

Development in paper machine clothing to meet growing needs.

Panda K. K , Routray D. G, Panda M. K

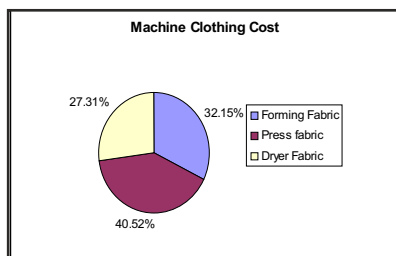
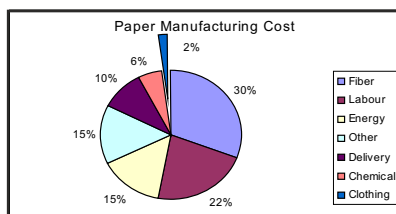
ABSTRACT

With the rising cost of paper production, the market is demanding more in terms of paper quality due to opening of Indian economy, it is time to optimize M/c condition, parameters and processes. JKPM always believes in continuous improvement and upgrade M/cs continuously by adopting new technologies in paper making. This article presents basics in M/c clothing, an overview of latest clothing technologies and how JKPM adopted these technologies from time to time to optimize cost of production and to improve paper quality. The changes made with respect to furnish, wet end chemistry and recent development in m/c clothing are explained.

Introduction

Technological developments, quality requirements, changes in furnish, wet end chemistry and moreover the costs of operation have led to rapid developments in paper machine clothings. JKPM being leader in taking innovative steps updated its system to the growing needs.

M/c clothing plays a vital role in the paper manufacturing process in terms of cost of production and quality. M/c clothing usually represents around 2% of over all cost per ton of paper (see figure). It is imperative that clothing design and application be focused on the largest cost driver. New technology introduced either in the process or in paper machine design forced the m/c clothing supplier to redesign physical characteristic of the m/c clothing. This aspect has become more significant with the globalization of Indian economy. To cope up with the changing environment JKPM continuously take



JK Paper Ltd., Unit: JK Paper Mills,
Jaykaypur-765 017 (Orissa)

numerous innovative steps in this direction by upgrading its plant and machineries, processes and operational parameter including m/c clothing.

Basics of Paper m/c clothing

Paper making consists of spreading a suspension of pulp evenly across a paper machine forming fabric followed by its dewatering in a manner that yields a product with desirable properties. As the solid content of the web increases additional water removal becomes gradually more difficult, time consuming, and expensive in terms of both capital and operating cost. The cost of dewatering the sheet in the wire section is 16%, in press section 7% in dryer section 77%. For this reason, operation of m/c clothing plays a vital role.

Basically m/c clothing is of two types i.e wet end clothing and dry end clothing. Wet end clothing generally refer to wire and press section clothing i.e forming fabric and press fabric. Dry end clothing refer to dryer section i.e dryer felts and dryer screen

Function of the forming fabric

- Convey the sheet from head box to the press section
- Forms a quality sheet
- Functions as a filter media
- Transmit power to the machine

Key indicators of good forming fabric

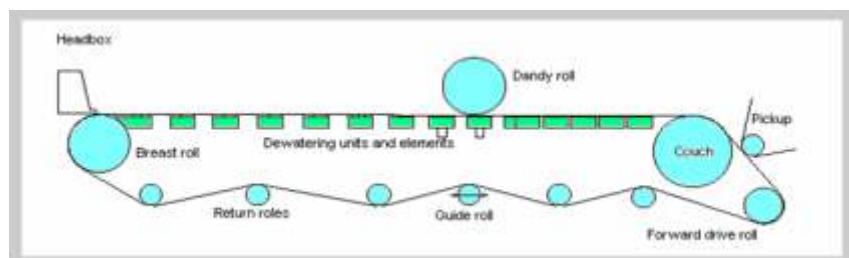
- Optimum Retention
- Good Formation
- Minimum Sheet two sidedness
- Abrasion resistance
- Mechanical stability
- Optimum Off couch dryness

Function of the press fabric

- Removal of water from the sheet in the press nip
- Support the sheet in the press nip to prevent crushing
- Provide uniform pressure distribution over the paper in the nip
- Impart a desirable surface finish to the sheet.
- Equalize pressure distribution over void and land area of the roll to eliminate or reduce shadow marking
- Act as a power transmission belt, driving all felt rolls in press section

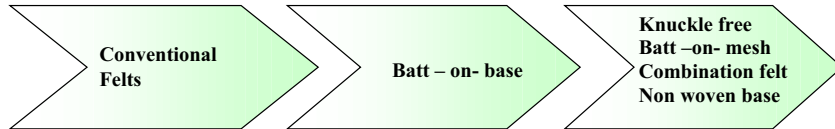
Key indicators of good press fabric

- Adequate strength
- Adequate void volume for low hydraulic pressure at the nip



- Fine and smooth felt surface to minimize rewetting and press fabric impression
- Low compressibility felt to maintain adequate void volume.
- Smooth surface to provide uniform compression
- Adequate permeability for low hydraulic pressure

Development of modern press clothing



- between the cylinder and the sheet causing increased heat transfer. Free passage of vapor becomes an important function so as to achieve faster and economical drying. For this, modern screens with high permeability are preferred over conventional dryer felts.
- Control of shrinkage- The tension of the clothing controls some of the shrinkage in the sheet.
- It works as a driving element by supporting the web through the dryer section. Fabric durability,

Dryer Clothing:

- Dryer clothing can be classified as
- Wollen dryer felt
- Conventional dryer felt
- Needled batt-on- base and batt-on mesh
- Open mesh dryer felt
- Dri screen dryer felt

Function of dryer fabric

- Support and guide the sheet through dryer section
- Improved drying- The tension of clothing improve the contact

dimension stability and structural stability are important factors influencing this function.

Key parameters for dryer screen

- Simple and quick seaming
- No seam mark
- Optimum dimensional stability
- Uniform permeability
- Low contamination tendency
- Good drying performance.

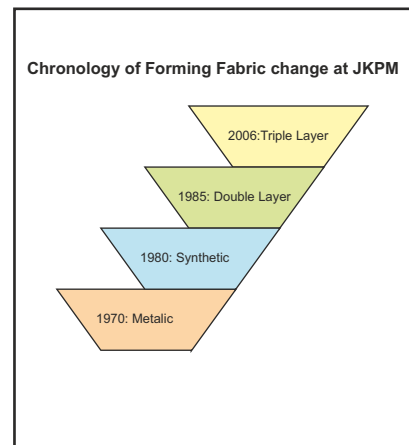
Over view of J.K. M/c configuration

M/c no	Type of machine	Web transfer type from wire to press	Press section	Dryer section	Press circuit
1	M Fourdriner	open	Open type 4 nos with 3 rd press as reverse and 4 th press off set press 1 st press with suction press	Pre dryer 30nos cylinder ,horizontal size press, post dryer 7 nos dryer cylinder and two cooling cylinder	
2	MG (Yankee cylinder)	open	Open type plain press	MG cylinder	
3	MF fourdriner	Closed transfer with suction pick up.	Dual press 1 st suction press center granite roll and top roll rubber covered roll . 3 rd press straight through press top roll granite roll and bottom swimming roll installed in the Year 1997	Pre dryer 16 no. of cylinder, horizontal size press, post dryer 7no including cooling cylinder	
4	MF fourdriner	Closed transfer combination of suction pick up and press	KMW unipress type 606 1 st press suction press center granite roll and top roll rubber cover roll	Pre dryer 12nos of cylinder ,inclined size press ,post dryer 6nos dryer cylinder including 1alloy and cooling cylinder	
5	MF fourdriner	Closed transfer combination of suction pick up and press	KMW unipress type 606 1 st press suction press center granite roll and top roll rubber cover roll .3 rd press straight through press with top roll granite roll and bottom rubber cover blind drill roll.	Pre dryer 19nos of cylinder ,inclined size press ,post dryer 10nos dryer cylinder including 1alloy and cooling cylinder	

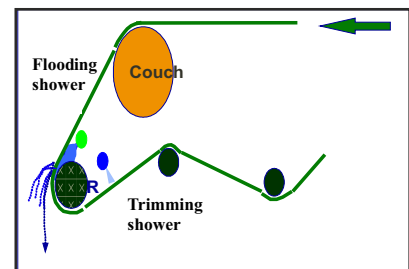
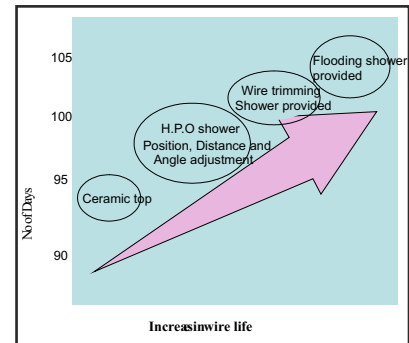
At JKPM we have five machines including one MG machine. We manufacture Photo copy paper, Writing and Printing paper, Bond, Coating base and Poster paper. The following table shows the configuration of the m/c with respect to web transfer, press section and dryer section which is the relevant parameter for m/c clothing selection

Developments In Forming Fabric At JKPM

- Metallic wire replaced with Synthetic forming fabric on all the machines
- Metallic wire had a very low life due to its inflexibility. It is easily prone to stretching, creasing and fraying causing quality defects.



- Synthetic Single layer wire changed to double layer
- Retention is low in single layer wire and tendency to develop wire ridge mark on paper is often observed. These defects



are reduced in double layer wire.

- Double layer to Triple layer in PM 5
To further improve wire life and retention we have gone for Triple layer. Additionally we got the benefit of lower two sided ness. However use of triple layer wire was discontinued due to problems relating to wire clogging and runnability issues.

- Besides going for latest technology, the mills have also made improvements in process to increase the life of forming fabric.
 - Conversion of dewatering element top to ceramic top on all machines. Ceramic top reduce wire drag load and give better life and reduce wire change down time

- High Pressure Oscillating shower was previously pneumatic. It was changed to variable speed electromechanical oscillator, for better cleaning of the wire, thereby improving wire life and performance.

- Problem of PM 3 wire top side getting worn out faster was solved by providing a flooding shower on the inside loop of the wire before the ingoing Nip of the FDR. H.P.O shower position changed, the shower distance and impingement angle set right for better cleaning. Wire life improved 100 days.

- In PM3 couch trimming was getting carried along with the wire, as a result of which edges of the wire was getting worn out. Trimming shower provided to eliminate this problem

- In PM3 couch trimming was getting carried along with the wire, as a result of which edges of the wire was getting worn out. Trimming shower provided to eliminate this problem

Impact of furnish change on machine clothing at JKPM

Prior to commissioning of Fiber line, furnish composition was predominantly bamboo (around 80%). After New fiber line was commissioned in 1998, the furnish was changed to predominately mixed tropical hard wood(85%).This furnish composed mostly of short fiber and consequently more fines, which retained less in the wire. Double layer forming fabric was useful in this case.

Changes inWet end chemistry

JKPM always believes in quality improvement and hence trials of various chemicals are taken at wet end on a continuous basis. In the early 90s our sizing system was acidic/neutral. After that AKD with calcium carbonate was taken for a short period. We switched over to ASA sizing on all the machines since 2006.

- While taking trial of AKD with calcium carbonate the life of the wire was drastically reduced to 50% on all the m/c. In PM 1 wire damage occurred frequently due to the high abrasiveness of Calcium Carbonate. We changed the filler to Talcum which is less abrasive than calcium carbonate, at that time. With this change, we could improve wire life.

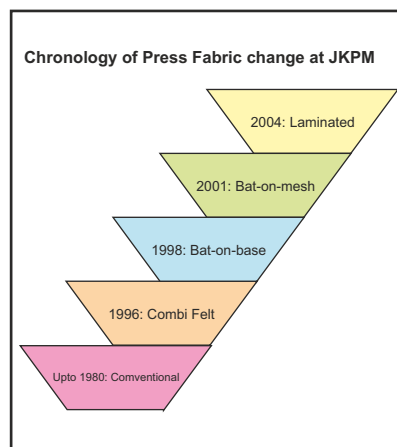
- All m/cs were converted to ASA sizing as a part of continuous improvement to improve our product. However due to this, we had to face numerous problem relating to hydrolysis and deposition of ASA, which is sticky in nature resulting in heavy deposition at the press felts, felt rolls and press rolls. This gave us runnability problems due to sheet breaks and quality defects like bluish spots on paper. Felt life reduced drastically.

- Before ASA sizing our felt conditioning system was only mechanical. Now we have both mechanical and (on line) chemical cleaning/conditioning systems to overcome problems relating to ASA deposition.

Developments In Press Fabric At JKPM

- Inner fabric removed from all the m/c

After the development of combifelt we removed inner fabrics in all the m/cs. By this we not only saved energy but also the downtime has been reduced to a great extent because of reduced felt mounting time. However fiber bleeding problem faced with this change which was eliminated by changing air permeability of the felt in consultation with the supplier



- Reduction of P.U Felt permeability.

In PM-3 web transfer from wire to press is through suction pick up arrangement . Pick up felt carries the web from wire to 1st press nip.In this type of arrangement we are facing sheet fluttering at the edges and some time sheet drop problem. Air permeability of the P.U felt reduced from 80 cfm to 40-50 cfm in consultation with supplier.

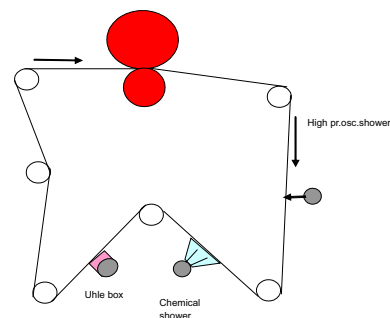
- Shrink sleeve removed from the suction press roll in the year 1998.

- Change the felt top layer finer filament to avoid felt mark problem

Presently we are using the following type of forming fabrics

M/c no.	Weave	Count/cm	Air permeability in CFM	FSI	DI
1	16 Shed 2.5L	50/3*17	430	120	32
3	8 Shed double layer	63/2*23	422	110	21
4	8 Shed 2.5L	62/3*18	430	140	36
5	8 Shed 2.5L	60/3*18	440	138	37

Press felt conditioning at JKPM



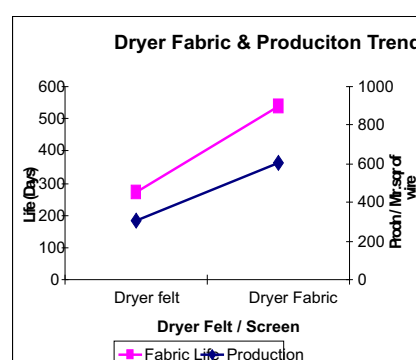
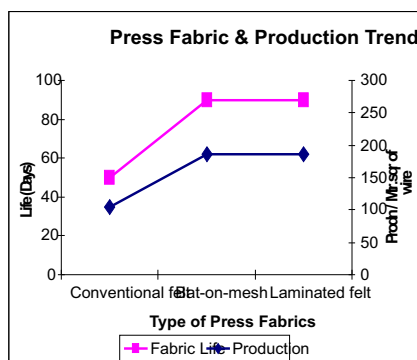
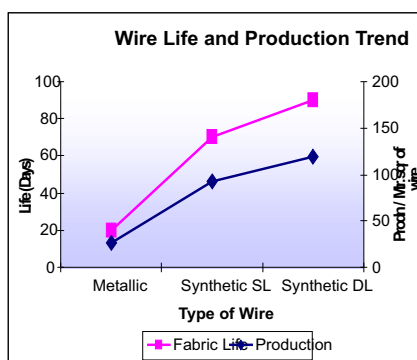
Presently following quality of press felt used in JKPM

PM #	position	Type of press felt	Air permeability in CFM	GSM of felt
	1 st press	Laminated felt	50	1500
	2 nd press	Two layer bat-on-mesh	40	1600
	3 rd press	Single layer bat-on-mesh	35	950
3	P.u.felt	Two layer bat-on-mesh	65 to 70	1500
	2 nd press	Laminated felt	50 to 55	1500
	3 rd press	laminated	45 to 50	1700
4	P.u.felt	Laminated	60	1600
	2 nd press	Laminated	50	1600
15	P.u.felt	Laminated	60	1600
	2 nd press	Laminated	50	1600
	3 rd press	Laminated	45 to 50	1700

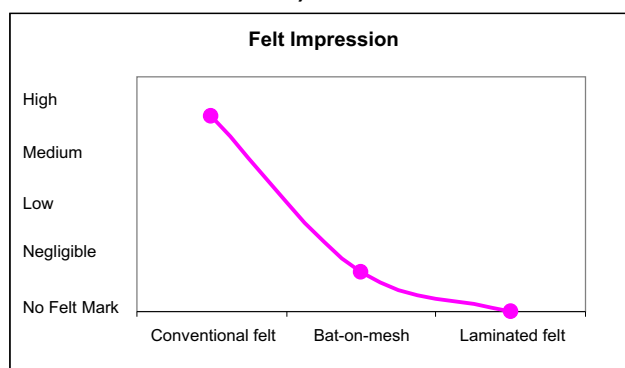
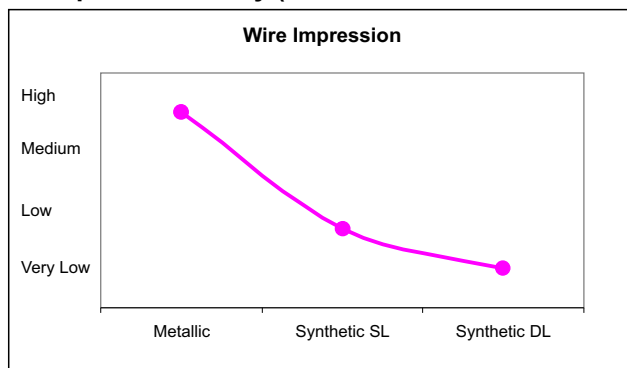
Presently following quality of Dryer screen used in JKPM

paper machine no	position	Type of Dryer Screen	Air permeability in CFM	GSM of felt
1	1 st Dryer group	Flat Monofilament	120 to200	1150 to1300
	2 nd Dryer group	Dryer Felt	15 to 20	2100 to 2200
	3 rd Dryer group	Dryer Felt	15 to 20	2100 to 2200
	4 th Dryer group	Dryer Felt	15 to 20	2100 to 2200
	5 th Dryer group	Dryer Felt	15 to 20	2100 to 2200
	6 th Dryer group	Dryer Felt	15 to 20	2100 to 2200
3	1 st Dryer group	Monofilament	120 to200	1150 to1300
	2 nd Dryer group	Monofilament	200 to 300	1150 to1300
	3 rd Dryer group	Monofilament	300 to 400	1150 to1300
	4 th Dryer group	Monofilament	300 to 500	1150 to1300
4	1 st Dryer group	Monofilament	120 to200	1150 to1300
	2 nd Dryer group	Monofilament	200 to 300	1150 to1300
	3 rd Dryer group	Monofilament	300 to 400	1150 to1300
	4 th Dryer group	Monofilament	300 to 500	1150 to1300
5	1 st Dryer group	Flat Monofilament	120 to200	1150 to1300
	2 nd Dryer group	Monofilament	200 to 300	1150 to1300
	3 rd Dryer group	Monofilament	200 to 300	1150 to1300
	4 th Dryer group	Monofilament	200 to 300	1150 to1300
	5 th Dryer group	Monofilament	200 to 300	1150 to1300
	6 th Dryer group	Monofilament	300 to 400 400 to 500	1150 to1300 1150 to1300

Impact on Productivity



Impact on Quality (Elimination/drastric reduction of certain defect modes)



- Vickery top converted to ceramic top on PM-3 to improve felt life
- H.P.O shower installed in all the press felts
- On line felt cleaning chemical started in 2nd and 3rd press felts.

Dryer fabric

- In PM-3 dryer felt replaced with dryer screen taking the advantage of high permeability of dryer fabric. Drying efficiency increased.
- In PM-3 P.V.Blower system installed taking the advantage of dryer screen. Production increased by 7%
- In PM 3, PM 4 and PM-5 1st group SLDF change to dryer screen
- In PM 1 & PM 5, 1st group converted to unirun taking the advantage of flat filament of dryer screen with increase in contact area.
- Accumulation of fluff in 1st bottom dryer cylinder problem solved and m/c runnability and quality improved. PM-1 1st group converted into unirun in the year 2007

Conclusion

Adoption of new technology and right quality of machine clothing always gives a positive impact on productivity and quality of the product