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## Revolving & Resolving The Technology around you

— ALL ARE IN CIRCULAR LOOP AS JUST LIKE BEARING

### Abstract :

“Everything around you is not stagnant, all are moving with its speed and accurate displacement. With that lots of changes have been seen in our day to day life.

Paper & Pulp Industry is one of the dominating and most priority industries having bearing as one of the socio – economic development of the country. In INDIA this section plays an important and vital role in the development of the nation. With this it also provides a necessary medium to propel and increase our knowledge based economy forward in the millennium.

The most common phrases that are common to this industry is “GREEN CHEMISTRY.”

Green chemistry is the word which is very much important and common for the paper & pulp industry.

Today paper and pulp is called as the most polluting industries as identified and categorized by Central Pollution Control Board (CPCB). It consumes a lot of water and chemicals & produces a large amount of effluent.

Due to which the industry is in the beginning stages of major transformations with the key major players investing in upgraded facilities and capturing the market share. Though there are some challenges and barriers while entering to the zone , but that can be overcome and uplifted by investing in the right state and acquiring the right assets which are very much important in are daily practices.

- 1) Sealed Bearings.
- 2) Proper Technical Support.
- 3) Interchangeability Design.
- 4) Conditioning Monitoring Equipment's.
- 5) Reduction of the Bearing Failure.

The most common problem is the failures of the equipment which are a large damage of time which can be refurbished by anyone. So we Indians Promote Indian products, having a huge number of bearing segments and manufacturing the largest sizes of the bearings in India.

We are able to give solutions rather not only in the bearing segment but we can provide solutions related to it.

### Introduction:

Now a days, attempts are being made not only to quantify the greenness of the chemical process but also to factor in other variables, such as, chemical yield, cost of reaction components, safety in handling chemicals, hardware demands, energy profile and ease of product workup and purification. Green chemistry thus combines important elements of environmental improvement, economic performance, and social responsibility to address environmental problems as well as industry competitiveness. Green chemistry developments are likely to have an impact on the global trade of chemical industry in future.

During the interaction with pulp and paper industry, the important issues emerged are: (i) Conventional

technologies used in manufacturing are highly intensive in consumptions of raw material, chemicals, energy and water, thereby, generating higher effluent loads, (ii) Uneconomic scale of operation, (iii) Average capacity of mills being small, their ability to introduce new technologies and automation, to improve the product quality and reduce the effluents, gets limited, (iv) High water consumption per tonne of product, (v) Colour and relatively high Chemical Oxygen Demand (COD) of the effluent, (vi) High energy input per tonne of product, (vii) Odour reduction on the premises, (viii) Solid waste management, and (ix) Absorbable Organic Halide (AOX) management. In order to understand these issues in detail, vis-à-vis the practices across the industry, as well as to identify the R&D opportunities, it was decided to undertake a scoping study of the sector.

### 1.0 Indian Paper Industry

Status of the Indian Paper Industry  
Number of mills 747

Installed capacity, Mt 12.7

Capacity utilization, % ~ 95

Production of Paper, Paperboard and  
Newsprint, Mtpa 10.7

Per capita Consumption (kg) 9.5

Annual Turnover,  
Rs. Crores 25 - 30,000

Contribution to Exchequer,  
Rs. Crores 2500 - 3000

Employment Direct, million  
people 0.30

Indirect Employment, million people 1

Indian Share in World's Production, % 3

### 2.0 Technology Intervention to achieve the Projected Growth Rate

There is an urgent need for the adoption of cutting edge technologies to achieve the projected growth rate, energy efficiency and quality improvement in

the Indian Pulp & Paper Industry. The industry requires investment in technology in different unit operations leading to capacity expansion in a planned manner. Technological interventions are required in this perspective in the following areas. – Raw material processing and handling.

– Manufacturing process : Pulping

Pulp washing

Bleaching

Paper machine

Chemical recovery

– Environmental Management.

### 3.0 Technology Intervention to Address the Environmental Issues

There is an urgent need for the adoption of cutting edge technologies and innovative R&D to address the following environmental issues being faced by the Indian Pulp & Paper Industry.

- High effluent load
- Colour removal
- Black liquor management (agro based kraft mills)
- Solid waste management
- Air pollution control

### 4.0 Have you checked the ARB pulp and paper practices?

- a) The feeler gauge usage and the clearance that has to be there before and after mounting.
- b) The clearance you have got is it fine enough – Is it C4 or C3.
- c) Interference fits Bearings with tapered bores are always mounted with an interference fit (i.e. a tight fit) on their seat. The correct interference fit is obtained by driving the bearing axially up its tapered seat. The first question is what is the correct interference fit? Well, an insufficient interference fit will lead to fretting corrosion († fig. 1) which is due to micro displacement between two surfaces and/or creeping which is due to ring deformation under high load. With time, the inner ring works loose and can rotate on its

seat leading to heavy wear and smearing. In general, we can say that the higher the load

- d) on the bearing, the tighter the fit that will be needed. However, too high an interference fit will create high stresses in the inner ring which, when combined with the stress due to load, can reduce fatigue life. It may also cause ring fracture with some steel qualities and certain heat treatment methods especially if there is raceway surface damage.

*Fig. 1. Inner ring of a spherical roller bearing showing fretting corrosion in the bore because of an insufficiently tight fit.*



Certain applications in pulp or paper mills need more precise recommendations. Examples include modern press roll bearings and felt rolls where tension has been increased due to increased speed or the conversion to a felt-driven drive system.

So looking forward towards the load and the speed the tolerances and the clearances are raised from C3 to C4.

#### EXAMPLE

23040 CK/W33, the 23040 CK/C3W33 and/or the 23040 CK/C4W33 will be mounted with the same clearance reduction range (0,090 to 0,130 mm), except if the operating conditions (or lack of knowledge about operating conditions) oblige us to select above minimum permissible clearance.

Minimum permissible clearance, : 23040 CK/W33 (normal clearance class) 0,070 mm

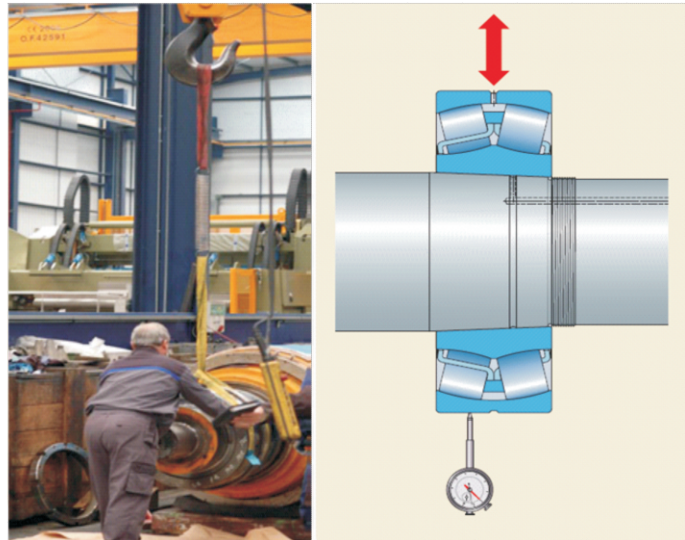
23040 CK/C3W33 (C3 class) 0,100 mm

23040 CK/C4W33 (C4 class) 0,160 mm

Note that we don't really care about the minimum value for the C3 or C4 class.

Let's continue with the 23040 CK/W33 example to show how the minimum permissible clearance can influence the clearance reduction.

If the bearing has a true clearance of 0,210 mm, the radial residual clearance after drive up should be between:  $0,210 - 0,130 = 0,080$  mm and  $0,210 - 0,090 = 0,120$  mm



#### Example with a 22320 KMB :

the radial clearance is 22320 KMB/C1 0,035 to 0,055 mm

22320 KMB/C2 0,055 to 0,080 mm

22320 KMB 0,080 to 0,110 mm (suffix CN is omitted)

22320 KMB/C3 0,110 to 0,140 mm

22320 KMB/C4 0,140 to 0,180 mm

22320 KMB/C5 0,180 to 0,230 mm

In addition, letters can be added to the clearance class for reduced or displaced tolerances.

C3L means the lower half of C3

C3H means the upper half of C3

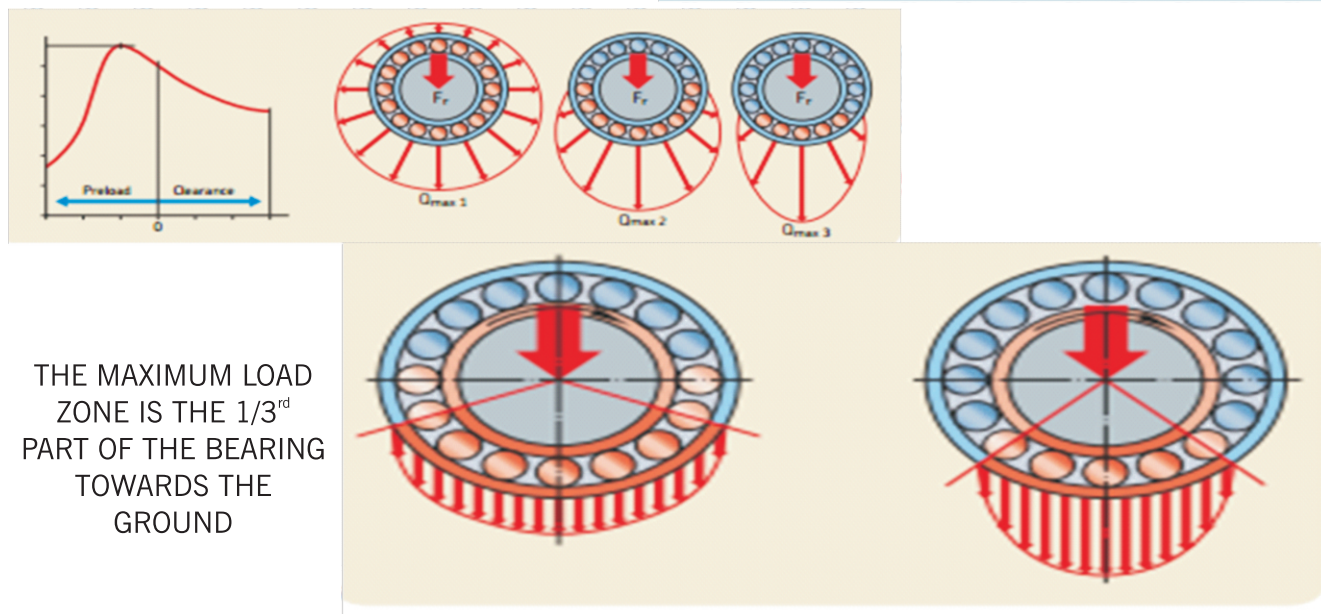
C3P means the upper half of C3 with the lower half of C4

C3M means the upper half of C3L with the lower half of C3H.



CHART SHOWS THE RESIDUAL AND TRUE CLEARANCE THAT HAS TO BE CHECKED BEFORE AND AFTER MOUNTING OF THE BEARINGS.

Bore diameter d		Reduction of radial thermal clearance		Axial drive-up <sup>1)</sup>				Residual <sup>2)</sup> radial clearance after mounting bearings with initial clearance		Lock nut tightening angle	
in mm	in in.	min	max	min	max	min	max	Normal	CA	CA	°
											degrees
24	30	0.015	0.020	0.3	0.35	—	—	0.015	0.020	0.030	110
30	40	0.020	0.025	0.35	0.4	—	—	0.015	0.025	0.040	120
40	50	0.025	0.030	0.4	0.45	—	—	0.020	0.030	0.050	130
50	65	0.030	0.040	0.45	0.6	3	4	0.025	0.035	0.050	110
65	80	0.040	0.050	0.6	0.7	3.2	4.2	0.035	0.040	0.070	130
80	100	0.045	0.060	0.7	0.9	3	4	0.035	0.050	0.080	130
100	120	0.050	0.070	0.75	1.1	3.9	2.7	0.050	0.065	0.100	—
120	140	0.065	0.090	1.1	1.4	2.7	3.5	0.055	0.080	0.110	—
140	160	0.075	0.100	1.2	1.6	3	4	0.055	0.090	0.130	—
160	180	0.080	0.110	1.3	1.7	3.2	4.2	0.060	0.100	0.150	—
180	200	0.090	0.120	1.4	2	3.5	5	0.070	0.100	0.160	—
200	225	0.100	0.140	1.6	2.2	4	5.5	0.080	0.120	0.180	—
225	250	0.110	0.150	1.7	2.4	4.2	6	0.090	0.130	0.200	—
250	280	0.120	0.170	1.9	2.7	4.7	6.7	0.100	0.140	0.220	—
280	315	0.130	0.190	2	3	5	7.5	0.110	0.160	0.240	—
315	355	0.150	0.210	2.4	3.3	6	8.2	0.120	0.170	0.260	—
355	400	0.170	0.230	2.6	3.6	6.5	9	0.130	0.190	0.280	—
400	450	0.200	0.260	3.1	4	7.7	10	0.150	0.200	0.310	—
450	500	0.210	0.280	3.3	4.4	8.2	11	0.160	0.220	0.350	—
500	560	0.240	0.320	3.7	5	9.2	12.5	0.170	0.250	0.360	—
560	630	0.260	0.350	4	5.4	10	13.5	0.200	0.290	0.410	—
630	710	0.300	0.400	4.6	6.2	11.5	15.5	0.210	0.310	0.450	—
710	800	0.340	0.450	5.3	7	12.3	17.5	0.230	0.350	0.490	—
800	900	0.370	0.500	5.7	7.8	14.3	19.5	0.270	0.390	0.520	—
900	1000	0.410	0.550	6.3	8.5	15.8	21	0.300	0.430	0.600	—
1000	1120	0.450	0.600	6.8	9	17	23	0.320	0.480	0.700	—
1120	1250	0.490	0.650	7.4	9.8	18.5	25	0.340	0.540	0.770	—
1250	1400	0.550	0.720	8.3	10.8	21	27	0.360	0.590	0.840	—
1400	1600	0.600	0.800	9.1	11.9	22.7	29.8	0.400	0.650	0.920	—
1600	1800	0.670	0.900	10.2	13.4	25.4	32.6	0.440	0.720	1.000	—



THE MAXIMUM LOAD ZONE IS THE 1/3<sup>rd</sup> PART OF THE BEARING TOWARDS THE GROUND

## 5.0 CUSTOMISED BEARINGS (SELF ALIGNING BEARINGS/ SEALED BEARINGS).

Here the bearings are having the sealed on to the cover the dust and the foreign particles to get in to the contact with the bearings and allow minimum failures possibilities.

While inadequate lubrication is the main cause of reduced bearing life generally, this isn't the case in paper machine applications. For all applications in all industries, it is estimated that 90% of bearings outlive the machines that they are installed on, 9.5% are replaced during planned maintenance and that 0.5% fail. Of the failed bearings, 36% fail due to inadequate lubrication and 14% due to liquid or solid contamination. The situation for bearings in paper machine applications is quite different. Very few bearings outlive the paper machine they are installed on with 40–50% failing due to liquid contamination. Corrosion marks can often be seen on these. Even if they cannot, the problem is inadequate lubrication due to too high water content in the lubricant. The difference between inadequate lubrication and liquid contamination is not always clear. For instance, there can be enough water in the lubricant to disrupt the oil film between the bearing surfaces without creating corrosion marks.



## During operation

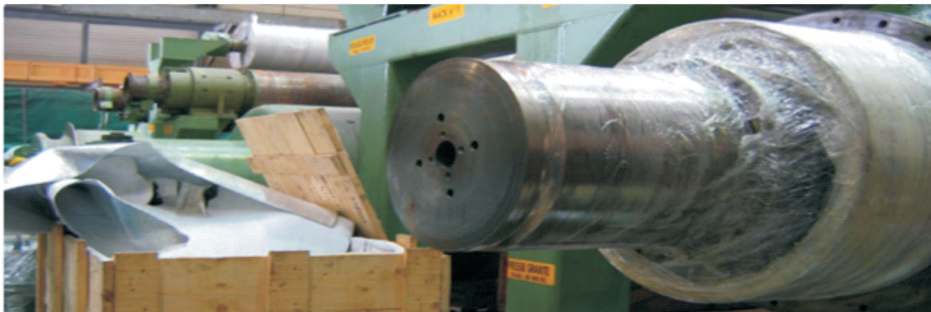
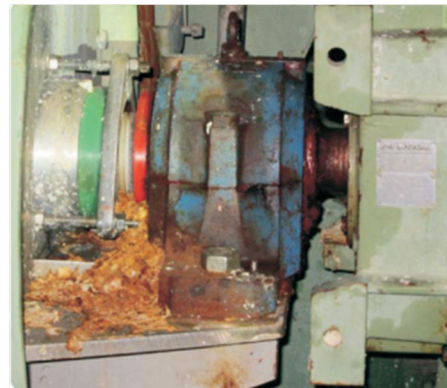
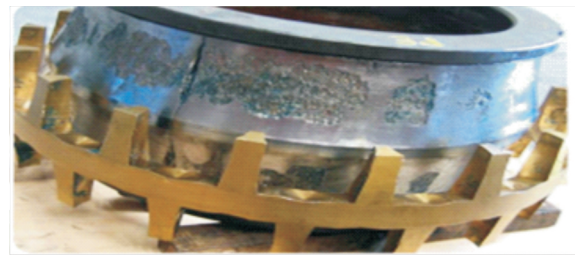
Bearings in operation must be protected against contamination that could bypass the housing seal assembly. This contamination can be either:

- 1 Solid and liquid such as fibre in the pulping process
- 2 Liquid like process water in the forming section
- 3 Solid only

The first step is to keep the contamination out of the housing.

Avoiding solid contamination is simple in theory. Just don't open the bearing packaging until it's time to mount the bearing! I say simple in theory because, in reality, paper mill staff will often open the packaging to check the bearing is the same as the one that needs replacing or to check that the designation indicated on the box is correct. In practice, many bearings are opened and then put

back in storage for use later on. Bearings in good condition that are dismantled and put back in the store are another issue. They need to be cleaned and protected against corrosion and solid contamination.



## 6.0 Heat Treatment

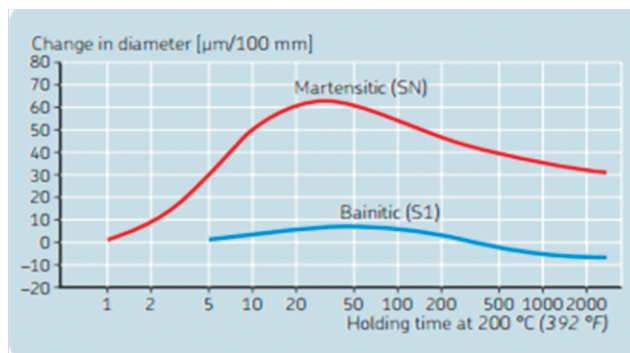
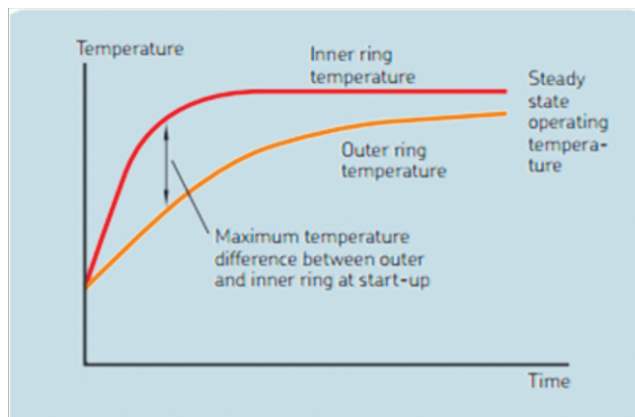
For maintaining the hardness the bearing has to pass on through hardening process that are:-

- 1) Case hardening.
- 2) Through hardening.
  - a. Bainitic heat Treatment
  - b. Martensite Heat Treatment

For high surface rigidity and the polished chamfered bearing has to be passed through the heat treatment process.

For maintaining the hardness of the bearing the bearing has to be tampered again with the heat thus to maintain the hardness of the bearing.

The below chart explains the hardness stability of the bearing:-



Examples:- Case hardening – Mud Pot.

Through hardening– Iron Rod.

**7.0** Bearing has to be checked before mounting that the shaft is oveled or not through Blue Matching in Tapered Bore. As today technology has changed a lot through thus with that we should check the shaft

before the failure comes. This has to be matched with the bearing Inner race with shaft with the tolerance level having 5% extra. Today maximum people doesn't have a practice to look upon the bearing due to which there is an misalignment problem where the bearing helps the shaft to get oveled.

## 8.0 LOOK – STOP – CHECK – CARE – MOVE.

Today in this competitive zone we are not able to keep lots of tools that are essential for checking the impacts the machine is facing and the direct and indirect load faced by bearings.

HAVE YOU EVER THOUGHT BEARING FAILED, BUT WHY?

Has the life of the bearing was that much? The quite and simple answer will be “NO”.

If in today's date the customers are complaining that the bearing failed then the bearing manufacturer will be providing a sheet to get filled and then they will be giving you 101 reasons for the bearing failures but no one will be coming to support you.

But we ARB group stands beside you as we are the bearing manufacturer in India will be coming at your door step whether you deal with ARB or not.

**We will be providing you FREE Services for the VIBRATION CONDITIONING MONITORING; and the Services regarding the Bearings and its Partner (Grease, oil Seal, Sleeves,) Etc.**

## Experiments :

The bearings are changed and development are done day to day.

As the cage are modified and allowed to take axial displacement with minimum cage failure as the drier bearings cages are the most prominent one which is failing mostly.

## Results :

Due to this experiment we have got the optimized life and the breakdown has been limited.

- 1) Shree Ganga Paper Mill, Ghaziabad.
- 2) Shree Krishna Paper Mill, Kotputli.

## Discussion :

Being a Indian Bearing Manufacturer we have the tendency and capability of making the designs of the bearings according to the customers requirement.

Having low hierarchy we don't need to take the permissions and wait for the reply. We can take the decisions accordingly.

We need a chance to prove that what we are and our product. Need a race with others.

## Conclusion :

- 1) The services will be free of cost like VMT, Trainings regarding the bearings.
- 2) There is regular change in the development of the bearings and produce the bearings according to the customers.
- 3) Customers are GOD and we serve them as like we do pray to the GOD.
- 4) We glad to have your regular visit at our premises and judge our strength.

## References :

Google , ARB Group, Sunil Goyal , SurrinderGoyal, My experience in bearing Industry.