Shreyans Doubled Its Capacity by Modification And Installing Process Automation System in A Paper Machine

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ABSTRACT: Today the Paper Industry is faced with the problems of fast increasing competition, the paper production cost is getting higher and higher due to increase in input costs and the consumers are becoming more and more quality conscious. To keep pace with the change in scenario, its is essential to upgrade the quality of paper economically by adopting the latest technologies and modernising and upgrading the existing plant and machinery to meet the requirements of customers today and in coming years. With this end in view, Shreyans Papers embarked upon a plan to modernise its existing plant in a phased manner.

INTRODUCTION

Modernisation is not only the key to success, but it is also essential to survive in the competitive and quality conscious paper market. To achieve these objectives Shreyans Papers has installed process instruments to scan, measure and control process variables, viz: basis weight, moisture profile and ash percentage in paper continuously by latest Distributed Control System (DCS) as offered by Valmet Authomation, Canada.

Because of modifications and changes made in a phased manner Shreyans Papers has been able to boost its production from 30 TPD to 70 TPD and upgrade the quality of its paper by having uniform GSM, moisture content and maintaining constant ash content in paper.

DETAILS OF MODERNISATION

Shreyans Papers had gone into production in the year 1982 and upto 1984 average production of paper was 550 to 650 T per month as shown in Table-1. At that time the wire part consisted of:

(a) An open Head-box

(b) Table Rolls - 23 Nos.

(c) Flat Suction Box - 5 Nos. each having two vacuum zones

(d) Suction Couch

(e) Lump Breaker

Table-1.

Year-Wise Paper Machine Production

	MT	
May 1982 to April 1983	3523	
1983 (7 months)	3,871.95	
1984	8,363.30	
1985	9,908.40	
1986	11,171.00	
1987	11,567.80	
1988	12,741.10	
1989	12,806.60	*
1990	15,736.10	
1991	14,480.40	**
1992	20,298.00	
1993	21,808.10	
1994 (6 months)	12,036.00	

* I-Phase modification: Sprocket and chain drive system changed to Spur gear and pinion drive system (shut period one month : 15th July 1989 to 13th August, 1989)

** II Phase modification: To change Headbox, wire table, press section (shut period 55 days)

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The press part was having open draw and consisted of:

(a) First press was suction press

(b) Second press was solid press

(c) Third press was reverse press

DRYER SECTION

The dryer section consisted of:-

Pre dryers:	14	paper dryers of 1500 mm dia
	6	Felt dryers of 1000 mm dia
Post dryers:	6	paper dryers of 1500 mm dia
	2	Felt dryers of 1000 mm dia
Cooling cylinders:	2	of 1500 mm dia

Horizontal size press between pre and post dryers

Calender stack consisted of 3 rolls:

(a) King roll -	550	mm dia
(b) Intermediate roll -	300	mm dia
(c) Top roll -	450	mm dia
Paper reel drum of	1100	mm dia

The dryers were provided with chain and sproket drive arrangement.

MODIFICATIONS

In 1985, Reverse press was converted into Inverse straight through press. The following advantages were achieved by this conversion:-

(a) Paper feeding time was reduced as paper tail automatically fed to press nip.

(b) Paper feeding to third press became safe

(c) Dryness of paper coming out from third press increased by 2 to 3%.

Rope carrier system in the dryer section was introduced, which resulted saving in time while feeding the paper to dryer groups.

In July 1988, Dryer cotton felts were replaced by 100% synthetic Dryer screen and the following benefits were noticed:-

(a) Evaporation rate per square meter of drying surface was improved, which resulted in increased machine speed as shown in Table II, and considerable amount of steam was saved due to removal of felt drying cylinders.

(b) The paper drying across the deckle became more uniform, thereby cockling in the paper was reduced considerably.

(c) The steam consumption per ton of paper was reduced.

Table-2.

Year wise increase in the speed of paper machine due to modification and rectifications

Sr.No.	Year	Speed of Paper Machine Mtrs per min.
1.	1983-85	165-170
2.	1986-87	185-195
3.	1988 - June 1989	200
4.	Sept 1989 to March 1991	220-230
5.	July 1991 to June 1993	300-320
6.	July 1993	350
7.	June 1994	380
8.	By December 1994	420

In March 1987, all table rolls were replaced by (C.H. Johnson, U.K.) hydrofoils and low vacuum foil units, to have controlled drainage of water, which is very critical to have uniform distribution of fibres across the deckle and quantity of fines going with the back water was reduced. The following improvements in the quality of paper were observed:-

1. Improvement in two sidedness.
2. Improved paper formation
3. Improvement in basis weight and moisture profile across the sheet width.

Originally Paper Machine dryer groups were driven by chain drive. It was replaced by spur gear and pinion drive system to overcome the following problems:-

1. Very frequently there were mechanical breakdowns in chain drive system causing considerable production loss.
2. Due to slippage of chain on sprockets the draw control of paper in the dryers was poor resulting in paper breakages in the dryers and particularly in the post dryers.

After commissioning of Spur gear drive system on dryers Paper Machine speed could be increased to

220/230 meters per minute as shown in Table II.

Table-3.

Reduction in Steam, Water, Power and Chemical consumption per ton of finished paper after Installation of Process Automation

Detail	Before Process Automation (1990-91) Avg.	After Process Automation July 1994
Steam	6.611 ton	5.370 ton
Water	274 cubic mtr	150-160 cubic mtr
Power	1399 KWH	1045 KWH
Finishing loss	7.47%	6.0%
Rosin	0.86%	0.70%
Alum	5.3%	3.3%
Talcum powder	14.2%	20.0%

Table-4.

Moisture content at various stages in paper machine before and after process automation Quality of Paper : 60 GSM Creamwove

Sr. No.		Before Automation	After Automation
1.	Consistency of Headbox	0.8	0.728
2.	Back water S. Solids	0.325	0.236
3.	Consistency before 1st low vacuum	1.48	1.671
4.	Consistency before 2nd vacuum	8.3	6.9
5.	Consistency after 2nd vacuum	11.2	10.2
6.	Consistency after high vaccum	16.8	16.5
7.	Dryness after suction couch roll	18.1	17.8
8.	Dryness after Bi-nip press	36.9	38.5
9.	Dryness after III press	39.5	41.5
10.	Dryness at Pope reel	96.2	94-94.5

Table-5.

Finishing losses before and after process automation of paper machine

Before Automation		After Automation	
Month	% Loss	Month	% Loss
Apirl 1992	7.43	July 1993	6.50
May 1992	7.62	Aug. 1993	7,66
June 1992	9.07	Sept. 1993	6.54
July 1992	6.75	Oct. 1993	7.03
Aug 1992	6.25	Nov. 1993	5.57
Sept. 1992	7.18	Dec. 1993	6.05
Oct. 1992	6.92	Jan 1994	6.14
Nov. 1992	6.90	Feb. 1994	5.72
Dec. 1992	7.23	March 1994	5.58
Jan. 1993	8.23	April 1994	6.03
Feb. 1993	7.26	May 1994	5.51
March 1993	7.03	June 1994	6.01
April 1993	8.20		
May 1993	7.11		
June 1993	7.45		

In April 1990, old high Density Polyethylene Hydrofoils were replaced with C.H. Johnson's Angled Ceramic Hydrofoils and low vacuum duoflow unit, which helped to improve the wire life and changing of Hydrofoils on account of worn out angles was totally eliminated. It also improved drainage characteristics.

In 1991, again major modification of paper machine was undertaken as given below:-

1. Old open Headbox was replaced with pressurised Headbox on order to increase the speed of paper machine.
2. Old press section was removed and a modern Bi-Nip pickup press (with suction pickup) and straight through third press was installed.
3. The wire length was increased from 24.54 mtr to 31.3 mtr and forward drive roll was installed.
4. A group of five dryers were added in pre-dryer section and two dryers added in post dryer section in order to increase drying capacity of the machine with and without size press in operation.
5. Pope reel was modified by having horizontal secondary arm system (Voith design).

By doing the above modifications, the speed of paper machine was increased to 300 meters per minute.

The dryness of paper web coming out after straight third press improved to 40-41% due to heavy press loadings, viz. 1st nip 60 kg/cm, IInd nip 80 kg/cm, IIIrd nip 120 kg/cm. Therefore, the steam consumption per ton of paper was brought down to 2 tons. The paper breaks at the wet end were reduced. The efficiency of paper machine became more than 90%. The paper breaks and fluttering in the dryer section were reduced by providing Uniscreen in zero group of dryer section.

It becomes easy to handle paper rolls at pope reel and the quality of parent rolls improved, thereby the quality of reels also improved by modification of paper reel with secondary arm system.

In August 1992 one more low vacuum foil box unit and one high vacuum foil unit were introduced in the paper machine wire table to take out more water. This resulted in getting the sheet dryness of 16 to 18% after high vacuum foil box unit. With the introduction of Hivac unit, synthetic fabric is being used

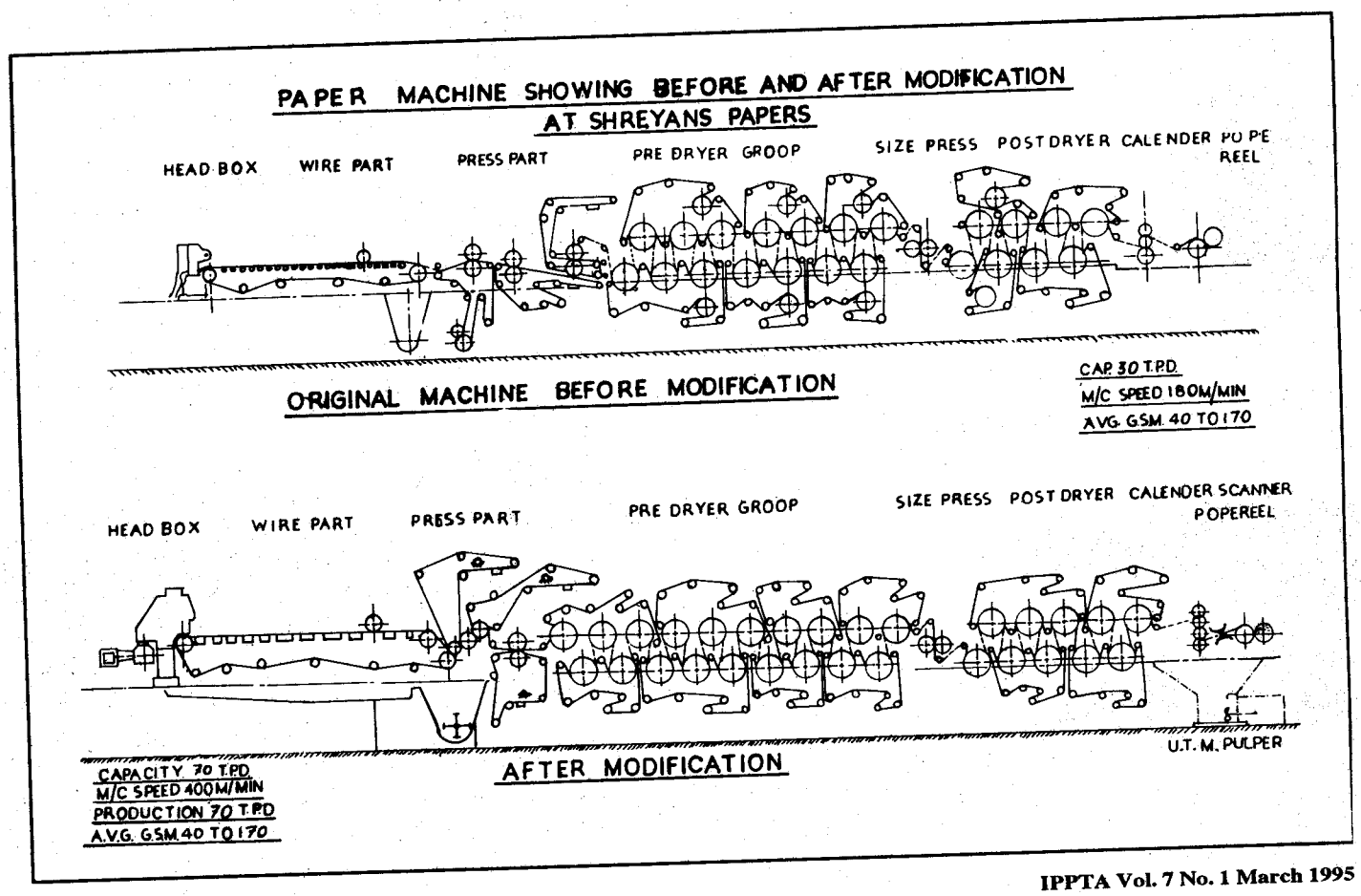
Table-6.

Downtime of paper machine due to breakdown of the failure of chain drive system

Sr. No.	Month/Year	Downtime due to machanical breakdown incl. failure of chain drive system	Downtime due to failure of chain drive system	Month/Year	Downtime due to mechanical breakdown after taking out chain drive system
		Hrs.Min.	Hrs.Min.		Hrs.Min.
1.	January 1988	42.30	21.30	January 1990	8.15
2.	February 1988	18.55	12.50	February 1990	10.05
3.	March 1988	32.55	16.30	March 1990	NA
4.	April 1988	17.15	--	April 1990	9.35
5.	May 1988	13.55	3.00	May 1990	18.55
6.	June 1988	43.55	16.20	June 1990	19.10
7.	July 1988	19.15	3.10	July 1990	14.05
8.	August 1988	9.30	6.30	August 1990	11.00
9.	September 1988	14.40	5.20	September 1990	17.00
10.	October 1988	13.10	3.25	October 1990	16.00
11.	November 1988	31.35	11.20	November 1990	19.25
12.	December 1988	16.20	8.00	December 1990	14.10

successfully on the paper machine in place of bronze wire. The paper machine before and after modification is shown in Figure 1.

In the beginning of 1993, a major decision was taken to instal Process Automation system on paper machine (Valmet QXD 9000 system) to accomplish



the primary objectives to upgrade the quality of paper to meet high quality paper demand in the future. The closed loop feed back control system is shown in Figure 2.

The automation system installed in July-1993 is

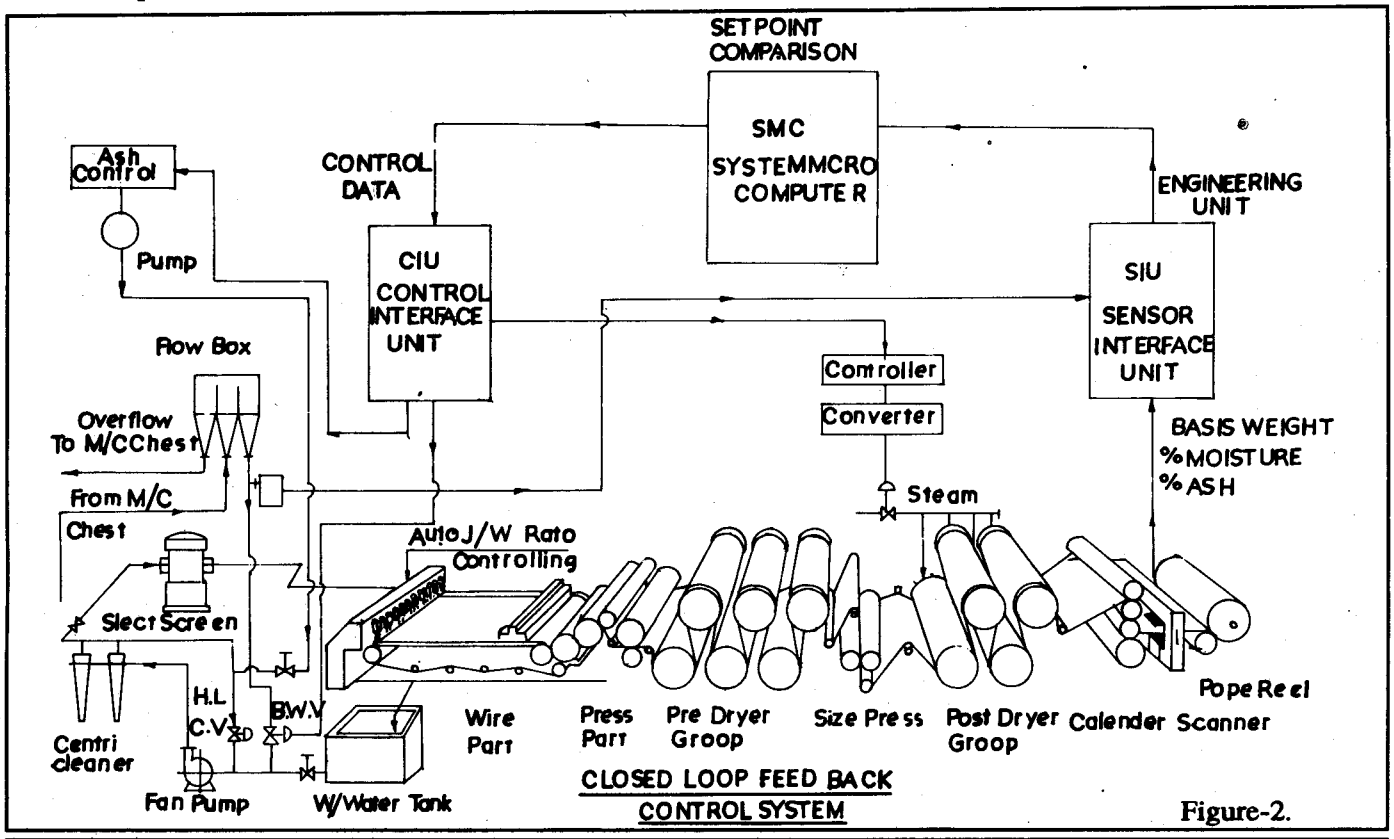
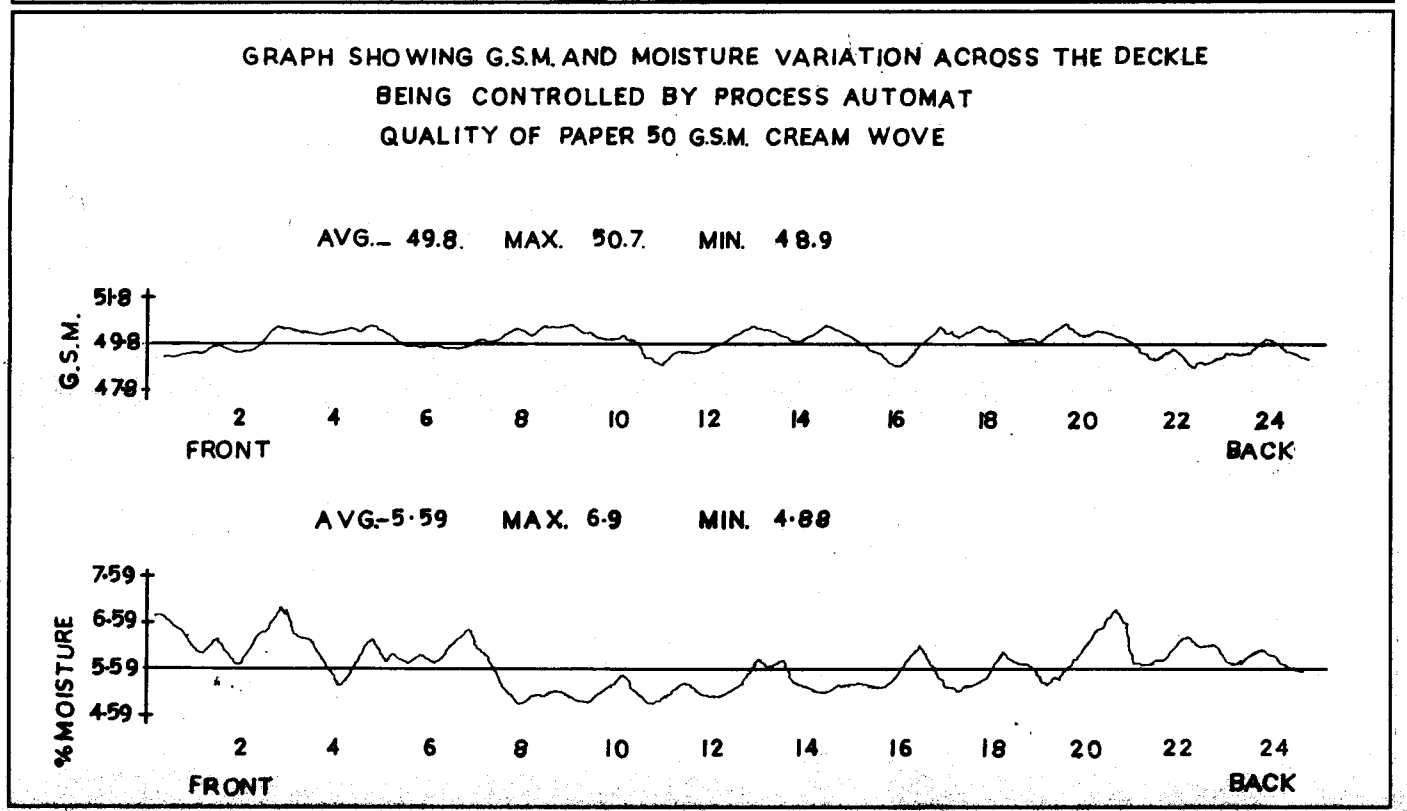


Figure-2.



performing the following jobs-

1. To measure and control the following at reel:
   (a) Basis weight
   (b) Moisture
   (c) Total ash
2. To access, view and print the following:
   (a) Quality control measurement profiles and trends;
   (b) Control strategy results (Basis weight, moisture, ash);
   (c) M I S reports, configuration, tuning and Diagnostics.

Following achievement have been made by installing the above Process Automation system.

1. The basis weight of the paper is being controlled within ± 2.5% as it can be observed in Graph No. 1 and average GSM variation of paper only within 1.0%. Hence the chai ces of making overweight or underweight paper became remote and neither the paper mill suffered loss by supplying overweight paper for which no extra money can be realised from the customers nor the customer gets chance to make any complaint of over or underweight paper supplied to them.

2. The moisture in the paper is kept within the controlled limits for better reel building and the printability. It can be seen from Graph I that the average moisture in the paper is well within the limits. It is well known that when there is limited capacity of drying on the paper machine, then keeping optimum moisture control in the paper at Pope Reel and reducing moisture content in paper web leaving the last press is very important in order to run the paper machine at higher speed. Thus the paper machine was speeded up by maintaining optimum moisture content in the paper at Pope Reel with the help of Process Automation.

As the basis weight of paper and moisture content in the paper is very precisely controlled and there is no need for frequent adjustment of steam and Basis weight value, this has helped to reduce breakage of the paper both at the wet end as well as at the dryers. This had resulted in improving the runnability of the paper machine. The graph showing the G.S.M. and moisture variation across the deckle is shown in Figure 3.

By having more co - ordination in control and process measurements, grade change time and start-up time have been considerably reduced. By controlling Basis weight, moisture content in the paper at Pope reel, the quality of parent roll is improved. Hence the quality of reels also gets improved.

From the printer logs the test results of basis weight and moisture content in the paper across the deckle and ash content in the paper are immediately and continuously available, therefore, the decision is taken effectively before the parent roll is converted either into the reels or sheets.

The diagram of Process Automation (Valmet QXD 9000 system) shows the various components of the system and the relationships between them. The readings of sheet quality regarding GSM, Moisture and Ash are taken by the System's sensors and are processed by the QXD-9000 Micro-computer. The system's Micro-computer compares these readings to the target values that have been entered as per requirement of quality of paper and makes any adjustments automatically in the process inputs. This unit also records the number and duration of paper breaks occuring at wet and dry ends to analyse the reason of the breaks and to take corrective steps. The sheet width of the paper under manufacturing is measured continuously and also the production is recorded. In very near future with modification in dryer gears, etc. efforts will be made to stabilise the paper machine to run at the speed of 425 meters per minute.

SUMMARY

Shreyans Papers intend to continue investing in new technology and methods for improving the quality of their product as well as to face competitive market. Constant efforts are being made to bring down the cost

of production by reducing water, power, steam consumption and better utilisation of Agro Cellulosic raw materials and to give top level of service to our increasingly conscious customers.

As some one has rightly quoted that the industry is beginning to wake up to the possibilities of customer-led production, the next step is to apply the right price to the right product.