

Improving Drying Efficiency Through Modern Dryer Fabric Design

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ABSTRACT

The ultimate valid criteria for the economic production of Pulp and Paper Industries are: Quality, efficiency and the cost. In this, efficiency is the link between quality and the cost. Now in India, paper makers are in the need of urge to improving the quality by less cost and improve efficiency in the productivity.

The demand for efficiency increase in the dryers is particularly insistent owing to the high level of energy consumption in comparison with the forming and press sections. The dry content of the sheet entering the dryers at about 50% must be brought to 92 – 98% at the reel. Therefore, "Production efficiency" in the dryers must mean the installation of high energy efficient clothing. This paper explains the benefit of modern high contact flat yarn dryer screen in this paper machine.

Introduction

The increasing demand for power has led to considerable fossil fuels burning which in turn has an adverse impact on environment. In this context, efficient use of energy and its conservation is of paramount importance. Energy efficiency would, therefore, significantly supplement the efforts to meet power requirement, apart from reducing fossil fuel consumption. India's proven coal reserves may last for more than 200 years, but the limited known oil and natural gas reserves may last only 18 years to 26 years, which is a cause of concern.

The economic development of a country is often closely linked to its consumption of energy. Although India ranks sixth in the world as far as total energy consumption is concerned, it still needs much more energy to keep pace with its development objectives.

India's energy intensity per unit of GDP is higher as compared to Japan, U.S.A. and Asia by 3.7 times, 1.55 times and 1.47 times respectively (1,2). This indicates inefficient use of energy but also substantial scope for energy savings. The increasing global trade liberalization and growing global competition have made productivity improvement, including energy cost reduction, an important benchmark for economic success.

Literature Review

Energy & Indian Pulp & Paper Industries

Even though Indian Pulp & Paper Industry ranked 12th at Global level, India's per capita consumption is at 9.2 kg only as against the global average of 56 kg. In India, out of approximately 700 units of Pulp & Paper industries, around 125 units were kept closed due to various reasons inclusive of energy related, environmental related and resources related issues.

Pulp & Paper industry is a highly energy intensive sector. Out of total energy required for Pulp & Paper production, 75% to 78% energy used as process heat and 22% to 25% as electrical power. At present average steam demand in Indian Pulp & Paper industry stands at 6 to 16 tonnes/tonne of paper against the average of 6 to 9 tonnes/tonne of paper in developed countries (1).

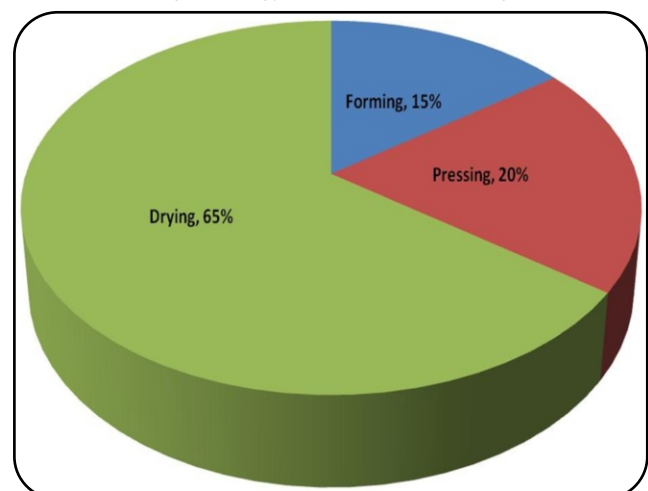
Energy needed for dewatering in paper industries

The demand for efficiency increases in the dryers is particularly insistent owing to the high level of energy consumption in comparison with forming and press section as shown in the figure. 1

Paper Maker's requirement

The following are the requirements for Paper makers to run the Dyer screen efficiently with low cost

Fig.1 Energy needed for Dewatering



- Must be dimensionally stable
- Fabric must show good runnability characteristics
- Low caliper
- Fabric must have a sufficiently smooth surface and seam
- Should have high contact area for effective heat transfer
- No sheet fluttering
- Must have adequate permeability throughout the life
- Easy seaming
- Must have reasonable resistance to hydrolysis, chemical degradation, contamination and abrasion.

The following parameters are most important in the dryer screens for good runnability and to achieve the required properties of the sheet.

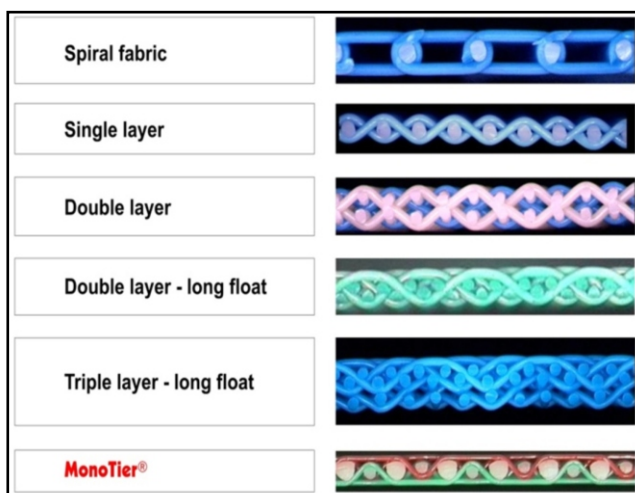
- No sheet fluttering by carrying air on return run
- Dimensional stability and high contact for uniform and high heat transfer from the cylinder to paper.
- No seam/knuckle mark in initial drying phase.
- Resistant to contamination of fluff or stickies.

Dryer Screen Design & Developments

The following are the development of design in the dryer fabric:

- Spiral Fabric (SLDF)
- Single layer
- Double layer
- Double layer Long float
- Triple layer Long float
- High contact flat yarn fabrics

Fig.2 Types of Dryer Screens



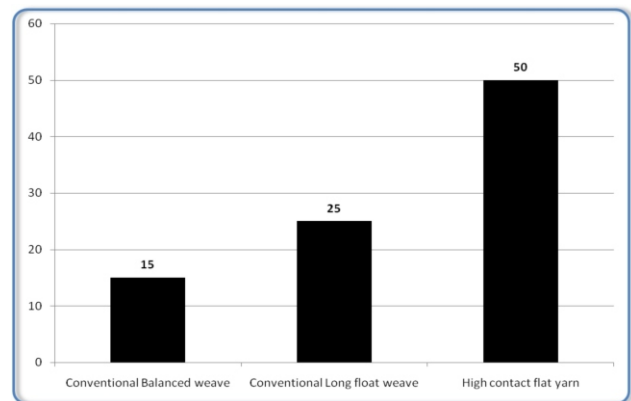
Emerging the design of Modern dryer fabrics

The modern dryer fabrics should serve for energy efficient way for quality output. To improve the heat transfer, it is necessary to have high contact of web with the dryer cylinder. To help, the modern high contact dryer screen design has developed.

High contact area

As shown in figure 3, the balanced conventional dryer screen have contact area of 15% and long float have 25%, where as the high contact flat yarn dryer screens have 50% contact area.

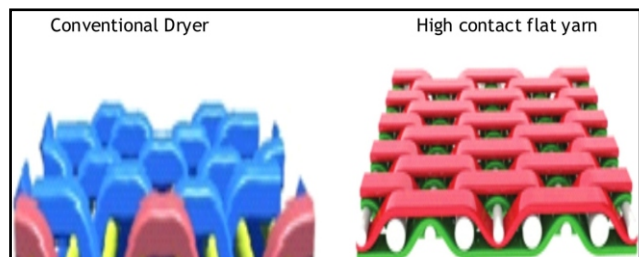
Fig.3 Surface Contact area



Surface Smoothness of Body

As the high contact flat yarn dryer screens have smooth surface, it will give uniform contact of paper with dryer screens to have uniform heat transfer. This will avoid moisture variation across the width due to uneven contact. Uniform moisture may be utilized by increasing the final moisture of paper at pope reel.

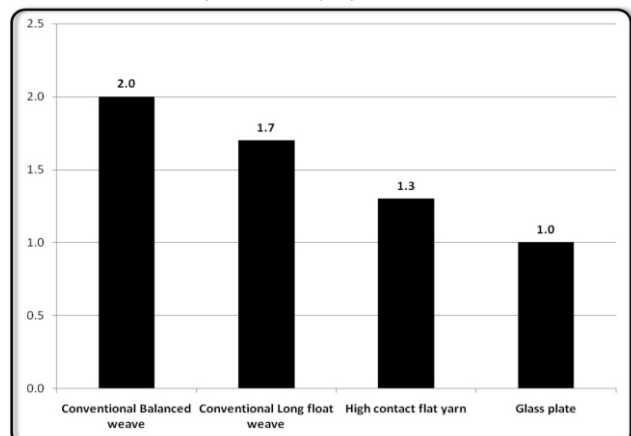
Fig.4 Surface Smoothness



Air carrying coefficient

Modern high contact flat yarn dryer screen have very low coefficient of air compared to conventional dryer screens. More air carrying lead to more air entrapment between screen and paper and also

Fig.5 Air Carrying Coefficient

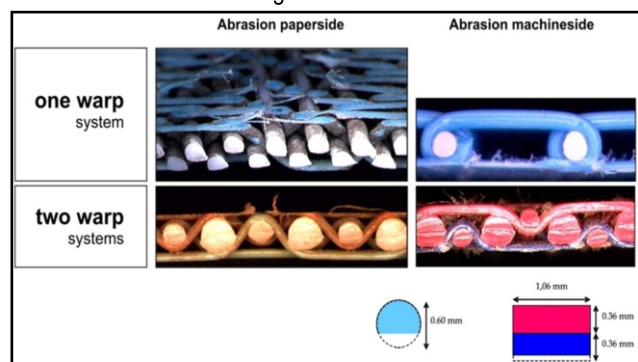


cause for sheet fluttering in the group change positions. This will lead to less heat transfer & sheet breaks at group change over positions. The following figure 5 shows the air carrying coefficient of high contact flat yarn dryer fabrics.

Abrasion

The high contact flat yarn dryer screen have the advantage of 2 tier independent warp system as shown in Figure.6. However, this will withstand the abrasion on surface to some extent.

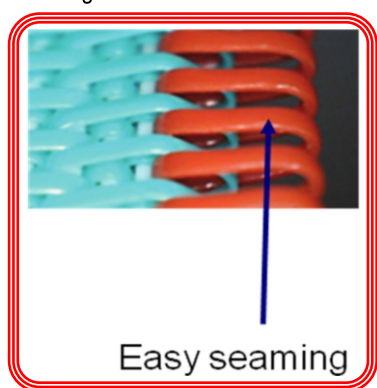
Fig.6 Abrasion



No seam mark

As shown in Figure 7, the pin seam provides easy seam and no marking seam on paper. This modern screen have warp loop seam and have more strength compared to conventional round yarn and conventional flat yarn seam.

Fig.7 Pin seam in Uno-tier

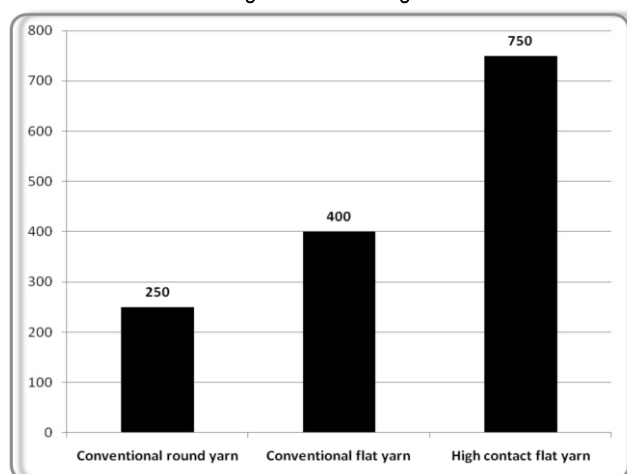


Benefits of High contact flat yarn dryer screens

By summarizing the benefits, the high contact flat yarn dryer screens have

- High contact area and low caliper
- 2 separate MD layers
- Smooth surface
- High stability no wandering of screens
- Easy to seam and uniform seam area
- Low air carrying no sheet fluttering

Fig.8 Seam strength



Dryer screen maintenance

A dryer fabric that maintains permeability throughout life is an invaluable asset to the paper maker, and with the increased use of additives as well as secondary fiber, fabric cleanliness has never been more important. Over time, contamination build-up can have drastic effects on runnability. Most importantly, permeability loss (filling of fabric) results in loss of drying and can cause sheet defects as well.

Sources of contamination

- Furnish from broke, secondary fibers, pitch, and bark from wood
- Additives such as fillers, strength adhesives, resins and sizes
- Stickies in form of glues, hot waxes, latex, ink

With the numerous cleaning systems available today, it is important to identify the specific make-up of the contaminants to determine a cost effective method of managing an effective cleaning program.

Cleaning methods

- Chemical cleaning (Batch washing)
- Mechanical cleaning (friction)
- Shower using water & Air (including high pressure, stationary and oscillating)

Chemical Cleaning

Much success has been achieved with the use of chemicals for cleaning non water soluble contaminants like adhesives, waxes, glues and resins. Most applications consist of a high volume/low pressure fan shower to apply the chemical followed by warm water rinsing to achieve a neutral pH.

Alkaline solvent may be used for contaminants like stickies, ink and glue which came from recycled boxboard and recycled newsprint.

On the other hand, a machine producing an alkaline coated free sheet may find an organic solvent application followed by a surfactant rinse an appropriate means for removing coating

material from dryer screens.

Precautions exist when using any type of chemical to clean dryer clothing as today's dryer fabrics are constructed primarily of polyester, a polymer very susceptible to chemical degradation if not closely monitored.

Steps to be followed

- o Turn off steam supply
- o Allow dryer cylinder temperatures to cool (less than 60 deg.C)
- o Use chemicals as per supplier's instruction
- o Maximum time of chemical contact should be 10 to 15 minutes
- o The fabric should be thoroughly rinsed with clear water until the pH is close to neutral.

Showers

This can be either stationary or oscillating/traversing, to clean the surface contaminants. The shower injects water, steam or air (either at low or high pressure) on to the dryer fabrics. Disadvantage of this shower system is the potential for streaking, particularly as the fabric gets older and/or the contamination gets worse.

Ultra High pressure shower is mostly recommended for cleaning method with shower with pressure of 1800 to 5000 psi. The shower does not damage the dryer fabric due to the low mass flow or lower volume of water. A save-all tray may be provided to capture the contaminants that have been removed from the fabric to prevent further deposits on the sheet, dryer cylinder, doctor blades and rolls.

Mechanical Cleaning

This is a least costly method for contamination control in the dryer section. Two of the most recognized methods involve rotating brushes and chain wire to scrap heavy contamination. These methods must be monitored to prevent excessive abrasion to the fabric.

Conclusion

On average, the dryer section consumes 55% of the total energy required to make a ton of paper, so efficiency in this section is becoming more and more important. To compete the world market, it is necessary to make high quality paper with less cost in efficient manner. New modern high contact flat yarn will help in energy reduction in paper making by high contact and uniform contact with good surface characteristics. Maintaining the permeability is important to drying and sheet handling. By choosing correct design of fabric and maintaining the fabric will save energy and reduce cost which is the need for hour.

Acknowledgement

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