Right Selection of Machine Clothing
A Key Parameter to Achieve Efficiency, Cost & Quality

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ABSTRACT

Increasing cost of inputs with ever changing customer perception on quality has become a challenge for paper manufactures to scale up their machine efficiency and produce a superior quality at an affordable price. In this context, over the years, the wet end chemistry of papermaking has moved away from the traditional sizing of paper to facilitate use of engineered fillers like Precipitated Calcium Carbonate (PCC) so that a higher filler content can reduce the fiber cost and at the same time, help producing a better quality of paper in terms of aesthetic and performance. This has led to a host of machine run ability problem and had a telling effect on life of machine clothing.

This paper deals with basic in M/c clothing, an overview of latest clothing technologies and various measures taken at JK Paper Mills, a unit of JK Paper Ltd. to address these issues and some more. The paper describes the efforts taken to design the machine wire so as to improve the life by 30 to 50 % and the machine idle time for felt conditioning could be brought down to more than 50 % by adopting a series of measures like on line felt conditioning chemical, biocide treatment etc. including change in design of clothing. All these initiatives could help in combating the change in fiber quality and the wet end chemistry, which ultimately resulted in producing a superior quality of paper at a competitive price.

Introduction

Technological development, quality requirement, changes in furnish and rising cost of operation have led to rapid development of paper machine clothings. JKPM being the leader, has taken innovative steps to update its system to overcome the aforesaid challenges.

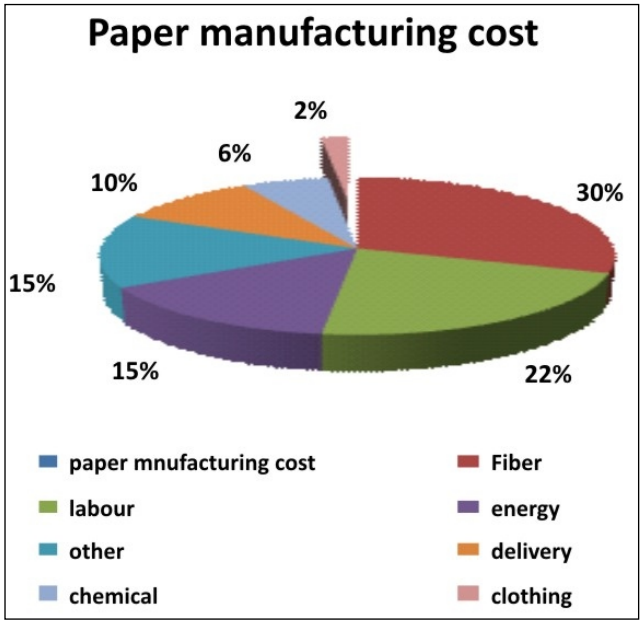
Machine clothing plays a vital role in the paper manufacturing process in terms of cost of production and quality. Although it accounts for around 2% of overall cost of production of paper, the loss due to improper selection of machine clothing and/or its usages can be colossal. New technology introduced either in the process or in paper machine design forced the machine clothing supplier to redesign the machine clothing. To cope up with the changing environment, JKPM continuously take numerous innovative steps in this direction by upgrading its plant, machineries, process and operational parameters including machine clothing.

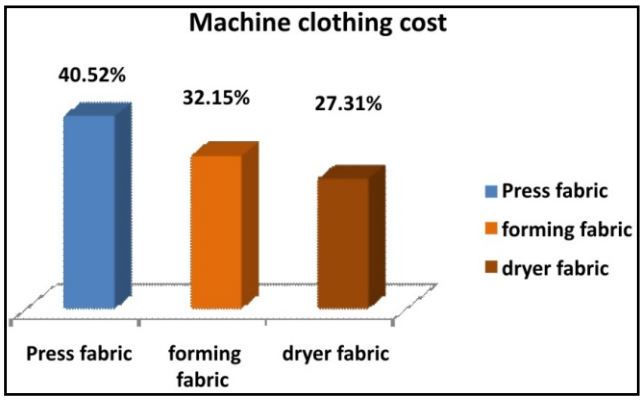
Paper Machine Clothing

Paper making starts with a spreading of suspension of pulp evenly across a paper machine forming fabric that yields a paper sheet with desired properties. The cost of dewatering the sheet on the wire section, press section, and dryer section amounts to 10%, 12%, 78% and in terms of energy consumption, it amounts to 15:20:65. Obviously, choice of machine clothing plays a vital role.

A-Forming fabric

- Supports and retains the fibers & fines to form quality sheet.
- Transfer the formed sheet to press section.
- Function as a filter media.





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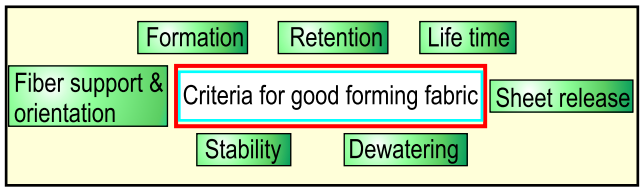
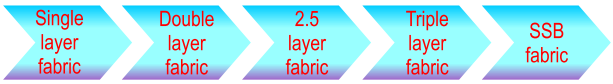


Development of modern forming fabric



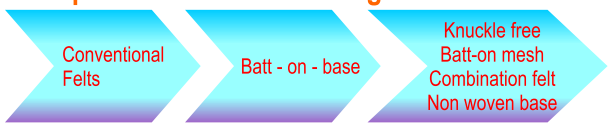
B-Press Fabric

- 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.

Key indicator of good forming 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.
- Smooth surface to provide uniform compression.
- Adequate permeability for low hydraulic pressure.

Development of modern forming fabric



C-Dryer Fabric

- Support and guide the sheet through dryer section.
- Hold the sheet against the heated cylinder surface and hence increase the heat transfer.
- Control the cross direction shrinkage.
- It works as driving element by supporting the web through the dryer section. Fabric durability, dimensional and structural stability are important factors influencing this function.

Key parameters for dryer screen

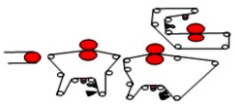
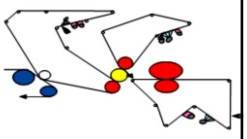
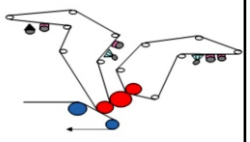
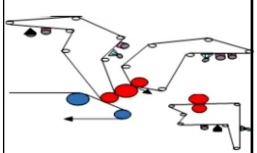
- Simple and quick seaming
- No seam mark
- Optimum dimensional stability
- Uniform permeability
- Low contamination tendency
- Good drying performance.

JKPM Machine Configuration

In JKPM, we have six Machines including one MG machine. We manufacture photocopy paper, writing &printing paper, bond, coating base paper & lightweight coated paper .The following table shows the configuration with respect to web transfer, press section and dryer section which is the relevant parameter for machine clothing.

Development of machine clothing at JKPM

JKPM always believes in quality improvement and continuously try to upgrade and add value to its product.

M/c no.	Type of Machine	Web transfer type	Press section	Dryer section	Press circuit
1	M F fourdiner	Open	Open type, 4nos with 3rd press Reverse press 4th press offset press 1st press bottom suction press	Pre dryer 30nos dryer cylinder with horizontal size press post dryer 7 nos cylinder and two cooling cylinder	
3	M F fourdiner	Closed transfer with suction pick up	Dual press 1st press suction roll, center granite roll and top roll rubber covered roll, 3rd press straight through press top roll granite roll and bottom swimming venta nip roll.	Pre dryer 16nos cylinder with horizontal size press post dryer 7nos cylinder including cooling cyclinder	
4	M F fourdiner	Closed transfer combination suction pick up and press	KMW unipress type 606 1st press suction press, center granite roll and top roll rubber covered roll	Predryer 12 nos of dryer cylinder, inclined size press, post dryer 6 nos of dryer cylinder including 1 cooling cylinder	
5	M F fourdiner	Closed transfer combination suction pick up and press	KMW unipress type 606 1st press suction press, center granite roll and top roll rubber covered roll. 3rd press straight through press top roll granite roll and bottom roll rubber covered blind drilled roll.	Predryer 19 nos cylinder, inclined size press, post dryer 10 nos of dryer cylinder including cooling cylinder	

This can be achieved through any one of the following or in a combination.

- Furnish
- Wet-end chemistry
- Making use of latest technology on Machine clothing

Furnish vis-à-vis machine clothing

Fiber furnish composition was changed from Bamboo 80% & 20% Tropical hard wood to 85% Hardwood and 15% Bamboo after commissioning of the New Fiber line in 1998. This furnish composed of mostly short fibers and more fines.

- Synthetic single layer forming fabric changed to double layer to improve retention, and formation. Single layer fabric had a tendency to develop wire ridge mark which gives quality defect to paper.

Changes in Wet end chemistry

In the early 90's our sizing system was acid/neutral. After that AKD with calcium carbonate was taken for a short period. We switch over to ASA sizing in all the machine since 2006. We introduced colorlok technology in 2010 to improve paper quality in terms of better image reproduction, less tonner consumption.

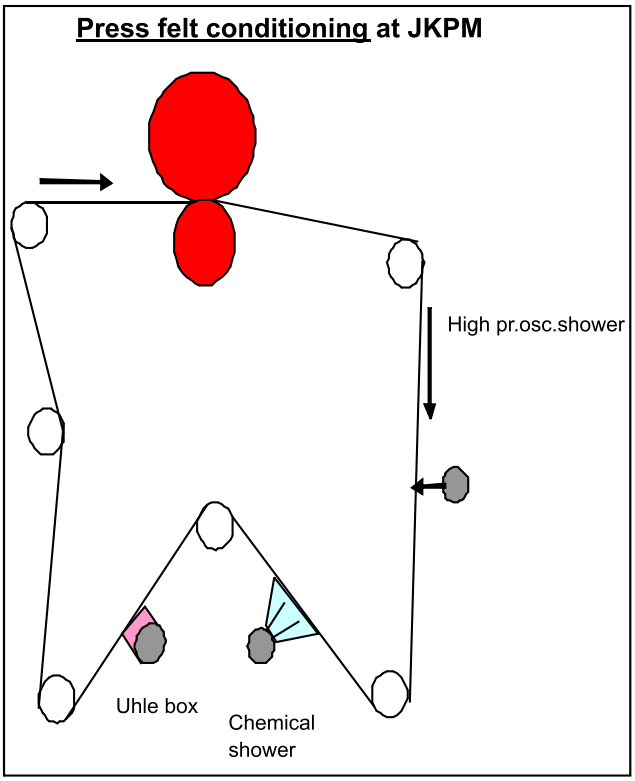
Prior to the colorlok technology talcum was the filler. After introducing colorlok technology, the filler quality was changed to Wet ground calcium carbonate (WGCC) and from April 2013, PCC (precipitated calcium carbonate) is being used as filler to improve brightness, printability and bulk of the paper. As the particle size of WGCC & PCC is smaller in size than talcum, retention of finer particle is a concern. To overcome these problems, JKPM made the following changes with respect to forming fabric.

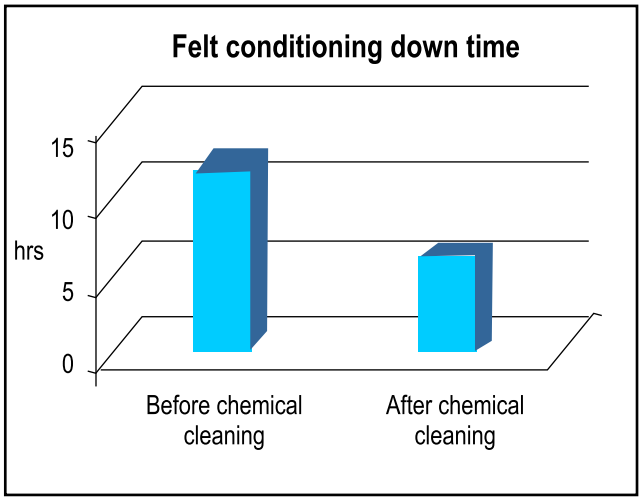
- Double layer forming fabric changed to 2.5 Layer. Retention increased by 1-2% but wire impression problem is there.
- 2.5 layer forming fabric changes to SSB forming fabric. Retention increased to 2-4% and
- Formation index improved by 20%,

All machines were converted to ASA sizing as a part of continuous improvement to improve our product .However due to this, problems related to hydrolysis and deposition of ASA,which is sticky in nature resulting in heavy deposition at the press felts, felt rolls and press rolls were encountered. This gave us runability problems and quality defect like bluish spots on paper. Felt life also got reduced.

Before ASA sizing our felt conditioning system was only mechanical. Now we have both mechanical and (on line) chemical cleaning system to overcome the problem relating to ASA deposition. With WGCC filler, the felt life got reduced by 45% (50 days against 90 days). Following steps were taken to counter the damage.

- Inside lubrication shower provided at 2nd press of PM-5, our felt life increase to 60 days.





- Uhle box top converted to ceramic top.
- H.P.O.shower provided on all press felts.
- On line felt cleaning chemical started in 2nd & 3rd press felt.

Adoption of latest changes in clothing technology

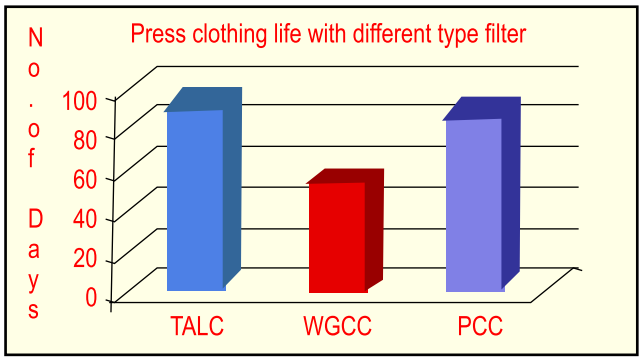
- Inner fabric removed from all the M/c.
- After the development of combifelt inner fabric in all the paper machines were removed. This not only saved energy but also the downtime to a great extent because of reduced felt mounting time. However, fiber bleeding problem faced with this change this was eliminated by changing air permeability of the felt .

Reduction of pick up felt permeability

- In Paper machine 3 web transfers from wire to press is suction 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 P.U.felt reduced from 80CFM to 40-50CFM.
- Shrink sleeve removed from the suction press by converting suction press roll to suction press cum blind drill roll.
- Change the felt top layer finer filament to avoid felt mark impression.
- In PM 1 & PM 5, 1st group converted to unirun taking the advantage of flat filament of dryer screen with increase in contact area.

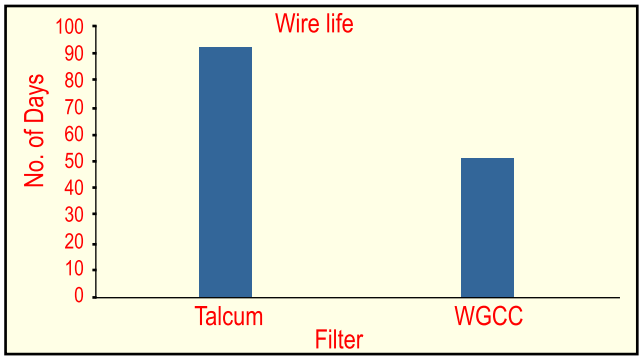
Accumulation of fluff in 1st bottom dryer cylinder problem solved and m/c runnability and quality improved. PM-1.

Impact of Machine Clothing on Cost



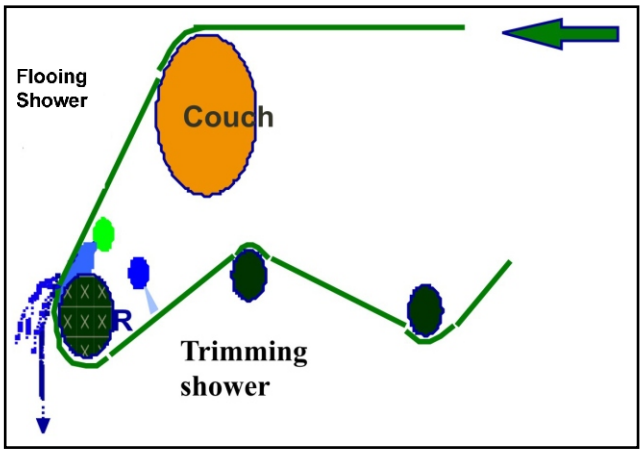
Life of the Forming fabric

- After switch over to AKD with calcium carbonate, the life of the wire drastically reduced to 50% on all the machines. However, maximum adverse impact was on PM-1 wire due to higher percentage of loading with such high abrasive filler. We changed the filler to talcum at that time which was less abbraviness than calcium carbonate. With this change we could improve the wire life.
- In PM-5 to improve wire life we change to triple layer wire and to improve retention .Though the twosideness of the paper reduced, the use of the triple layer fabric discontinued due to problem related to wire clogging and runnability issue.
- After switching over ASA sizing in all the machine we use talcum as filler instead of calcium carbonate. After the introduction of colorlok technology we use WGCC as filler. After changing the filler to WGCC wire life got reduced .We are losing down time and no.of wire changes increases.

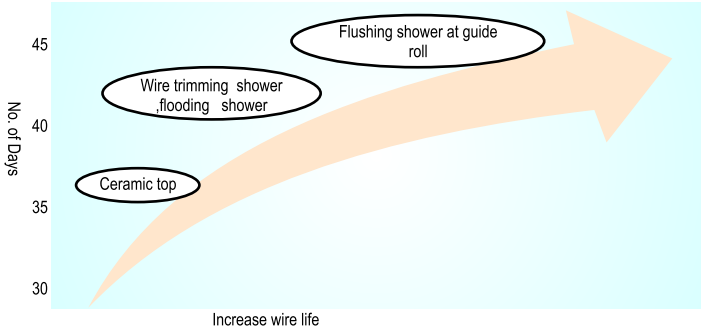


Besides going for latest technology in the machine clothing, the mills have also made improvement in process to increase the life of forming fabric.

- 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.



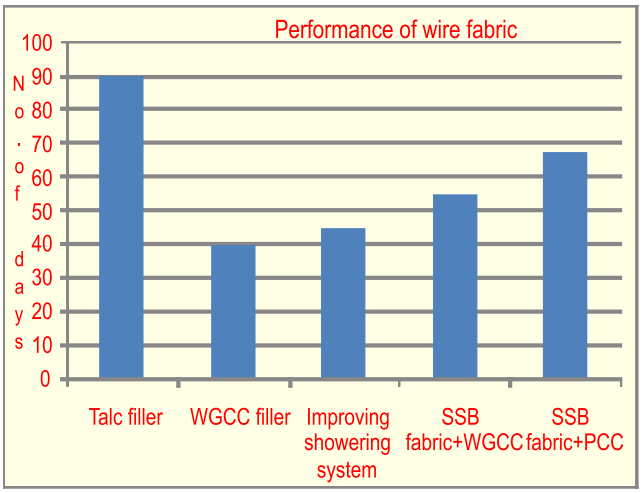
- High pressure oscillating shower was previously pneumatic. It was changed to variable speed electromechanical oscillator, for better cleaning of the wire, thereby improving wire life.
- Wire top side getting worn out faster was solved by providing a flooding shower on the inside loop of the wire before the ingoing nip of the FDR to flushed filler and fines.
- Much fiber accumulation on the guide roll of the wire causing rapid worn out of the top side of the wire. A lubrication shower provided to flush out the same.

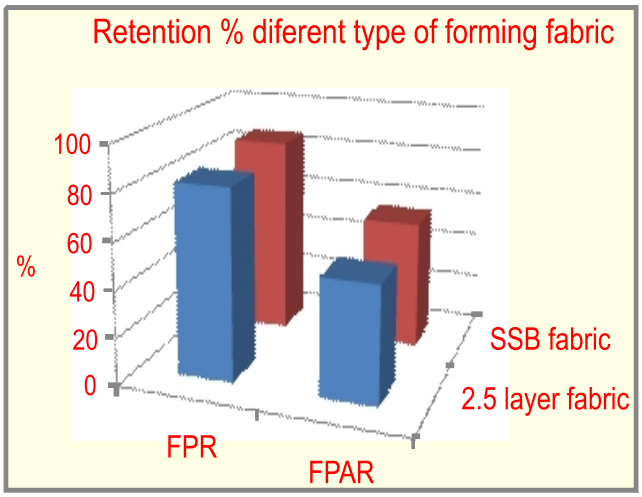


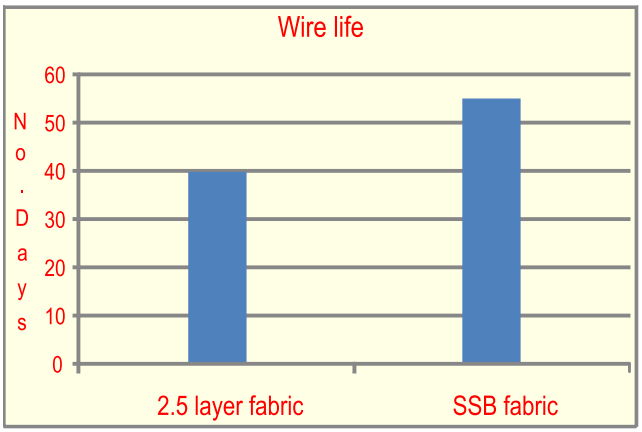
- In PM-3 couch trimming was getting carried along with the wire, as a result of which edges of the wire was getting worn out . Trimming shower provided to eliminate the problem.

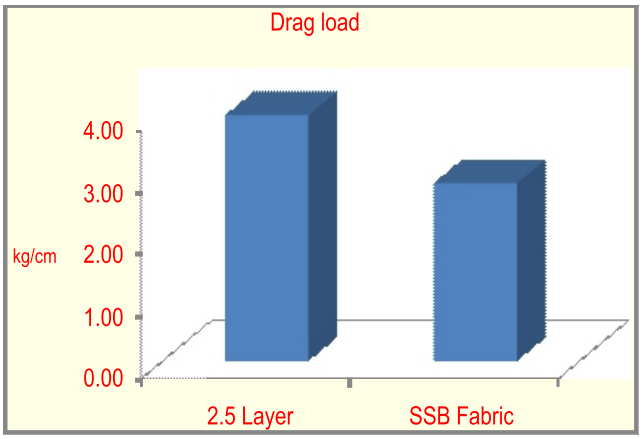
Changing of forming fabric to SSB fabric.

With WGCC filler, wire life got drastically reduced. We take the advantage of latest technology in forming fabric and change 2.5









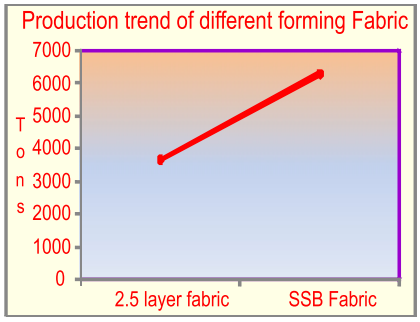
FORMING FABRIC SPECIFICATION AT PM (1,3,4& 5)

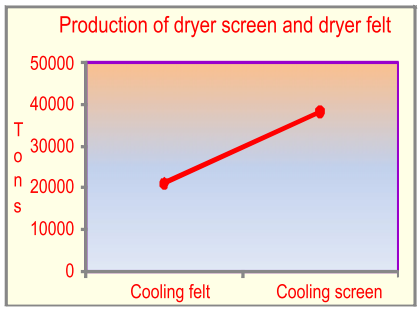
Sl no.	Particulars	unit	WIRE A		WIRE B	
			16 shed 2.5 layer	SSB fabric	16 shed 2.5 layer extra support shute	SSB fabric
			previous	present	previous	present
1	Warp diameter	mm	0.17	0.17	0.2	0.13 X0.21
2	Weft diameter	mm	0.18 X 0.13 X 0.30	0.17 X0.15 X0.30	0.22 X0.13X0.30	0.15 X0.14X0.30
3	Warp count	no/cm	60	60	55	59
4	Weft count	no/cm	56.5	68	51	66
5	FSI		129	166	120	162
6	caliper	mm	0.84	0.87	0.87	0.92
7	frame length	mm	0.401	0.14		
8	Air permeability	CFM	386	415	415	400
9	Drainage area	%	39.4	32		30.7
10	Drainage Index		33.6	35.8	38.2	
11	Stiffness MD/CD	Taber	58/130	138/125		
12	Wear Volume	cc/m^2	62	70		

DRYER SCREEN SPECIFICATION AT PM (1,3 ,4 &5)

Paper machine no	Posittion	Type of screen	Air permeability(CFM)	GSM of of felt
1	1st dryer group	Flat monofilament	120-200	1150-1300
	2nd dryer group	Dryer felt	15-20	2100-2200
	3rd dryer group	Dryer felt	15-20	2100-2200
	4th dryer group	Dryer felt	15-21	2100-2201
	5th dryer group	Dryer felt	15-22	2100-2202
	6th dryer group	Dryer felt	15-23	2100-2203
3	1st dryer group	Monofilament	120-200	1150-1300
	2nd dryer group	Monofilament	200-300	1150-1300
	3rd dryer group	Monofilament	300-400	1150-1300
	4th dryer group	Monofilament	300-500	1150-1300
4	1st dryer group	Monofilament	120-200	1150-1300
	2nd dryer group	Monofilament	200-300	1150-1300
	3rd dryer group	Monofilament	300-400	1150-1300
	4th dryer group	Monofilament	300-500	1150-1300
5	1st dryer group	Flat monofilament	120-200	1150-1300
	2nd dryer group	Monofilament	120-200	1150-1300
	3rd dryer group	Monofilament	200-300	1150-1300
	4th dryer group	Monofilament	300-400	1150-1300
	5th dryer group	Monofilament	300-500	1150-1300
	6th dryer group	Monofilament	400-500	1150-1300

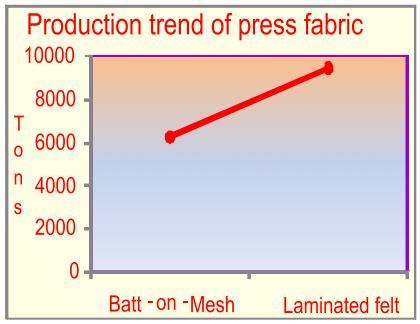
Impact on Productivity



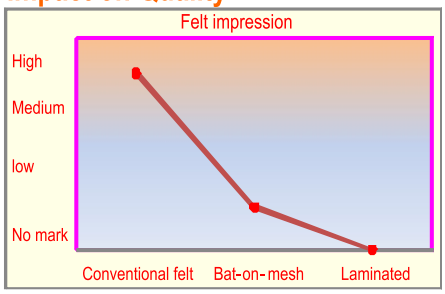


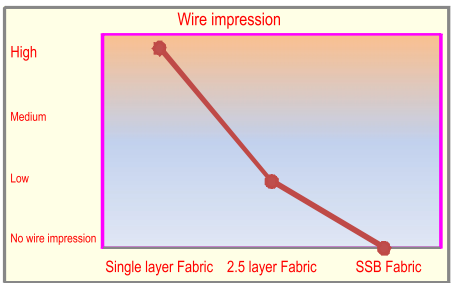
PRESS FELT SPECIFICATION AT PM (1,3,4 &5)

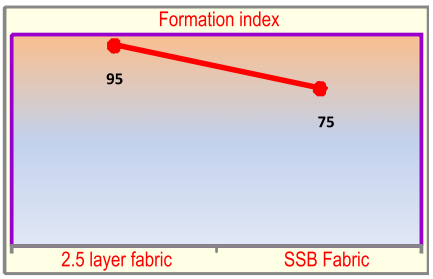
Paper machine no	Posittion	Type of press felts	Air permeability(CFM)	GSM of of felt
1	1st press	Laminated	50	1500
	2nd press	Two layer bat-on-mesh	40	1600
	3rd press	Single layer bat-on-mesh	35	950
3	1st press	Two layer bat-on-mesh	65-70	1500
	2nd press	Laminated	50-55	1500
	3rd press	Laminated	45-50	1700
4	1st press	Laminated	60	1500
	2nd press	Laminated	50	1600
5	1st press	Laminated	60	1600
	2nd press	Laminated	50	1600
	3rd press	Laminated	45-50	1700



Impact on Quality







layer forming fabric to SSB forming fabric to improve wire life. we change the filer to precipitated calcium carbonate which is less abrasive than WGCC to improve wire life ,besides that we get the benefit of higher filer content to reduce the fiber cost and at the same time ,help producing a better quality of paper in terms aesthetic and performance. This has led to machine runnability problem and retention of filler and fines concerned to us. In consultation with the supplier we change the FSI and caliper of the SSB fabric. By this we improved our retention and life of the wire.

Reduction of Wire drive load

Drag load of wire reduced to after taking SSB fabric to 33% thereby saving energy and increase wire life.

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.
- We converted cooling cylinder to dryer cylinder to increase drying efficiency.
- Cooling felt change to dryer screen for better steam economy.Thus flet life increased from 200 days to 365 days.

Conclusion

With the change in technology, machinery and inputs to produce a better product, the usual by – product is process disturbance. Such disturbances can be in operation, quality and/or the machine parts including clothing. Anticipation and preventive measures are the need of the hour. JKPM did anticipate some and some surfaced during the run for which corrective as well as preventive measures could be taken. It not only helps in improving the bottom line but can help sustaining the leadership in the market.

Acknowledgment

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