

Efforts Taken at EPML for Better Maintenance Practices

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ABSTRACT

Today paper industries are passing through a tough time. So effective efforts are needed from key departments for sustainability. Effective preventive & proactive maintenance is necessary to increase productivity in terms of quality and quantity & plant availability.

This paper envisages that how an effective maintenance practice can improve productivity, reduce power consumption, reduce breakdowns and increase machine efficiency.

Introduction

The total productivity and efficiency of the plant operation depend upon the machine availability time for operation or in other words maximum machine running time with minimum breakdowns. This becomes more relevant while operating a second hand machine & with the requirements of higher production for better sustainability. For this, it is essential to follow best maintenance practice with more stress on preventive & predictive maintenance. There must be proper interactions between the operating departments & maintenance department for adopting the most effective approach for avoiding the breakdowns & making the machine available for maximum operating hours. The best managed maintenance department will have to follow the following working principles.

1. Fix the target & follow up-if in some occasion the down time exceeds the target; it should be made up in the subsequent period.
2. Maintenance methodology & practice
3. Spare parts management
4. Critical checks & recording during any available shut (May be for process or any other reason)
5. To improve the awareness of the people in the area of Best Practices in maintenance.
6. To build a positively challenging relationship across the maintenance departments
7. Create a learning opportunity for the development and education of maintenance people.
8. To create an atmosphere where people will readily share experiences and information.
9. Use modern systems for health check of machines & equipment.

Experimental and case studies on Improvements done in Emami Paper Mills Ltd.:

PM#1:

Writing & Printing machine with 100% recycle fiber, Line shaft open gear drive, Open draw. Present production 50 MT/day at 54 Anchor GSM, Deckle 2.1 meters, Speed 320 MPM

1. There used to be frequent breakdown of Dryer felt rolls due to journal shearing after changing from dryer felt to screen & speeding up the machine. The journal size of 45mm was replaced with 50 mm for all felt rolls to avoid this breakdown.

PM1 Clutch and Gear



BEFORE

BEVEL



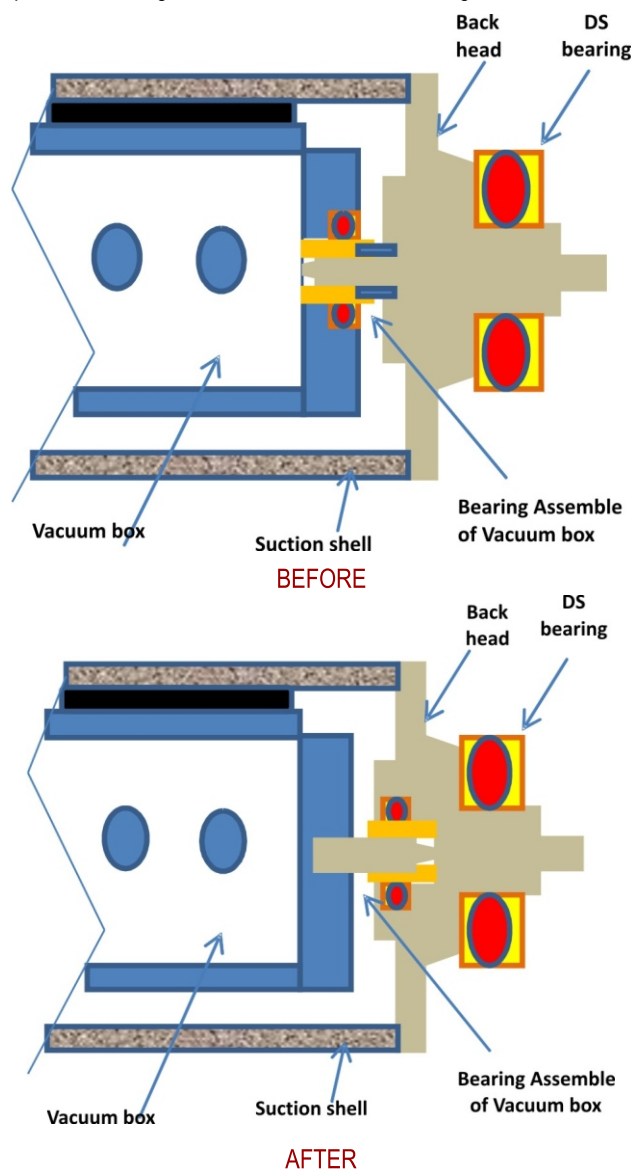
AFTER

- Failure of Drive gearbox and Pneumatic clutch of Line shaft drive arrangement is another reason for mechanical downtime of machine. After replacing the Gearbox gears from Bevel to Helical gear and redesign of pneumatic clutch installation these breakdowns almost eliminated.
- Paper breaks at couch lead roll was reduced by redesigning the couch draw roll system. Previously the couch lead roll was 110 mm diameter without drive. For high RPM and low diameter and without drive paper breaks was occurred and incurred downtime daily about half an hour to one hour. This downtime was saved by increasing the lead roll diameter and VFD drive arrangement.

PM#2:

Newsprint machine with 100% recycle fiber, Line shaft open/closed gear drive, closed draw. Present production 95 MT/day at 45 Anchor GSM, Deckle 2.85 meters, Speed 515 MPM

Paper Machine No.2 productivity increased by increasing machine speed & reducing downtime. Some case studies given below:



• Case Study-1:

The main downtime occurred in suction couch and suction pick up roll. Both the rolls were designed for 400 mpm and primitive type, where internal bearing are located in vacuum box and stud was on drive head. Number of pins fitted at drive end for locking. Downtime occurred due to shear of those pins. With in-house design, the box bearing installed at drive head and the stud fitted with vacuum box, pins removed. All those jobs carried out in our work shop. Since then there is no breakdown for suction rolls.

• Case Study-2:

In line shaft drive, the pneumatic clutch and nylon gear failures has been observed frequently. It was investigated that the Clutch failed due to sudden drop in clutch pressure and instant run while machine at full speed. To overcome such failures, clutch pressure was kept higher than the normal pressure as specified by clutch manufacturer. Clutch pressure monitored continuously and an individual air receiver tank installed nearer to clutch to stop sudden drop in air pressure. Gears are kept clean with oil regularly which ultimately reduces the gear failure.

YEAR	NO. OF TIMES CLUTCH FAILURE	NO. OF TIME GEAR FAILURE
2008	3	3
2009	1	4
2010	1	3
2011	2	2
2012	0	0
2013	1	1

The reduction of above downtime built up the confidence in PM#2 team which ultimately help to speed of the machine from 470 mpm to 515 mpm by little modification in the machine in wire part and press part.

- Wire table dewatering element added.
- Press roll diameter increased
- Maxi flex doctoring system at center press roll installed
- New hydraulic system installed for Press and calender
- Higher dia wire return roll and new doctoring system fixed

Year	Target downtime, Hrs.	Actual Downtime, Hrs	Speed, MPM	Production, MT
2008-09	398.48	494.00	470.1	28476
2011-12	374.4	361.2	494	30695
2012-13	454.32	418.57	505	30986
2013-14	488.89	456.91	506	30896

(In 2013-14 machine was run slow for 168 hrs for drive problem)

In 2008, production of PM#2 was 28476 MT/Annum. After reducing the downtime and speed up the machine, machine production increased to 30986 MT/Annum.

• **Case Study-3:**

During annual shutdown, head box HDPE diffuser block was broken for which machine could not run at desired speed and paper rejection increased. With In house design, the diffuser block manufactured & installed successfully .Since then machine is running satisfactorily with desired speed for 10 months till the SS diffuser are procured.

DIP#1:

At the beginning of the plant set up the power consumption found too much even 525 KW/ton paper. The equipment suppliers are called and their solution not fulfills the purpose. After in-house research area wise observed that the most power consuming area is cleaning and screening section. A comparative chart is prepared to compare between horizontal screen and vertical screen as follows:

PARTICULARS	Horizontal slot screen	Vertical slot screen	Horizontal hole screen	Vertical hole screen
Slot/Hole size	0.15 mm slot	0.15 mm slot	dia 1.8/2.2	dia 1.4 mm
Basket size	Ø740 x 600	Ø495 x 500	Ø500 x 430	Ø495 x 495
% of Open area	4.2	5.7	9	12.7
Rotating element weight Kg	580	270	275	270
Rotor dia	733	490	496	490
Rotor rpm	571	440	763	715
Tip velocity m/sec	22	11	20	18
Inlet Consistency (%)	1.6-1.8%	0.8-2.0%	2.5-2.6%	3-3.5%
BKW	75	15	39	31
Motor KW	90	18.5	45	37
Motor rpm	1500	1455	1500	1450
Motor FLC	157	35	81	66
Motor RLC	128	25	74	55
Running KW	77	15	44	33

After changing the Horizontal screen by vertical screen power consumption has reduced to 360 KW/ Ton of paper from 525 KW/ Ton of paper.

DIP#3:

Reduction of Screw press vibration in News Print Deinking Plant:

Screw Press vibration observed on higher side because of polished surface in high pressure zone of the Screw press shaft. By that we could not get desired output consistency, screw press runs with lower torque. Vibration reduces temporarily after grinding the same surface .With that experience we have fixed body plates in the high pressure zone which eliminate vibration. After that we are able to get the desired output consistency from screw press & increase productivity.

Reject Plastics Handling in Newsprint Deinking Plant:

Plastic handling is one of the most vital issues in Recycling paper mills. Previously ~60 people were engaged to dewater & bale the

plastic rejects coming from Pulping system in Deinking Plant. Plastics coming from the drum screen of Pulping system were shifted to another place & baled in an in-house bale press. With the in-house on line conveying system & local bale press with high hydraulic pressure we could manage to handle the total plastics by 12 people. The average moisture in the baled plastic bundle came down to 20 % from 50-60 % & the transportation to Cement factory has become easy.

PM#3:

Newsprint machine with 100% recycle fiber, Present production 250 MT/day at 45 Anchor GSM, Deckle 3.55 meters Speed 1120 MPM

There were heavy vibrations in the forming section. FE analysis study was conducted with the help of IIT, Kharagpur & the position of the bow roll in top wire circuit was accordingly changed. Now the vibration level is in the acceptable limit.

On-line condition monitoring system:

On-line condition monitoring system installed at Emami PM # 3 is first of its kind in paper industry in India to monitor the health of rotating equipment/machinery round the clock and give alarm in advance to avoid break down. This on line system is very effective specially to monitor inaccessible bearings in Paper Machine, avoiding unplanned stoppage, safety of machine and man,

The parameters that are monitored are

• **Shock Pulse Measurement:**

It is unique technique which helps us to understand the mechanical & the lubrication condition of rolling equipment bearings.

• **Vibration Monitoring:**

Vibration signature from online condition monitoring system helps us to understand the machine

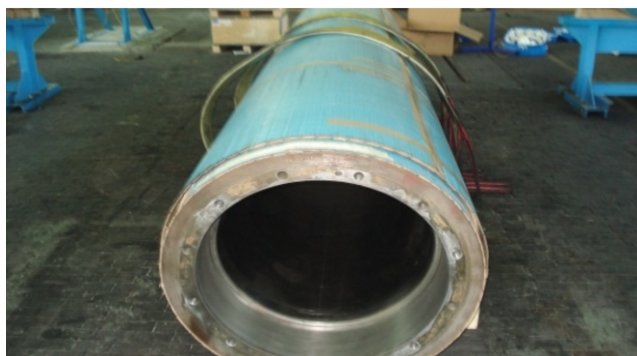
condition like unbalance, misalignment, looseness, levelling of the rolls etc.

Reduce breakdown on account bearing failure by condition monitoring on line and off line:

Online and offline bearing conditions are monitored regularly in all sections of the mill. The failure of bearing reduces by 20% since last 5 years. Consumption reduces drastically. Total consumption of bearing cost reduces to half which in directly reduces downtime on account of bearing failure .Our highest speed machine is equipped with complete online condition monitoring system. Other than the same area, condition monitoring is followed offline in other areas. We also checked and corrected the roll dynamic balancing at our site.

In house overhauling of swimming & nipcoroll reduces foreign experts cost:

Previously the Swimming roll and Nipcoroll servicing was carried out by sending the rolls to Europe. We have developed in house facilities for overhauling & maintenance of same.



In-house Maintenance of Material handling equipment:

The central material handling equipment such as forklift, Hydra and Pay loader maintenance are carried out with our own team without annual maintenance contract with original equipment manufacturer which saves Rs. 2.5 lacs /year. The container loading arrangement was made in house for vertical loading of reels in container.

Conclusion:

1. Frequent breakdown of Dryer felt rolls on PM#1 was eliminated by changing the journal size from 45mm to 50 mm for all felt rolls.
2. By increasing the lead roll diameter & with VFD arrangement Paper breaks at couch roll in PM#1 reduced.
3. PM#2 machine speed increased from 470 mpm to 515 mpm by in house modifications in suction couch & suction pickup roll, adding wire table dewatering element & installing maxi flex doctoring system at centre press roll resulting increase in Production by 2000 MT/Annum.
4. Reduce power consumption at Deinking plant#1 by 165 KW/ton of finish paper after changing Horizontal screen by vertical screen in both Hole & fine screening stage.
5. In-house plastic handling system reduces the manpower & nuisance in the Plant.
6. In house overhauling of swimming & nipco roll Eliminated supervision and experts cost Rs. 10 lacs/annum.
7. The deinking plant poire is being rebuild at our workshop which saves around 2.5 Lac/year

Acknowledgement

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Reference:

1. Chowdhury Bikramjit, Reddy S V - The demand for installing on line bearing condition monitoring system on high speed paper machine IPPTA Jan March'2009
2. Internal Plant Reports