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Industrialisation is an index of the growth and advancement of a country towards self-sufficiency. Economical production in an industry depends on the proper handling and care of production equipment and this could be ensured by having a scientific outlook towards the maintenance problems. Paper Industry is one wherein modern trend is towards the adoption of preventive maintenance.

In earlier times when Paper Mills were few and no sense of competition was felt, the maintenance production equipment used to be of little importance. With increased competition the time actually put into production as well as economy of production became factors of primary importance. It is obvious that the time taken for maintenance purposes ultimately reflects itself in the production cost of the items and every

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Maintenance in Paper Mills with Specific Reference to Seshasayee Paper and Boards Ltd.

Planned maintenance is productive maintenance. A well organised system of maintenance lowers the repair cost, reduces the number of breakdowns and increases the profitability of operation. The loss resulting from poor maintenance in Chemical Industry in India amounted to Rs. 2,000, crores in 1972-73. What is true of other chemical industries is true of paper mills too. A systematic maintenance programme will avoid confusion, waste of time and money. This article deals with the maintenance practice generally followed in Paper Mills with specific reference to maintenance work in Seshasayee Paper and Boards Ltd. It also mentions some of the problems faced by the Mill and solutions thereof.

shut down, however short it may be, reminds the managerial personnel of the necessity of reorganising maintenance in a more systematic and planned way.

Preventive maintenance is the technique which helps in minimising unforeseen breakdowns and helps in planning the maintenance of equipment in a systematic manner.

Preventive maintenance calls for taking an equipment for repair at planned intervals These intervals are decided mainly keeping in view the following factors :

- 1. Complexity of equipment
- 2. Load conditions
- 3. The position of equipment.

Item 1 plays a very important role in the maintenance and as such, it is of vital importance in deciding the duration of repair, the repair cycle, stock of spares, repair cost and man power planning.

Item 2 gives the idea of type of loading, continuous or intermittent.

Functions of maintenance department in an Indian Paper Mill can be broadly enumerated as below :

- 1. Installation of stand-bye machines for the critical equipment in continuously running sections and keeping them ready for service any time.
- 2. Strict vigilance on running

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maintenance.

- 3. Planned maintenance backed with scheduling.
- 4. Colour coding of pipe lines for identification. Inter connections in piping installations tò increase flexibility of operations.
- 5. Timely replacement of old and corroded pipelines and valves.
- 6. Systematic lubrication practice -with suitable colour coding for different lubricants.
- 7. Indigenisation of imported equipment wherever possible to avoid dependence on imports.
- 8. Standardisation of equipment to reduce inventory of spares.
- 9. Periodical check up of equipment for assessing their operating efficiencies.
- 10. Maintaining proper record for repairs-drawings etc.
- 11. Maintaining thermal insulations on steamlines, tanks and vessels wherever required for minimising heat losses.
- 12. Keeping down environmental pollution by good house keeping.
- 13. Maintaining tools, measuring instruments, lifting tackles in good conditions to comply with safety precautions.
- 14. Educating workmen in fundamental safety precautions.
- 15. Providing suitable guards for the equipment drives to prevent accidents.
- 16. To be judicious in controlling maintenance cost.

view, the equipment in a Paper Mill can be classified into two groups.

(1) Critical and (2) Non-critical. Critical equipments are those which come in the direct line of production, the stoppage of which affects production.

In the case of critical items, it is always advisable to instal standbye equipment. Wherever it is not possible to instal stand-bys, adequate spare parts should be maintained to keep the down time to the minimum in case of a breakdown or planned repair.

A few examples of critical item in Seshasayee Paper and Board are :

- 1. River intake well pumps and process water supply pumps.
- 2. Liquor circulation pumps for stationery digester.
- 3. Filtrate pumps for Brown Stock washers.
- 4. Stock pumps in bleach plant.
- machine.
- 6. Venturi circulation pump in Recovery furnace.
- 7. Condensate extraction pump in Turbogenerator.
- 8. Boiler feed water pump.
- 9. Fan pumps.
- 10. Centricleaner pumps.
- 11. Oil supply pumps for paper machine drive, turbine and drying cylinder bearings.
- 12. Vacuum pumps in paper machines.
- 13. Water booster pump.

- Keeping the above points in 14. Machine chest, blending chest agitators etc.
 - 15. Air compressors.

equipment are Non-critical those the stopping of which for a specified duration may not affect the production.

should be Critical equipment such inspected regularly. On inspections the following observations are to be made :

- 1. Operating conditions.
- 2. Lubrication system.
- 3. Unusual heat or temperature rise.
- 4. Vibration or noise.
- 5. Cleanliness of oil filters.
- 6. Tightness of bolts and nuts.
- 7. Leakages if any.
- 8. Cooling system.
- 9. Tension and wear of belts/ chains etc.
- 10. Working of limits switches,
- 5. Pulp supply pump to paper 11. Functioning of brakes/clutches.
 - 12. Condition of guards, fencings etc.
 - 13. General cleanliness.

Planned preventive maintenance can be very well applied to equipment in Pulp Mill, Soda Recovery section and to a certain extent to Power House and Paper Machines. An example of the preventive maintenance schedule for Chipping Section at Seshasayee Paper and Boards Limited is shown below :

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Maintenance Schedule-Chipping Section

1) Chippers

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Ser. No.	Details of Checkup	Type of maintenance	Bamboo chipper	Spiral chipper	KMW chipper	REMARKS
1. 1	Disc change		1 1 Y	11 Y	1 Y	
2. 0	Bear coupling		tonnes) $1\frac{1}{2}$ Y	tonnes)		
3. A 4. K	Anvil Base Enife pads		Ŷ	·		Reconditioned one
5. K 6. F	Luife holding plates eed Rolls 4.5.6&7	CHANGE	Q IN D		4 M	Dee 1:4:- 1
7. F	ced Rolls1,2,3,8,9,&1	0	Q	_		Reconditioned one
9. S	ide plates		4 D 2 M			
10. C	nife holding studs		HY Q	_	-	
12. W	Vear plates earings	Checkup	-	FN M	2M	

2) Connected Equipments

Ser.	Details of	Туре	OS	VS	RC	В	DF	RS	TS	KS
No.	checkup	of Maint								
1.	Bearings	Check	Y	М	M	М	М	ну	ну	0
2.	Tension of wire ropes	Check	Y	Μ			· .	•		×
3.	Rope clamps	Check	HY			,				
4. 3	Bearing Housings	Change		2Y						
5.	Springs	Check	•	Y						
6.	Wire ropes	Check		Y		•				
7. :	Screen plates	Check/	B.Hy.	B.HY						•
		Change	T.Y	T.Y						
8. 9	Shredden bars	Change			Y				·	
9.	Hammers	Side change			4M [·]					- ·
10 4	Anvil	Repair			Y		-			
11.]	Rotar assembly	Change				Y	Y	YC	YCh.	
12.	Drive belt	Check	D	D a a	D	D	D	D	- 011	

YC-Checkup yearly; YCh. Yearly change; B-Bottom Mesh T-Top Mesh.

Abbreviations: OS-Oscillating screen; VS-Vibrating screen; RC-Rechipper; B-Blowers; DF-Dust fan; RS-Rotary screen; TS-Trimbely screen; KS-Knottle screen; Y-Yearly; HY-Half yearly, Q-Quarterly; M-Monthly; FN-Fortnightly; W-Weekly; D-Daily.

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Paper Machine Maintenance

The method of maintenance in the Paper Machine department is quite different with that of other departments as most equipment fall in one line and run in series. Therefore, it is necessary for the maintenance crew to keep strict vigil and daily inspection of every vital point to maintain uninterrupted production. Running maintenance is very necessary in Paper Machine departments. A great number of failures can be avoided, if an effective lubrication with correct lubricant is done. An external inspection of bearings and stuffing boxes will help to avoid many breakdowns. As all Paper Machine equipment operate on 24 hour basis, sometimes extending even for seven to fourteen days of uinterrupted production, it is necessary for the maintenance department to keep pace with this, by attending to accumulated jobs during the planned stoppages such as wire change felt change, order change, system, washing etc. Minor jobs accumulated from time to time are listed out and sufficient supervisory and labour strength required for the job are planned much ahead of the programmed shut downs. A full utilisation of such shutdown is ensured by the maintenance crew.

Major overhauls, modifications, renewal of old pipelines, equipment change as part of standardisation, rectification of foundations, change of slide rails for

Vee belt drives, replacement of 10. Change of doctor valves on critical lines, repair or replacement of suction pipes 11. Check up of alignment of of critical pumps or any new installation are generally taken up during long stoppages like annual shutdowns. Wire changes are usually foreseen and scheduled one day ahead. The list of 13. Change of calender rolls or jobs attended to is normally done by plant engineers. Men are brought in from the other shifts or from other departments in order to get the planned work completed during the specified time. The normal jobs that are 15. Check up of vickery shoes, attended to during wire change at our mills are:

- 1. Change of rotor assemblies of any stock pump
- 2. Gland packings of leaky stuffing boxes.
- 3. Rectification of any leakages in steamlines
- 4. Replacement of rotary joints/ check of condensate system
- 5. Cleaning of manifold pipes and selectifier screens, check gear boxes of holey rolls.
- 6. Easing up screw rods on wire 20. Repairs to centricleaners if return rolls to facilitate adjustment of wire when it runs to sides
- 7. Cleaning and check up of sectional drives and clutches
- 8. Vee belt tensioning of vacuum pumps on couch, suction press, vickery and flat boxes.
- 9. Check up of flat boxes and if necessary it is levelled and ground.

- blades wherever required.
- rope carrier pulleys and securing them firmly.
- 12. Change of any gear couplings in the machine drive system.
- check up or replacement of doctor blades for calender rolls.

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- 14. Check up of calender jack devices
 - cleaning, replacement if necessary.
- 16. Cleaning of shower pipes and check up of squirt nozzles.
- 17. Check up of hydrapulper and repairs to the screen plates if necessary.
- 18. Cleaning and easing belt shifting guide rolls.
- 19. Visual inspection of cone pulleys drives and check up of the belt joints, if necessary a spare belt is prepared and inserted for emergency.
 - any or replacement of component parts.
- 21. Easing of felt tensioning devices.
- 22. Check up of internals of machine chest/blending chest agitators.
- 23. General lubrication of dryer open gear system and all other equipment of the machine.

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- 24. During stoppage of the paper machine for wire change, the switches, starters, and motors of all critical equipment are checked for loose connections and paper contacts. In normal course of running of the machine if any defects of the motor bearings soldering etc. are observed they are checked and set right. Once in a month during paper machine wire change shut, a shut of the Turbogenerator is taken and routine preventive maintenance like checking of commutators bushes, are done.
- 25. Machine drive turbine oil filter is cleaned, turbine and gear lubrication, governor system and tripping devices are checked to ensure trouble-free running till the next wire change.
- 26. On the instrumentation side, the auto guides are checked for their effective operation. Air cylinders for the press sections are checked for any air leaks and if any leak is observed, the air cylinder is changed.

Solutions to certain problems faced by Seshasayee Paper and Boards Limited in keeping the production unhindered are described below and it is felt that our experience may be of use to other mills.

(a) Chlorine lines

Maintenance of chlorine lines posed a difficult problem as even stainless steel lines were getting

corroded very fast resulting in severe problem in the bleach plant. After series of trials, this problem was overcome by using extra thick walled seamless Mild Steel pipes. After we have started using 8 mm seamless pipes for this purpose, the breakdown on the chlorine line has been virtually avoided. All short bends in the chlorine lines were replaced by long bends with the same thick walled seamless pipes.

(b) Chlorine washer

Ever since the commissioning of the mill in 1962, the bleach plant was running with a chlorine washer supplied by M/s Dorr-Oliver, USA. Early in 1974 this washer developed a leak in the filtrate area. The drum of this washer was of mild steel construction rubberlined from outside and inside. The rubberlining got damaged at certain places and acidic water got into the mild steel drum virtually corroding the whole drum. This critical equipment in the direct line of production could not be bypassed for a long period. When the suppliers were contacted, they advised that the equipment has served its normal life and has to be replaced by a new one which takes normally 10 to 12 months for delivery at a cost of Rs. 9 lakhs. A firm dealing in FRP lining was contacted and it was decided to make an experiment by giving FRP lining to both inside and outside the The FRP lining was drum. completed in about 3 weeks time

at a cost of Rs. 2000/- and the washer is running trouble-free for the last one year and it is felt that the washer can run for easily another two years. In the meantime the Mill has ordered a washer with M/s Dorr-Oliver and has already procured it and kept as stand-by.

(c) Digester Blow Lines

The bends in the digester blow lines were getting eroded very fast and had to be patched up frequently. This was overcome by incorporating Impact boxes in all bends, forming a hard mass providing cushion effect for the blowing pulp stock. By this method, the erosion in these bends has reduced considerably. This type of impact boxes are now being tried in our chip blow lines also.

(d) Vaccum Pump in the Board Machine

The vacuum pump in the board machine section of our mill runs for about 10 days in a month when duplex board is made on M.G. Machine. This is a 200 series SLM Maneklal vaccum pump. During one of the inspections of the vacuum pump, it was observed that bronze impeller blades have been completely damaged possibly due to water hammering. The spare impeller ordered with SLM Maneklal 6 mononly was due To keep the later. ths machine going, it was decided to repair the rotor by turning the impeller blades to its root and brazing a set of new blades in the place of the old blades. This

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vacuum pump with the improvised rotor is running for a year now.

(e) I.D. Fan drive turbine nozzles

The I.D. Fan in the recovery boiler at Seshasayee Paper and Boards is driven by a 413 hp steam turbine supplied by Messrs KKK, West Germiny. After about 10 month's of start of the plant in 1969, one steam nozzle out of the 3 mounted on the casing of the turbine, got broken at the throat. The same was welded and tried. But this worked for a week and we found the other two nozzles were also broken. As no spare nozzles were available, we made few nozzles at our workshop out of 304 stainless steel. All the stainless steel nozzles did not last more than a month. We airlifted few nozzles and even these did not last more

than two weeks. We decided to increase the wall thickness of the nozzles and made 3 nozzles with 5 mm thickness. These nozzles are running for the last 3 years without any trouble.

A conscientious and well organised inspection and proper maintenance of record is the most effective weapon against unforeseen breakdowns. It may not be possible to eliminate the breakdowns completely. But by scientific methods of working it can be kept to minimum.

At Seshasayee Paper and Boards Limited we follow strictly a system of reporting about breakdowns. These are known as "failure reports" and are submitted to the top management, the very next day of a failure on an

equipment. This report includes the cause of breakdown, how it was rectified, steps taken to avoid such occurrence in future. Invariably such reports will pinpoint the mistakes or lapses of the concerned maintenance or operating personnel. Apart from this, norms are fixed for down time due to mechanical trouble, electrical trouble and process troubles. By strictly trying to keep norms fixed and by analysing breakdowns to avoid them in future by maintenance of proper records and good housekeeping, it has been possible for the mill to keep the downtime to the minimum and we strictly follow the old dictum "A stitch in time, saves nine."

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