

A study on improving the Knitting Machine Efficiency



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Abstract

This project contains study of speed factor and its effect on production & efficiency of the weft knitting machine & also defective less fabric is achieved. The speed of the machine plays an important role in fabric defects. Thus, an optimum speed should be maintained for optimum production. In this project alteration of speed was made and the various process Parameter was recorded. Speed of machine was increased by 1 & 2 rpm daily & negative impact of the various parameters like fabric defects, yarn breakages & needle defects was found.

Introduction

The efficiency of weft knitting machine is related to knitting parameter, yarn quality, human skill. It is assumed that poor quality of yarn appearance, improper machine parameter causes fabric faults, yarn breakages, ultimately its effect on efficiency. In project study machine type, machine Dia/gauge & (with desired machine parameter such as gauge, needle type, cam type, yarn feeding system, number of feeders, take down system, cloth rolling or spreading, monitoring and control systems, etc. according to fabric structure) were first selected. Yarn quality also selected which is having desired yarn count. Then select the process parameters such as cam setting, speed, yarn tension, sinker setting (in single jersey), delay time (in double jersey), stitch length, take down rate, condition of machine, etc. which plays vital role in deciding the quality of the fabric. Daily machine speed was changed according to machine condition & observed for the machine efficiency, yarn breakages and various fabric faults. During trial period we checked machine parameter (Yarn tension, stitch length, GSM, width of fabric), & machine setting {Q.A.P. (quality adjustment pulley), (Fabric take-up)} also taken the breakage study daily. After completed of shift we calculated the machine efficiency, production, roll doffing time loss, breakages attending time loss. We are followed the Q.C. report for analysis of fabric faults (Wt. of roll, fault type fault range, Rejection %.)

The objective of this study is to improve the machine efficiency & production by selecting optimum speed. To produce the better quality of knitted fabric by reducing the fabric faults. Machine efficiency observed low as where increased the speed, we are trying to improve the m/c efficiency & produce the defective less fabric by selecting the optimum speed.

Machine specification

We have carried the study on total 2 machines out of which 1 is manufactured by Mayer & cie and other are manufactured by Pai- lung. The details of the machines are as follows.

Trial 1

Machine specification

PAI LUNG M/C:
Model – PL-X53B/C
Cylinder Dia. – 30”/ 28 gg
Feeders – 90
Volt – 440, 50Hz
Needle – 2640
Safety rpm- 28

Trial 1

For 1 trial following yarn properties used by comparing with norms

Sr.No.	Specification	Actual	Standard
1	YSM NO.	Y00715	
2	Sale contact	S.S.:323	
3	Nominal count	30/1CHX ORG	30 CH
4	Lot no.	6LH1000063	
5	Actual count	29.66	26.06
6	Count cv %	1.32	Less than 1.5
7	CSP	2835	2600
8	U%	9.34	9.2 to 9.8
9	Thin place/km	0	Less than 2
10	Thick place / km	16.3	Less than 33
11	Neps / km	65.5	Less than 63
12	Total imperfection /km	81.8	Less than 50
13	Hairiness H	6.71	Less than 5.59
14	RKM (UTJ4)	19.31	More than 16.6
15	Elongation	4.84	More than 5.5
16	TPI/TM	20.15/3.68	3.5 to 3.6
17	Classimat-7class/100km	0	
18	16-class/100km	294	
19	Cone tip	Red arrow	
20	Avg. cone weight (kg)	2.5	

Material and Method

Fabric quality	M/C type	Dia/GG	M/C no.	Count	S.L.	G.S.M.	Width
Organic spandex plain SJ	SJ OW	30/28	SO 34	30's /30D	3.1	250	91 cm
Yarn lot no.	30's organic lot Alok spinning 6 LH100063				Design No.	Spandex	Name of operator
					AK13858	40 D	Subash sahuo
Sr. no.	Fixed values	Minimum	maximum	Actual			
1	Yarn Tension	5	7	6			
2	CSP	1900	2400	2835			
3	Yarn elongation	2%	4%	4.84			
4	Spandex tension	Nil		2			

10	Expected prod in kgs / shift	132.2	133.9	140.3	146.6	153	153	146.6	140.3	133.9	133.9	133.9
11	Act. Prod in kgs / shift	127.5	131.1	125	121.9	114	115.8	118.5	127	128.8	132.1	132.39
12	Rejection in kgs / shift	4	3	3.2	4.5	5.8	5.7	3.9	4	2.4	2.5	1.06
13	Rejection %	3	2.3	2.6	3.7	5.1	4.9	3.3	3.1	1.9	1.6	1.2
6	Doff counter	0	0	1600	1600	0	1600	0	1600	0	0	
7	Std rev. to be / shift	9600	10080	10560	11040	11520	11520	11040	10560	10080	10080	10080
8	Act rev / shift	8010	8390	8000	7800	7298	7412	7585	8131	8241	8435	8488
9	machine efficiency / shift	83.42	83.2	75.8	70.7	63.4	64.3	68.7	77	81.8	84	84.20

Method

Production in kgs / shift

$$= \frac{\text{RPM} * 8 * 60}{D} * W * \text{efficiency (\%)}$$

D

Where,

W = Weight of roll in kgs

D = Roll counter

Machine Efficiency(%) / shift

$$= \frac{\text{Actual counter / shift}}{\text{Calculated counter/shift}} * 100$$

Machine Stoppages Study (Daily Report)

Quality Assurance Dept.

M /c no - so34

shift - A

Date - 7-Sep

Dia / gg - 30/28

Start time - 7.00

End time - 3.00

Structure - plain s/j

Yarn details - 30's/40d

End time - 3.00

23	1		4		5		
24	4				4		
24	3	2	7		12		
23				9	9		
22	3	2			5		
21	1			2	3		
21	1		1		2		
21	1	1			2		
Fabric faults on machine							
	Oil line	Holes	Press-off	Needle line	Lycra line	Double yarn	Total faults
20	1						1
21			2				2
22			1				1
23					3		3
24		2			3		5
24	1	1			2		4
23		1	2		1		4

22					1		1
21			1				1
21							0
21							0
	Total rev. expected	Total rev. found	Total rev. losses	Effici.%			
20	9600	8463	1137	83.42			
21	10080	8390	1690	83.2			
22	10560	8000	2560	75.8			
23	11040	7800	3240	70.7			
24	11520	7298	4220	63.4			
24	11520	7412	4108	64.3			
23	11040	7585	3455	68.7			
22	10560	8131	2429	77			
21	10080	8241	1839	81.8			
21	10080	8435	1645	84			
21	10080	8488	1592	84.20			

Results and Discussion

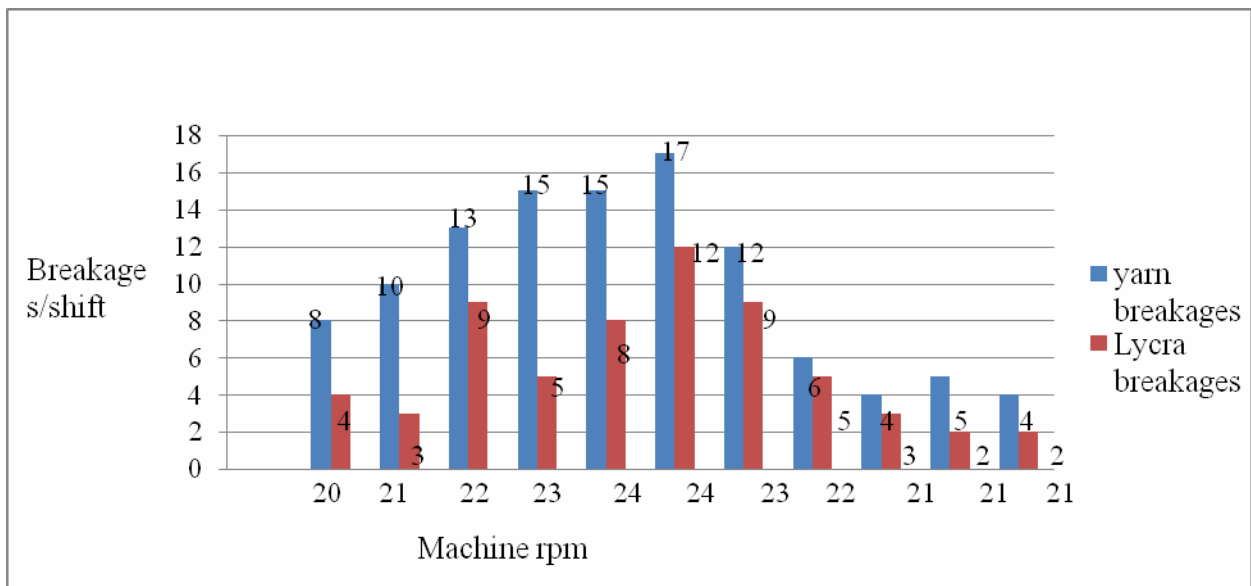
1 Yarn / Lycra Breakages

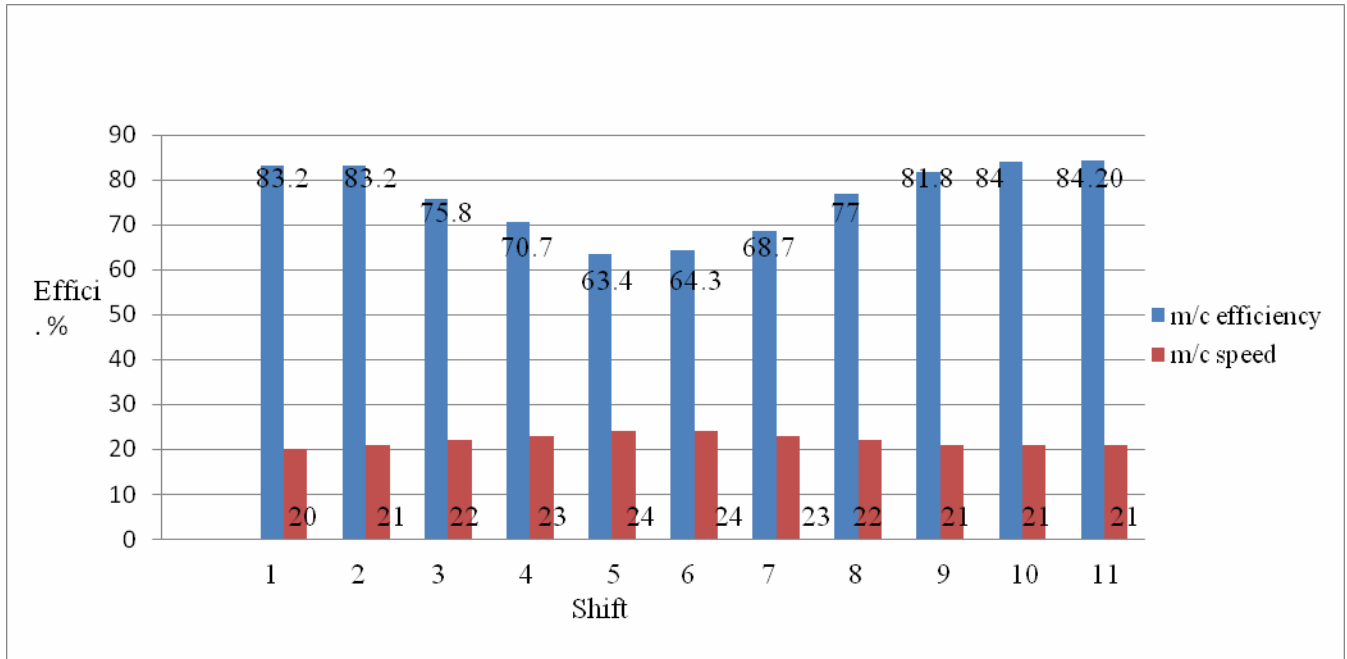
When increases the m/c speed, the Yarn / lycra Breakages is increased because fluffs is disturbed in feeding of yarn and needles eye due to friction in between yarn to metal . If week places in yarn, improper cleaning of machine, such as (area around the cylinder), strength of the knot is less, which leads to yarn breakages and hence fabric cut occurs and there are maximum chances of needle break due to

Graph 1

- Hanging of yarn from end of pkg.
- hanging of yarn from reserved pig when not connected
- When pkg is soft.

2 Machine Efficiency / Shift

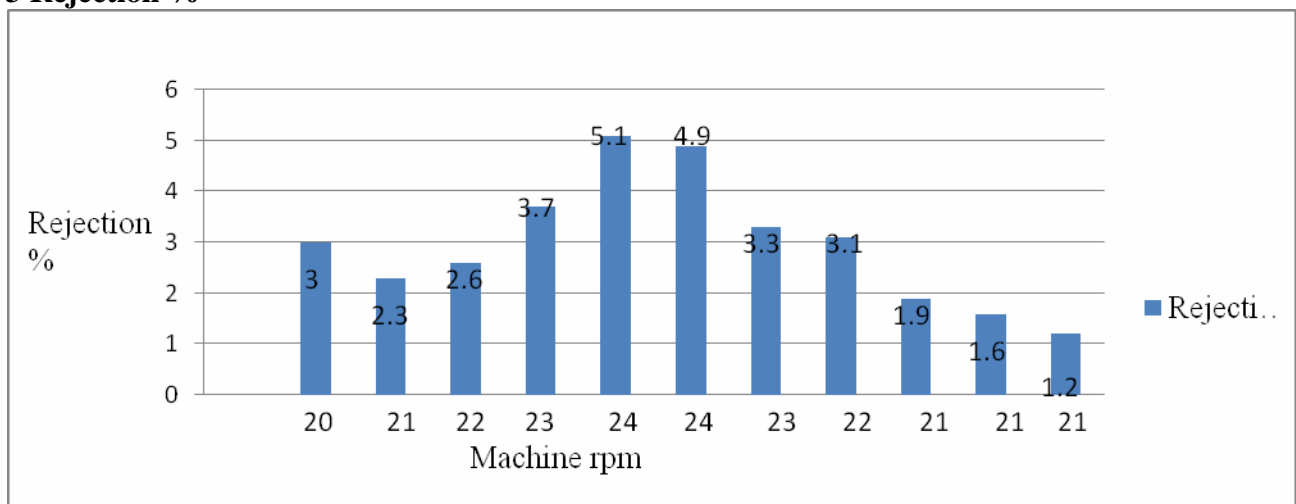




Graph no..2

In this trial of that machine efficiency is decreased from 83.2 to 63.4, where speed is increased up to (24 rpm) due to machine stoppages. Then run the machine at optimum speed (21 rpm) by reducing the speed, here we achieved the optimum efficiency.

3 Rejection %



Graph no. 3

Here Rejection % is increased where increases the speed due to fabric fault is more occurred at higher speed of machine. During trial period I have observed following faults for 30's/40D plain S/J fabric

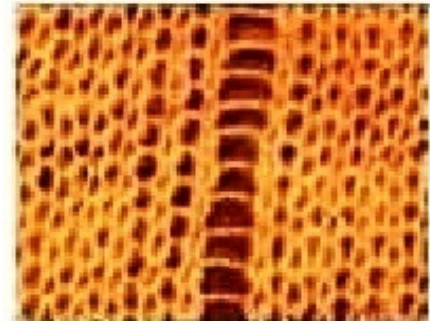
Fabric Faults

Needle Line

Causes

Setting: Machine setting like fabric tension & yarn tension.

Operator: As the visibility of this line is after fabric comes down up to the take down. Some time due to higher speed of m/c the needle line may not visible. Also when slit line is in fabric operator confused with the broken needle line as well the slit line.



Needle or Sinker: Due to over age of needle.

Corrective Action:

- 1) Reset the m/c accordingly.
- 2) Remove the defective needle & use new one.

Preventive Action:

- 1) Train the technician for the m/c setting.
- 2) Check the fabric by reducing the rpm at more frequency stop the m/c, whenever

Confusions happens with slit line plan the work in a way by frequent checking of fabric is Possible adjust with nearby open.

Fig. no. 1

Oil Line

Causes:

Setting: Excess or less oil flow, oil flow in unwanted needle tracks.

Operator: improper cleaning of needle grooves, mixing of different aged needles.

Corrective Action:

- 1) Recheck the oil flow & make as necessary.
- 2) Training for proper m/c cleaning.

Preventive Action:

- 1) To monitor during preventive maintenance & to keep enough spares.

2) Train the operator

Trial 2

M/C Specification

MAYER & CIE M/C

Made in Germany

Dia – 24” / 24gg

Feeders - 78

Here for second trial following yarn quality is used

Quality Assurance:

sr no.	SALE CONTRACT NO	1664562	1653449
1	YSM NO-	y00816	y00794
2	Nominal count (Ne)	30'CH SLUB	32/1 CH SLUB
3	Lot no./Quality	2LH100081	2LH100074A
4	Actual count (Ne)	29.3	31.94
5	Count cv%	1.29	1.06
6	CSP	2353	2579
7	No of slub/m	5.5	5
8	Slub length (CM)	6.20cm	6.73cm
9	Slub Distance (CM)	11.98cm	13.37cm
10	RKM (UTJ4)	16.19	17.76
11	Elongation	4.36	4.26
12	TPI / TM	22.24 /4.06	22.24 / 3.93
13	Paper cone tip	Red checks	multiple cone tip
14	Avg. cone Weight (kg)	1.503	1.878

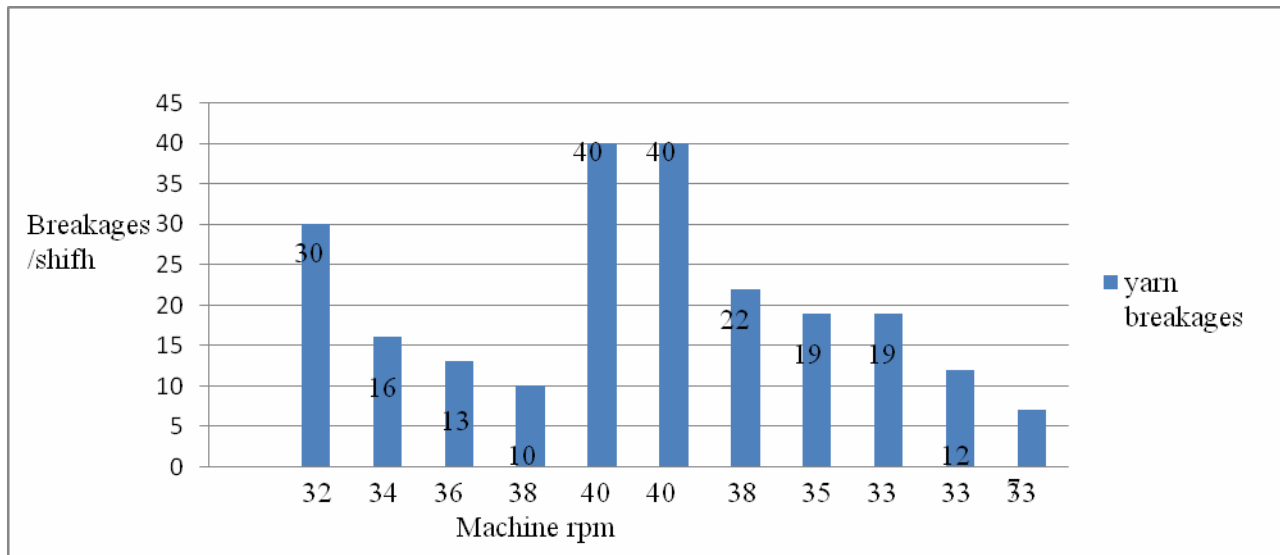
sr no.	Factors description	7-Sep	8-Sep	9-Sep	10-Sep	11-sep	12-Sep	13-sep	14-sep	15-Sep	16 sep	17-sep
1	Speed (RPM)	32	34	36	38	40	40	38	35	33		33
2	Needle breakages	0	2	4	5	0	0	0	1	1	0	1
3	Yarn breakage	30	16	13	10	40	40	22	19	19	12	7
4	fabric faults on m/c	4	7	5	8	12	12	3	3	3	2	3
5	Lycra Breakages	0	0	0	0	0	0	0	0	0	0	0
6	Doff counter	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100
7	Std rev. to be / shift	15360	16320	17280	18240	19200	19200	18240	16800	15840	15840	15840
8	Act rev / shift	13500	11000	12520	13420	13002	12895	12000	14100	14286	13720	14132
9	machine efficiency / shift	87.9	67.4	72.5	73.9	67.7	67.2	65.8	83.9	90.2	87	89.14
10	Expected prod in kgs / shift	108.9	111.9	118.5	125	131.6	131.6	125	115.2	108.6	113.3	113.3
11	Act. Prod in kgs / shift	105.7	88.7	101	108.8	104.9	104	96.8	113.7	115.2	105.4	108.1
12	Rejection in kgs / shift	4	3	2.6	3.1	3.7	4.2	4.7	4	2.5	2.6	1.9
13	Rejection %	3.7	3.4	2.6	3.1	3.7	4.2	4.7	3.5	2.2	2.4	1.7

Table no. 2.6

Material & Method

Fabric quality	M/C type	Dia/gg	M/C no.	Count	S.L.	G.S.M.	Width
32's slub plain SJ	SJ Tub	24/24	ST 02	32's	3.05	100	84 cm
Yarn lot no.	32' s slub Alok spinning 2LH100074				Design no.	spandex	Name of the operator
Sr. no.	Fixed values	minimum	maximum	Actual	AK13858	Nil	1
1	Yarn Tension	5	7	7			
2	CSP	1900	2400	2732			
3	Yarn elongation	2%	4%	4.7%			
4	Spandex tension	Nil					

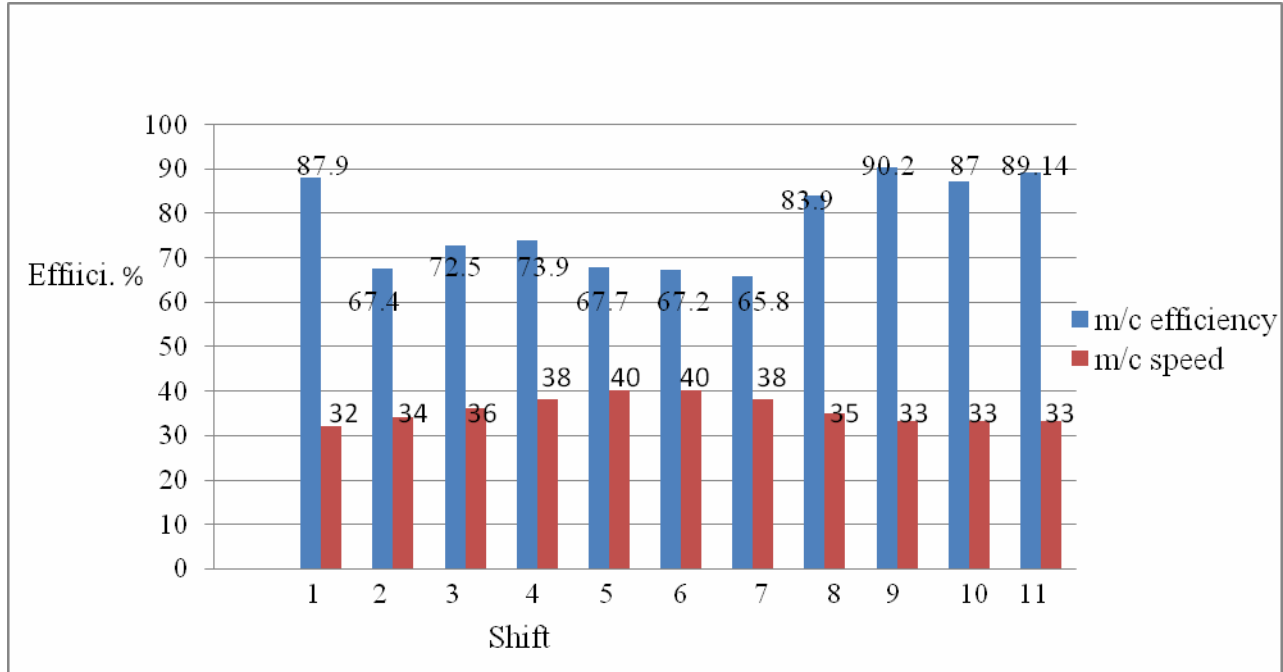
Result and discussion: 1. Yarn Breakages/shift



Graph no. 4

This graph shows where increased the machine rpm there is lower yarn breakages occurred but after increased rpm beyond a limit, higher breakages occurred and faults also occurred in the fabric, due to some points discussed with (graph no.1).

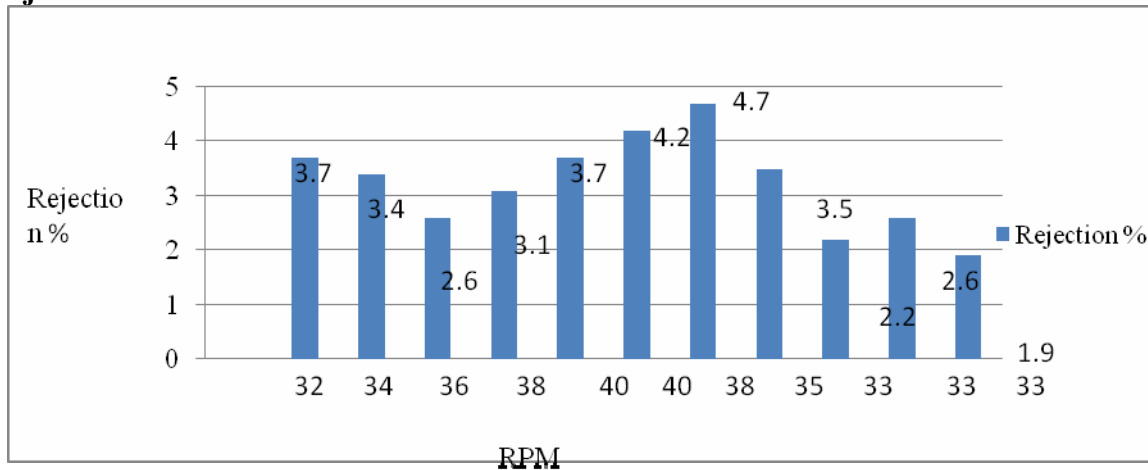
2. Machine Efficiency/Shift



Graph no 5

Here decreasing the machine efficiency from 87% to 67% as where increased the m/c speed up to 40rpm, after that when run the m/c at optimum level of m/c speed (33rpm) as per m/c condition their achieved the optimum efficiency (87-90)

3. Rejection % / Shift



Graph no. 2.3

Here also rejection % is increased due to more fabric faults occurred during running of machine at higher speed but when reduced the speed at certain level there is achieved the low rejection % with defective less fabric quality.

Following fabric faults observed during this trial.

Press- off

Causes:

- Material: Due to improper quality of yarn .
M/C : Improper knot catcher, yarn tension, rough yarn passages.
Operator: Not aware to identify the problems & either rectify or give feedback to technical.
Improper yarn content on coin or positive feeder .

Corrective Action:

- Find the quality problem & stop the yarn from the production.
- Set the m/ c properly & replace the defective spares.
- Attend the problem identify the cause & start the m/c.
- Yarn content on conic should be 15-20 rounds.

Preventive Action:

- Complaint to the supplier & make him aware of the same.
- To monitor during preventive maintenance & to keep enough spares.
- Train the operators.

Holes

Causes:

- Material: 1) Due to dyed yarn quality.
2) Due to poor quality of yarn like knots, hairiness, thick places, weak Spots etc.
M/c : 1) Defective needles, feeders etc.
2) Improper setting
Method: 1) Making bigger knots.
2) Improper cleaning, lack of work knowledge

Corrective Action :

Identify the defective cones, inform to customer.
Replace the feeder get new eyelet attend the passages.
Give proper work instruction to operator.

Preventive Action:

Raise complaint & educate the supplier, find out the right supplier.
To monitor during preventive maintenance & to keep enough spares.
Train the technician for m/c setting.
Train the operators.

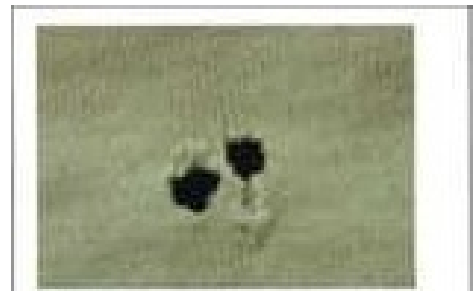


Fig no.2 Holes

Yarn Breakages

Causes:

Material : 1) Improper yarn quality

Operator: 1) Improper Cleaning Of M/C.
2) Improper knotting during cone change.

Method: 1) improper feeding of yarn.

Corrective Action:

- Identify the defective cone.
- Give the proper training to operator.
- Stop the m/c & proper feeding of yarn.

Conclusion

Here it is clearly visible that when run the machine at optimum speed such as (21rpm) in first trial according to machine type, machine condition , fabric structure , the efficiency and production both are increasing as compare to higher speed (22,23,24 rpm) and in second trial run the machine at(33 rpm) , here also efficiency and production both are increasing as compare to increased speed (34,35,36,38,40 rpm) .

So from this study conclude that if we run the machine at optimum speed according to type of machine , machine condition , fabric quality Which not only increase the efficiency it also helps in production of better fabric quality in an economical manner.

We should give the training to operator about the fabric faults, machine cleaning, and machine operating; attending the faults at minimum time by work practices we can achieve the optimum efficiency and production with better quality of fabric.