

# A CASE STUDY: CAUSE OF OIL LEAKS & ELIMINATING BY OPTIMIZING BEARING SEALS

Anil Bhardwaj<sup>1</sup>, Bharat Bhatt<sup>2</sup>, B.D. Bhomia<sup>3</sup>, Supriya Rakshit<sup>4</sup>

<sup>1</sup>Propertior, Indian Engineering Company, Gujarat, India

<sup>2</sup>Vice President, Operations & Technical Services, Adani Power Rajasthan Ltd., India

<sup>3</sup>Consultant, Electrical, Indian Engineering Company, Gujarat, India

<sup>4</sup>Technical Support Executive, Electrical Engineering, Indian Engineering Company, Gujarat, India

\*\*\*

**Abstract** - Many parts of rotating machine observe an oil leak problem. Any part of equipment fed with oil fed bearings, such as turbines, motors, gearboxes and compressors, are susceptible to oil leaks. Oil level is to be maintained as per manufacturer requirement & if not mentioned it must be according to the standards. This paper presents a case study for the cause of oil leaks and means to eliminate it by optimizing bearing seals. Perhaps motor is having history of oil leakage since commissioning. Existing design deficiencies needs optimization.

**Key Words:** Oil leaks, Optimization, Anti migration groove, labyrinth seal, mud-daubing

## 1. INTRODUCTION

Oil leaks need to be dealt due to fire hazard potential along with the danger of oil coated surfaces and the time and money spent cleaning this wasted oil, which then needs to be replenished [1]. The environmental impact of waste oil containment and disposal is always a consideration when dealing with machinery oil leaks.

Dirty, oil-soaked windings are a good indication of an ongoing oil leak, caused by excessive clearance of the labyrinth seal or by a pressure differential between oil chamber and atmosphere. The longer the leak has been present, the more dirt will be found mixed into the oil.

## 2. CAUSES OF OIL LEAKS

When oil leak is suspected, use a manometer to measure the pressure differential between the inside of the bearing chamber and the motor enclosure.

A case study of 5200 kW BFP motor is done to investigate the cause for oil leaks. As motor is having history of oil leakage since commissioning, the windings were oil saturated when it is dismantled. Certain design deficiencies are been noticed during dismantling of motor.

One missed cause of leaks by repairer is absence of anti-migration groove been unnoticed as shown in Fig.1.

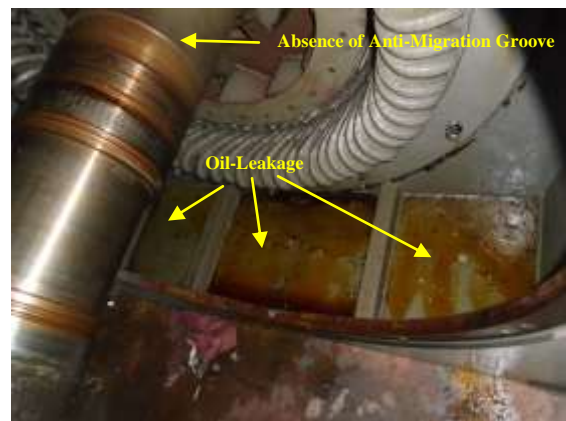


Fig -1: Absence of Anti-Migration groove

Second possible cause for the oil leaks is blocked openings. The inside labyrinth seal should be vented to the exterior of the motor instead of to the air baffle. Many designs incorporate a vent opening cast into the end bracket usually in the bottom half [3]. Perhaps a vent has been inadvertently blocked, or mud-daubing insects have nested in the vent opening [2].

Third possible cause for the oil leaks is the hose used to vent the inside labyrinth seal to the air baffle is not having proper gradient. The intent is to equalize the pressure between the oil chamber and the inside of the motor, thereby preventing airflow through the chamber [3].

## 3. OPTIMIZING OIL LEAKS

Anti-migration groove should be machined in the shaft just inside the bearing groove [2]. Centrifugal force prevents oil from migrating past the labyrinth seal while the shaft is rotating. The groove should be just inboard of the labyrinth seal [2] as shown in Fig. 2.

By venting inner labyrinth seal to atmosphere, air drawn through labyrinth seal passes through vent opening, rather than bearing chamber. The bottom line is that if the air doesn't pass through the bearing chamber it won't carry oil with it. That means no more oil leak [3].

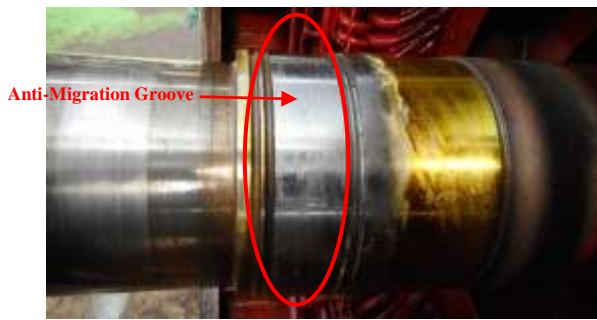


Fig -2: Anti-Migration groove



Fig -5: Bottom side of NDE bearing: Minor oil seepage observed

#### 4. DESIGN MODIFICATIONS

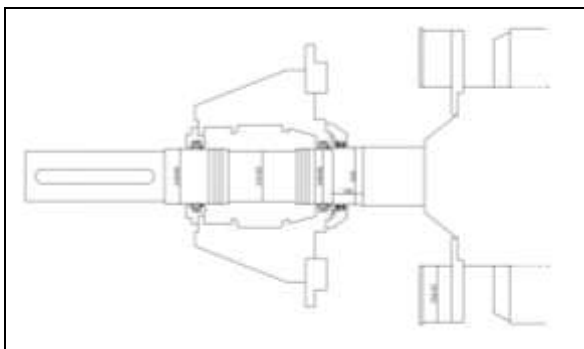


Fig -3: Existing DE Side

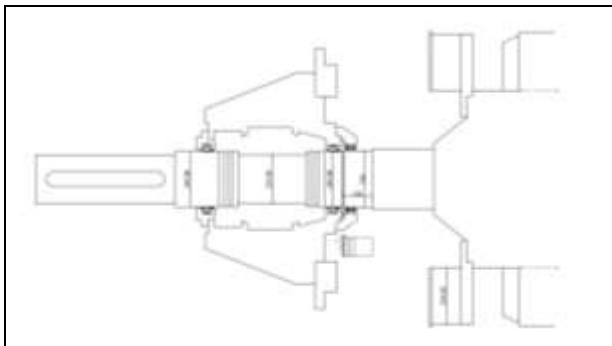


Fig -4: Modified DE Side

#### 5. RESULTS

As thought process enough anti migration groove was required. The same has been incorporated and post running of about 500 hours on load it has been observed that negligible oil spots were found on windings and NDE bearing side.

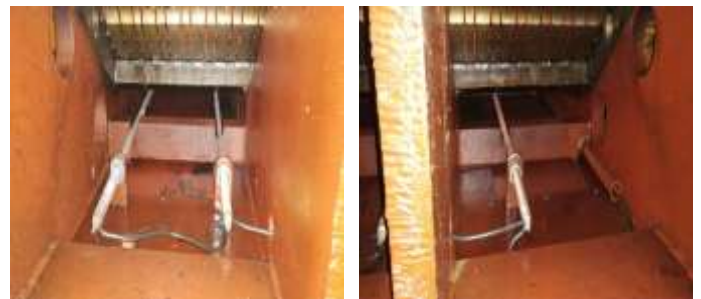


Fig -6: Space heater area: No oil observed in bottom portion



Fig -7: Overhang winding: No oil observed in both side of winding



Fig -8: (1) Cooler side: oil not found  
(2) Side portion of NDE Bearing: Few drops of oil found

#### 4. CONCLUSION

The modification in existing design proved to be success as the oil leakage problem is been eliminated after its successful start only negligible spot of oil on winding is noticed. Other reasons narrated in article may not be always the cause of reason for oil leaks. So, it is necessary to go through all perspective and understand the main cause of it. A general practice followed when such problem arise is to install lip seals on the inner labyrinth seal, trying to stop the nuisance oil leak. Tighter clearances did not fix the problem. A lip seal creates friction, and a 2- pole shaft has a high peripheral speed. The result is heat, and a brittle lip seal. Heat also transfer along the shaft to babbitt bearing. These materials inevitably wear or harden and lose their effectiveness.

#### REFERENCES

- [1] John K. Whalen, Skip Krieser. "Eliminating oil leaks by optimizing bearing case oil labyrinths," proceedings of the Twenty-seventh Turbomachinery Symposium, 1998: pp. 93-99.
- [2] EASA Technical Manual Published by Electrical Apparatus Service Association, Section 8: Version 0117, 2016: pp. 44-47.
- [3] Chuck Yung. "Start with cause of oil leaks in repair process on sleeve bearing motors" Proceeding of EASA Currents July 2000.

#### BIOGRAPHIES



Anil Bhardwaj is founder & Owner of Indian Engineering Company. He is having more than 40 years of experience in Electrical Service industry and in field of repair and maintenance of Electrical Rotating Machines. He has received B.E. in department of Electrical Engineering.



Bharat Bhatt is Vice-President – Operation & Technical Services. He has served Gujarat State Electricity Corporation Ltd. (GSECL). Mr. Bhatt received his B.E. (Electrical) from L. D. Engineering College (1983). He is serving to Adani Group Thermal Business as VP (Operations & Technical Services) in Electrical Department.



B.D. Bhomia is working as consultant (Electrical Machine) in Indian Engineering Company since 2013. He served BHEL for about 24 years at various designations. He retired from BHEL as Sr. Deputy General Manager. He has worked as Chief Energy Auditor. Mr. Bhomia received his B.E. (Electrical Engineering) from BITS, Pilani (1968). He was member of APPELLATE Committee of Madhya Gujarat Vij Company (MGVCL) and is certified energy auditor.



Supriya Rakshit has received her B.E & M.E in the department of Electrical Engineering in 2008 & 2014 respectively. She is having interest in field of Electrical Machine, Power Electronics, Artificial Intelligence, Restructuring and deregulation. She is working in Indian Engineering as Technical support Executive.