paper machine, and the furnish.

Permeability of dryer fabrics should be maintained no matter where they are located in the dryer section. Fabrics are designed to given permeabilities, so that adequate amounts of air are pumped into the dryer pockets. This dry air is the vehicle to transport moisture out of the dryer pocket. Fabric permeability is specified to be compatible with existing ventilation equipment. If permeability is decreased, a loss of drying occurs within the dryer section.

Large amounts of cellulose fines can form wet streaks in the fabric; in turn, these cause wet streaks in the paper. The resulting nonuniform moisture profiles across the sheet will result in calendering and reel-building

problems. If the dryer fabric can be cleaned, these fines will be removed and fabric uniformity will be improved.

On dryer sections where single felting is used, a filled fabric will cause sheet blowing, thus creating wrinkles and breaks. Debris from a dirty fabric also can contaminate the paper. This is particularly critical on the fine paper and coated publication grades. A comprehensive cleaning and conditioning program of dryer fabrics will improve the quality of all grades of paper and minimize rejected product.

Methods of cleaning

Over the years, several approaches to dryer fabric cleaning have been tried. These include showering with high-pressure water, showering with a combination of high-pressure water and air or steam, showering with air only, showering with steam only, showering with various types of chemical cleaning solutions, and continuous treatment with mechanical brushes. When chemicals are used, rinsing is sometimes required with a low-pressure, high-volume shower.

After many years of both laboratory and field trials, the industry seems to be standardizing on the use of one of these three approaches:

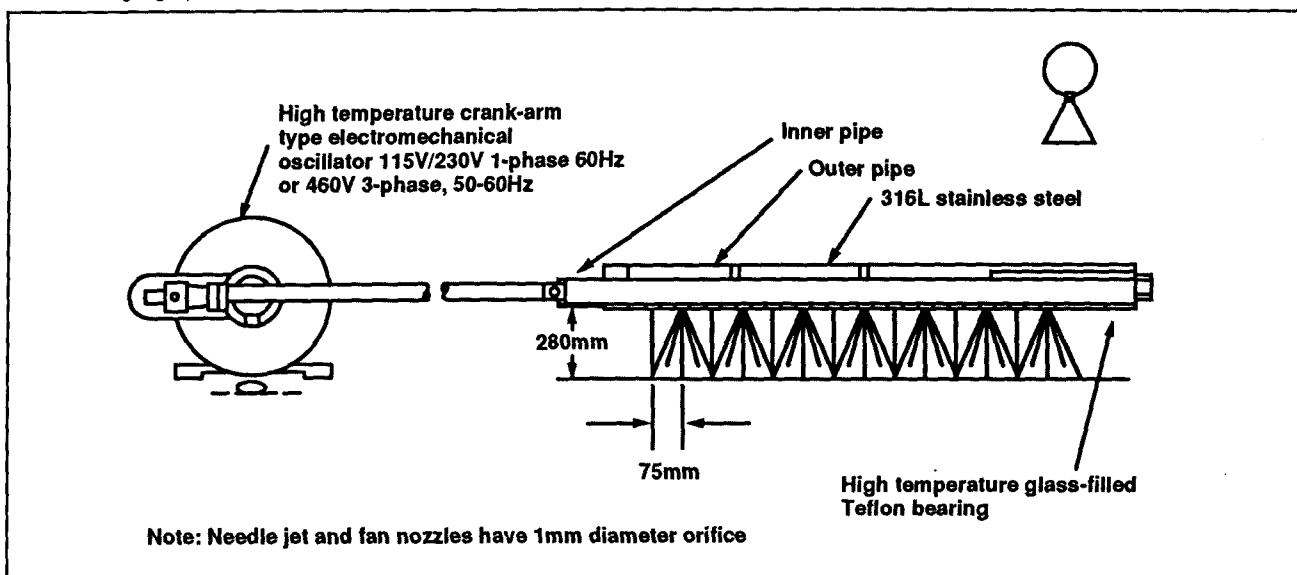
1. Intermittent cleaning using an oscillating high-pressure shower with alternating needle jet/fan nozzle for applying water or chemical solution to the dryer fabric.
2. Intermittent cleaning using a low-pressure, high-volume fan shower to apply a chemical solution, followed by an oscillating high-pressure shower with alternating fan needle jets. The oscillating high-pressure shower serves to remove the contaminants loosened by the chemical and to remove the chemical from the dryer fabric.
3. Continuous cleaning using a traversing single-nozzle high-pressure needle jet combined with an air fan nozzle to dry the water after applying it to the dryer fabric.

Oscillating alternating needle/fan jet high-pressure shower

Developed specifically for dryer fabric applications, this

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1. Oscillating high-pressure shower



shower is illustrated in Fig. 1. The shower consists of an inner and outer pipe manufactured from 316L grade stainless steel. The inner pipe support bearings and the alternating needle jets and fan nozzles mounted on 75 mm (3 in.) centerlines are integral parts of the inner pipe itself. This subassembly can be easily removed by sliding it out of the outer pipe, making all serviceable components easily accessible for maintenance. The outer pipe remains fixed to the dryer section frames or mounting surfaces.

The oscillator is an electromechanical crank-arm style unit. The integral motor gear reducer is designed for operation in high temperatures common to typical dryer sections. The oscillator is designed for a stroke of 150 mm (6 in.) which provides double coverage relative to the 75 mm (3 in.) nozzle spacing.

Low-pressure, high-volume chemical/rinse shower

This shower, shown in Fig. 2, is also manufactured using 316L grade stainless steel. The nozzles are 60° fan-type assemblies mounted on 150 mm (6 in.) centerlines with an orifice selected according to the flow required for the specific application.

Programmable traversing single water jet/air jet shower

The programmable traversing shower, detailed in Fig. 3, consists of a 316L grade stainless steel box section into which is assembled a traversing mechanism. Attached to this is a single high-pressure needle jet and a single fan-type air nozzle. The needle jet is used to apply water to the dryer fabric while the trailing air fan is used to evaporate and dry the water applied by the jet. This permits continuous use of the shower in most applications without causing water-related streaks.

The programmable feature of this shower provides an operator with the options of selecting either a normal traversing function, an extra-coverage function, or a spot-cleaning feature only.

Factors to consider in shower installations

Operating pressures

The operating pressure of either the high-pressure alternating needle fan shower or the single jet traversing shower is generally dictated by the application. The style and permeability of the dryer fabric, the type of contaminant, the grade of paper, and the type of fabric run are but a few considerations. Based on operating experiences, the normal pressure range is between 18 kg/cm² and 35 kg/cm² (250–500 psi).

Shower location

The location of the shower in the dryer fabric run is dependent on the style and permeability of the dryer fabric, the type of contaminant, and space considerations within the section.

For dryer fabrics with high permeability, optimum cleaning will usually be obtained if the shower is located on the inside of the fabric run. For lower permeability fabrics, more efficient cleaning may result when the shower is mounted on the face side of the fabric.

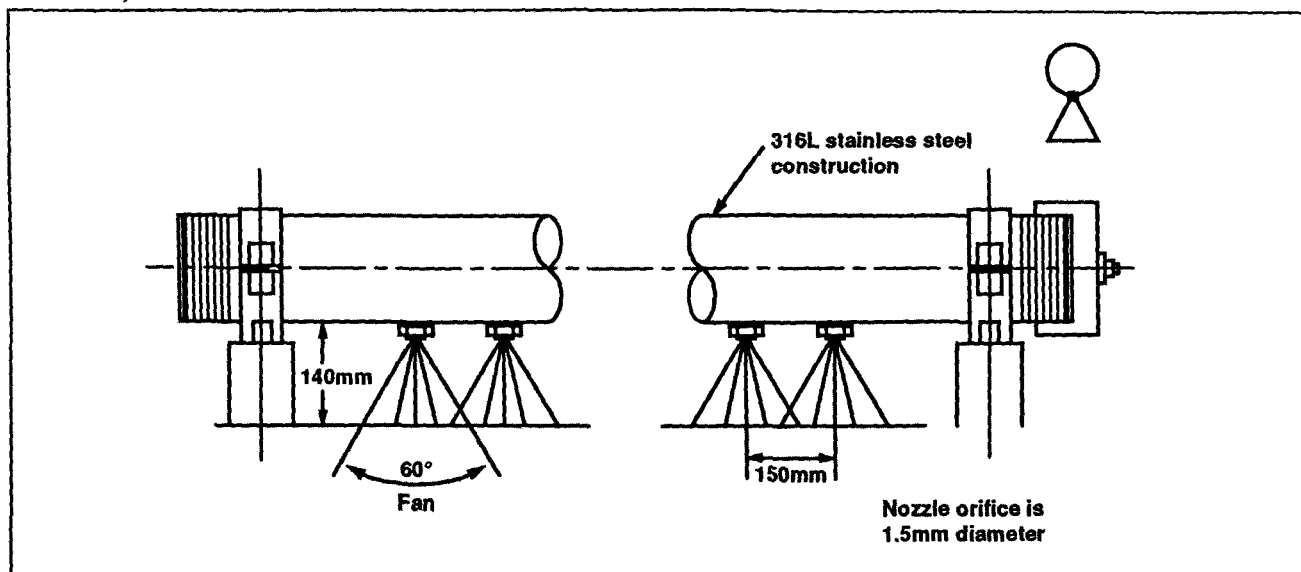
Similarly, shower location can be influenced by furnish contaminants. In the case of paper fines, fiber, clay fillers, and other contaminants that could affect the permeability of the fabric, better results may be obtained by mounting the shower on the inside of the fabric. However, if the contaminants are predominantly "stickies" that have adhered to the surface of the fabric, face side showering would be more appropriate.

We recommend that each application be individually evaluated.

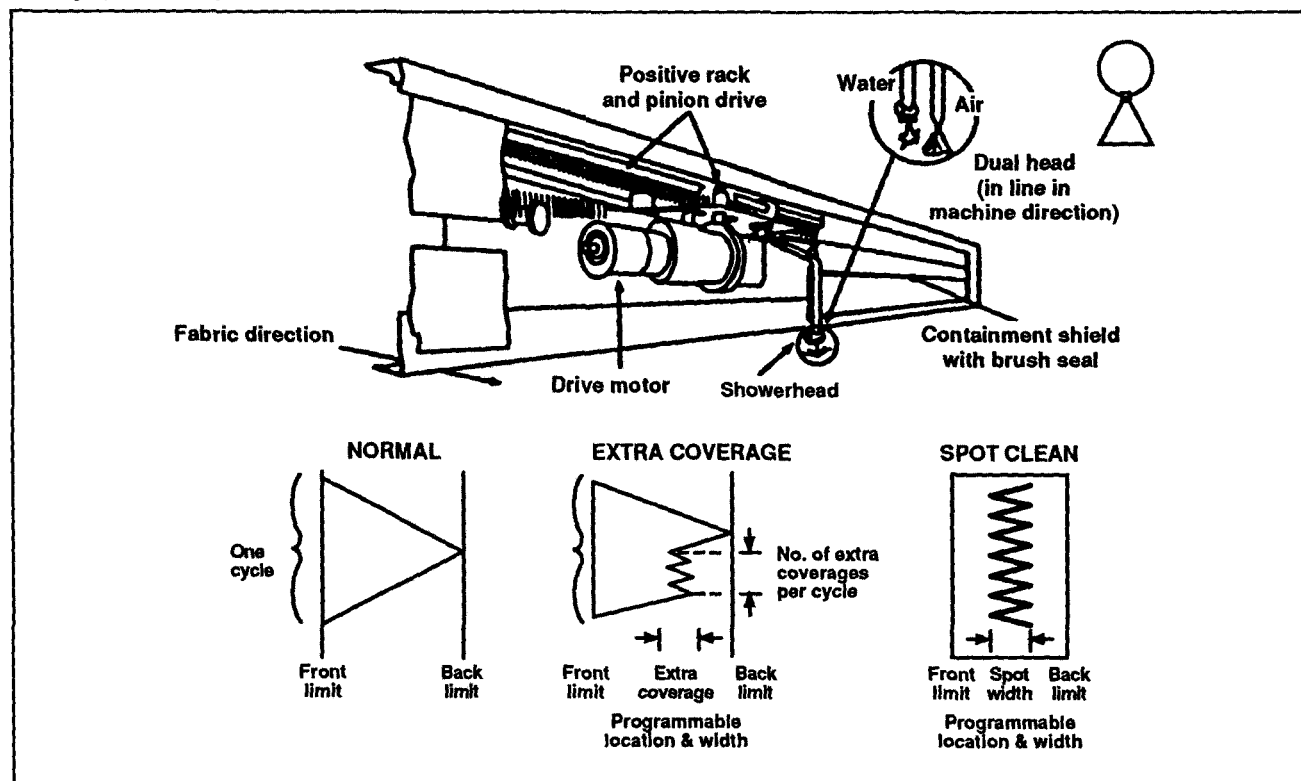
Water specifications

The typical orifice size of the alternating needle jet/fan nozzle and the single jet traversing shower is 1 mm (0.04 in.). This relatively small orifice should be protected against blockage by contaminants carried in the water supply. Since total volume consumed is relatively low, this

2. Stationary shower



3. Single jet traversing shower



can best be accomplished by using a clean, fresh water supply for the application.

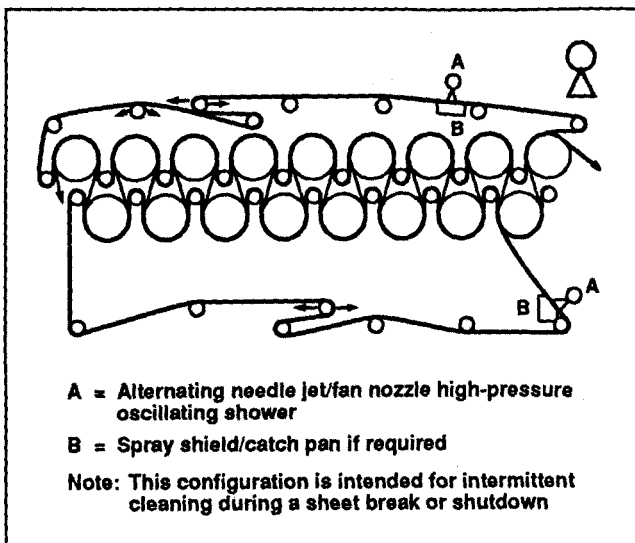
The importance of using heated water cannot be overemphasized. Both laboratory experiments and actual field trials have proven beyond doubt that hot water is significantly more effective than mill temperature water. It is highly recommended that water between 65°C and 85°C (150–185°F) be used. Use of cooler water may cause thermal shock to the fabric. Permanent creases and wrinkles can be formed in the fabric, particularly on

sections not completely cooled down.

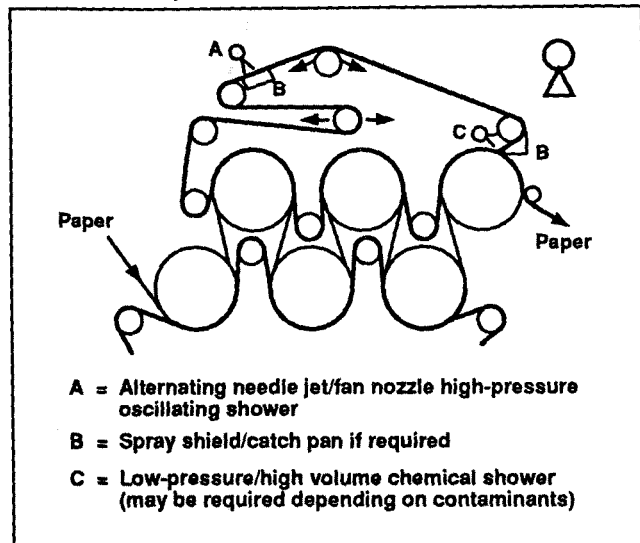
Chemical specifications

Certain contaminants such as adhesive, waxes, and resins are not water-soluble and therefore require chemical treatment for most effective cleaning. These chemicals can be applied by either the high-pressure alternating needle jet/fan nozzle shower or by the stationary high-volume, low-pressure chemical shower. In some cases, the chemical is applied through one shower and rinsed using the second

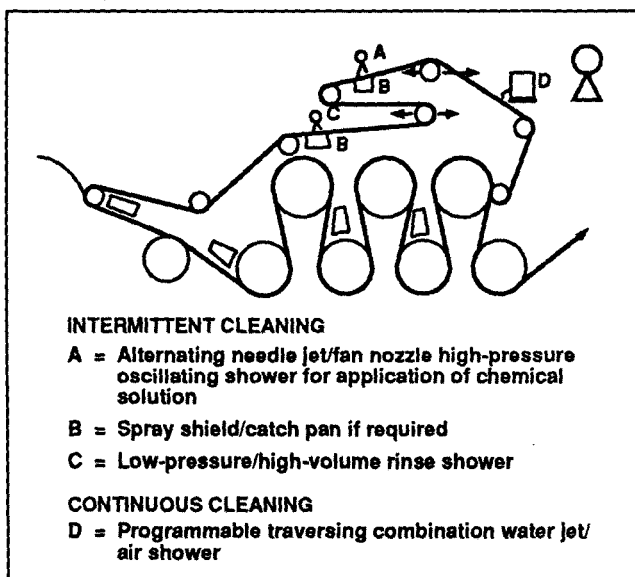
4. Main dryer section



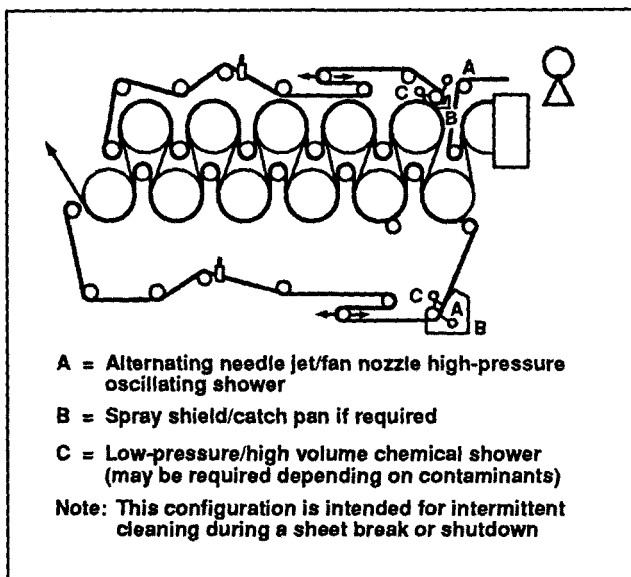
5. After-coater dryer section



6. First dryer section uniron



7. Conventional dryer section



shower.

The type of chemical used depends on the contaminants being treated. The appropriate shower configuration depends on the chemical applied. The application of chemicals in the paper industry is a highly specialized technology which should be addressed by experts. When the need for chemicals is evident, we recommend consultation with the chemical supplier of your choice.

Choosing a cleaning method: consider grade of paper and type of contaminant

Fine paper

Because of the wide variation in furnish materials used for fine paper grades, the rate of filling varies from machine to machine. Machine conditions and fabric selection also play a major part in determining the rate of filling.

There are three types of dryer sections for fine paper machines: the main section, the after-size section, and the after-coater section. Each has its own shower specifications because the type of contamination is different in each section. In the main dryer section, the fabrics are generally filled with cellulose fibers and fillers that are easily removed. In the after-size section, the size can often be removed by hot water. After-coater dryer section requirements vary depending on the coating used, the rate of filling, and the fabric. The shower systems for typical main and after-coater sections are shown in Figs. 4 and 5.

Newsprint

The recommended cleaning system for newsprint dryer sections often depends on the type of furnish and its related contaminants. When dealing with virgin fiber, the dryer fabrics generally fill with fairly loose and easy-to-remove

cellulose fiber. A high-pressure shower can generally be used successfully to keep low-permeability dryer fabrics common to this grade clean and in optimum condition.

However, newsprint that is manufactured from recycled fiber contains resins and other contaminants that are much more difficult to clean. For these applications, high-pressure showering plus chemicals are often required. Typical installations are shown in **Fig. 6**.

Corrugating medium, kraft, and linerboard

Dryer fabrics used in these grades often have a high rate of filling. The rate at which they lose their permeability and the ease of cleaning these fabrics on the machine also depends on the type of furnish and the fabric design.

The number of secondary fibers typically used in the corrugating medium furnish affects the rate of filling and ease of cleaning. Dryer fabrics on bogus 9-pt machines will plug up not only with the usual cellulose fibers, but also with asphalt and other hard-to-remove substances such as adhesives, waxes, and glues. High-pressure showering, frequently with chemicals, is almost always required to clean these fabrics.

The debris that fills fabrics on linerboard and kraft machines is primarily fiber. Most linerboard machines and many kraft machines use high-pressure steam in the

dryers. Fabrics made of hydrolysis-resistant spun and multifilament yarns are used on many of these positions. Usually permeabilities are also relatively high on most positions, which permits the use of high-pressure showers to restore the fabrics to the original design characteristics. **Figure 7** illustrates a typical installation.

Benefits of a cleaning and conditioning system

In conclusion, the benefits of a well-designed and properly operated dryer fabric cleaning system are:

- Consistent dryer section performance
- Improved heat transfer
- Reduced sheet defects
- Improved sheet profile
- Improved pocket ventilation
- Reduced steam usage and energy cost. □

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