

# Developments in Dryer Fabrics : Issues Related To Speed, Cleaning and Paper Quality.

Choudhary P. S.

## ABSTRACT

The dryer section of the paper machine plays the significant role in the paper and board manufacturing process. It removes water from the paper and board. To achieve the optimum result in the dryer section in modern high speed machines the design & quality of the dryer fabric is utmost important. To keep the fabric durable and to manufacture good quality of paper and board the proper pocket ventilation and cleaning of dryer fabric is very essential. This paper highlights the properties of dryer fabric, advance dryer sections & major issues related to dryer fabric in the paper machines.

## Introduction

As paper machine speeds increase, the requirement for total operational control in the dryer section becomes of paramount importance. Modern production requirements confront us with the ever increasing challenge of drying paper with minimal energy use in the shortest time. The dryer fabric influences the drying process and machine runnability by nature of its openness, structure, chemical resistance surface properties even at higher speed and that too with controlled Cross Machine Direction shrinkage and minimized contamination.

Current paper technological developments in the dryer section are therefore concentrated on accomplishing effective energy savings. This has necessitated improved heat transmission, ventilation effectiveness, web stability through reduced open draws and by utilizing more advanced web stabilizing equipment.

## Paper Drying:

The sheet formed by gravity & forced dewatering on a Forming fabric is further consolidated and dewatered mechanically in press section and thereafter it enters the drying section. The dryness of sheet entering the dryer section ranges from 40 to 50 %, depending on configuration of press

*Wires & Fabriks (S.A.) Ltd.,  
Industrial Area: Jhotwara,  
Jaipur 302 012. India*

section. Drying is most important and the highest energy consuming process in paper making. Thus while designing a dryer fabric, the major objectives are:

1. Dry the paper.
2. Produce acceptable paper quality
3. Achieve high production rate
4. Minimize operative cost

To meet the above objectives lot of work and development has taken place to improve the efficiency of the dryer section. This has forced dryer fabric manufacturers to update and innovate new dryer fabric designs.

## Function of Dryer Fabric:

The main function of a dryer fabric is to hold the sheet against the heated cylinder surface and hence increase heat transfer rate. However it also performs the following,

1. Supports and guides the sheet.
2. Prevents sheet from cockle.
3. Diffuses the heat and supplies the sheet with a uniform condition of drying.
4. Controls the cross direction shrinkage.

## Requirements of Dryer Fabric for Efficient Drying Operation

1. It must be strong enough to run in tension, there by creating good heat transfer between the paper and the drying cylinder. The material should be very durable under the condition so that fabric can tolerate a high running tension during its life.
2. It must have even and smooth surface that can press the paper evenly and firmly against the

surface of the drying cylinder without marking.

3. It must be sufficiently supple in order to properly wrap round the drying cylinder.
4. It must have good dimensional stability and run straight at higher speed.
5. Must be economical, easy to install and easy to dry.
6. It should have a non marking seam joint.

## New generation dryer fabric:

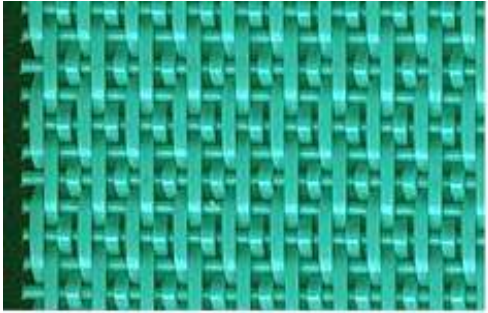
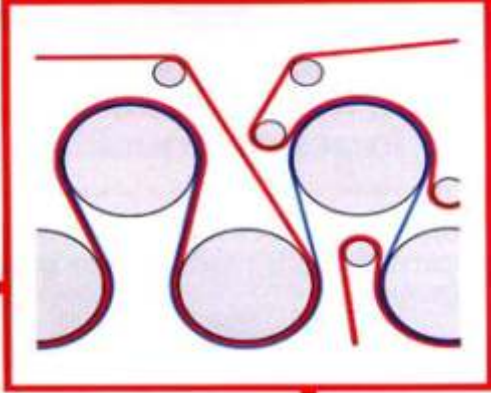
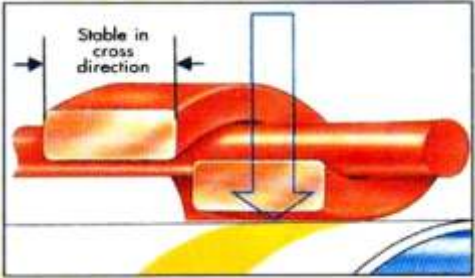
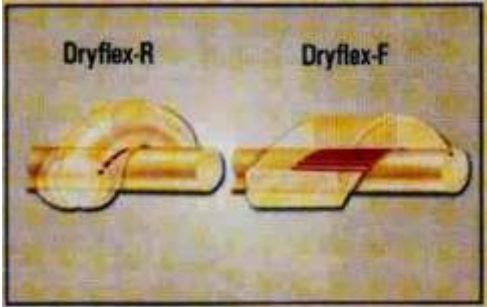
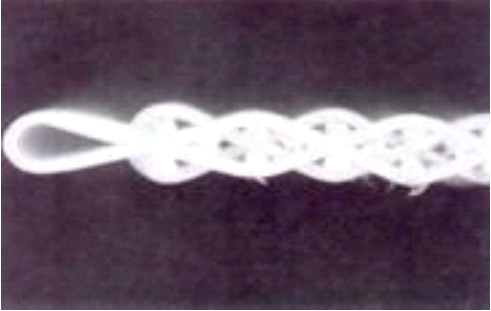
Over a period dryer sections have been modified to meet the new challenges of paper quality and production with optimum cost. The Unirun, Single tier dryer design and Silent drive designs have been developed and installed in dryer section to enhance the efficiency of dryer section.

To meet the requirement of these innovations, fabric manufacturers have done lot of research on fabric design, permeability, surface characteristics, seams and raw material to develop new fabric to suit all applications. The new generation dryer fabrics are having the features as illustrated on next page.

## Selection of Dryer Fabric:

Though the cost per ton of paper produced by paper machine clothing is very less, the losses due to poor quality of paper produced can be very high due to wrong selection of the fabric design. The selection of the fabric design for particular machine is very important process and needs lot of practical experience.

Selection of a dryer fabric for different

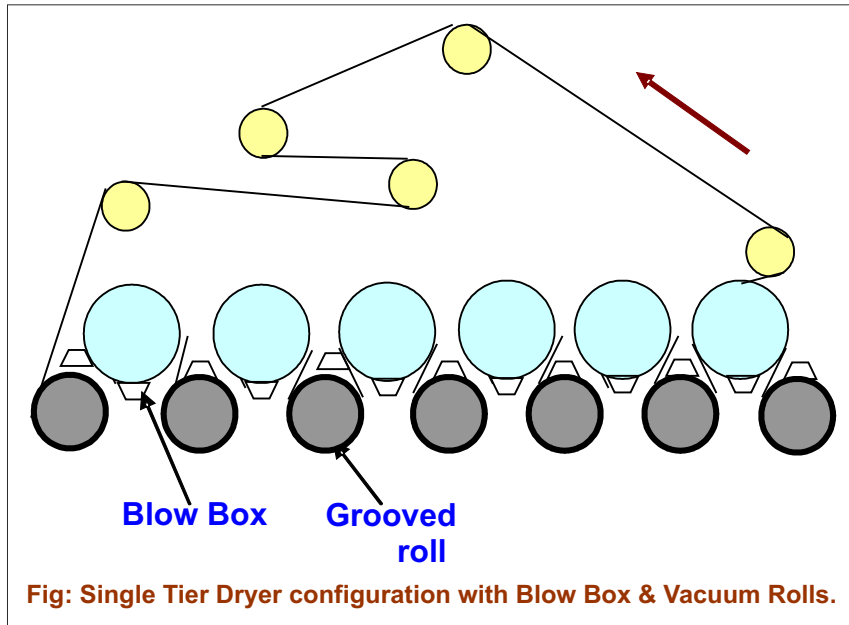
<p>1. Dryer fabric for high drying efficiency and low energy requirements.</p>	
<p>2. Very high Hydrolysis and abrasion resistant flat polyester yarn in machine direction.</p>	
<p>3. Flat yarn ensures high contact area and fast heat take up.</p>	
<p>4. Increased contact area at cross over points leading to high cross directional stability.</p>	
<p>5. Flat knuckles provide fewer anchorage points for stickies.</p>	
<p>6. Smooth, sturdy and non marking seam.</p>	

groups depends upon many factors like, Paper grade produced, Basis weight range, Dryer Group position, presence /absence of coating unit etc.

The most important properties of dryer fabric which affect the operation is Air Permeability generally known by paper makers as CFM. It is the volume of air of atmospheric pressure that flows through one unit of area of the clothing per unit of time ie cub.ft/sq.ft per min (0.5”wg). or Cub.m/sq.m per hr (10 mm wg).

**Serpentine (Uni-Run) & Single tier dryer Design:**

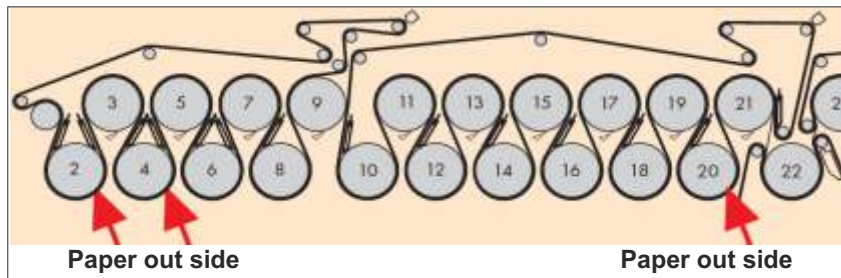
During the past decade a number of innovations have been made in paper drying. Open draws have been almost eliminated. Ventilation and drives have been greatly improved. Sheet quality has been enhanced and paper machine speed has increased dramatically. The single tier dryer configurations have been one of the main contributors in this advancement, providing efficient drying, improvement in paper quality and safe and stable operations at the



**Fig: Single Tier Dryer configuration with Blow Box & Vacuum Rolls.**

The serpentine run reduces sheet flutter by providing support to the web between dryer cylinders. The increased strength helps reduce the number of sheet breaks allowing the machine to run faster. Special Dryer fabric seam,

1. The paper tail could be forwarded with out the use of ropes.
2. There were no enclosed dryer “pockets” to ventilate.
3. The fabric wrap angles were longer.
4. Each of the dryers directly contact the wet web.



Significant advancements have been made in the design and operation of paper machine dryer sections. The focus has been on the extension and enhancement of single tier dryer configurations. These efforts have resulted in higher speed, higher dryer rate, reduced capital and operating cost and improvements in end product quality.

highest speed.

Extreme air turbulence can cause the sheet to flutter, in machines with speeds exceeding 600 m/min particularly in open draw sections. Turbulence is caused due to air carried by the dryer fabric and paper sheet. The increase in air carried with increasing speed is not in linear progression. This causes edge fluttering on the paper particularly in lighter grammage papers owing to pressure difference around the ingoing and out going dryer cylinder pockets.

weave and permeability were developed specifically for serpentine run. The serpentine run was also enhanced by adding the web control boxes in the pockets between top dryer cylinders. These boxes are used to generate a slight vacuum, to keep the paper web in contact with the fabric as it passes around the bottom dryers. To improve sheet stability, the surface of bottom dryers is grooved, to extend the vacuum around the dryers. Bottom serpentine dryer does not directly contact the wet web they are not often heated by the steam.

**Dryer Fabric Cleaning:**

Packaging grades with 100% waste furnish mainly contribute to dryer fabric contamination.

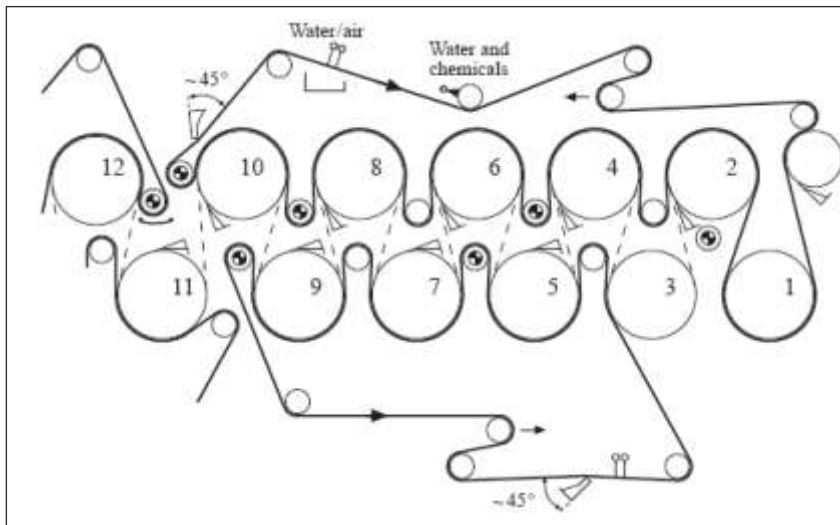
Contamination of dryer fabrics leads to loss of air permeability and can reduce the effectiveness of pocket ventilation system thus reducing drying capacity. Fabric filling is rarely uniform, and may contribute to paper moisture variations and non uniformity. Dryer fabric contamination may lead to sheet quality problems such as fiber picking and hole in the sheet. The type and frequency of fabric cleaning can have a significant effect on machine efficiency and life of the dryer fabric.

- Sheet flutter can be reduced by installation of blow boxes which use the injector effect to create a vacuum and to attract the paper sheet to the fabric.
- It is the permeability of the dryer fabric responsible for carrying air. Change of permeability of the dryer fabric can also reduce the flutter.

The fabric that was developed for the original serpentine dryer section also worked well in the single tier dryer sections. The single tier dryer groups were top felted hence broke handling was easier in the event of sheet breaks.

Single tier dryer configurations had a number of advantages.

The two approaches applied for the dryer fabric cleaning include Batch washing and continuous cleaning. Batch washing is less expensive, is



**Fig: Chemical Cleaning arrangement of Dryer Fabric.**

performed during a shut and entire fabric is cleaned on machine using a cleaning solution.

However failure to rinse the fabric thoroughly after using cleaning chemicals, can result in fabric degradation.

Continuous cleaning is expensive and consists of three to four traversing high pressure showers to clean the fabric. These systems normally include a high pressure water shower coupled to an air jet. Traversing needle jet are located on the cross machine direction, either

inside or from outside of the fabric loop. The jet is normally a high pressure water jet at pressure 15 – 40 kg/cm followed by a high pressure air jet. This combination first loosens the contaminant and then blows it off the fabric. Because of the considerable potential for the fabric degradation and failure associated with batch washing, continuous cleaning systems are usually favored. Type of dryer fabric used on the machine is important. Monofilament fabric offers a number of advantages over multifilament fabrics. Most suppliers of fabric cleaning

chemicals have tested fabrics to ensure that their chemicals can be used safely. A cleaner should not be used unless it is specifically recommended by the chemical supplier for that application. Low pressure hot steam shower are prescribed primarily for 100% Kraft application with stickies problem. Steam showers are less expensive than the chemical shower for stickies problem with no rust and rinse and less shower time. Steam showers can be used during shut down to effectively clean starch and other soluble contaminants from the fabrics. Steam shower is applied at 80 – 85 degree C.

**Conclusion:**

It is thus clear that to tackle the issues related to Speed, cleaning and paper quality, dryer fabric selection becomes an important factor. Modern dryer fabric designs can provide an economic solution to solve these issues by optimizing the CFM, for high drying efficiency at low energy cost, by using high abrasion & hydrolysis resistance yarns, with smooth & sturdy non marking seam to suit modern paper machines.

**ACKNOWLEDGEMENT:**

The author thanks M/s Wires & Fabriks (S.A.) Ltd management for the consent to publish this paper in IPPTA workshop on “Paper Machine Clothing” Oct’ 2009.