

| EVENT ANALYSIS REPORT   |                        |           |   |                               |
|---|------------------------|-----------|---|-------------------------------|
| UNIT NO : 04  | TPS : Khaperkheda TPS  |           | Unit Capacity : 210 MW                  |                               |
| 1. *HO Code :   | Station Code :         | Time -    | Date -                                  | No. of days from last sync. : |
|   | T003                   | 21:56 Hrs | 09/01/2017                              | 00 Days                       |
| <b>2. Operating conditions at the time of Event :-</b>  |                        |           |   |                               |
| Load  | Coal Cycles in service |           | Oil Support                             |                               |
| 90 MW   | B & C                  |           | 4 guns at AB and 2 guns at CD Elevation |                               |
| <b>3. Nature of Event :</b> T. A. set tripped due to axial shift very high.   |                        |           |   |                               |
| <b>4. Name of First Up , Main Protections &amp; Protection on which GCB tripped :</b><br>Axial Shift Very High (First Up), Turbine Tripped, MFT Operated, Turbine Trip Gear Operated.   |                        |           |   |                               |
| <b>5 A) Observations :</b> On dt. 09/01/17 at 16.10 hrs, Unit-4 was withdrawn for attending CT oil leakage at GCR. After attending oil leakage, the set was rolled & synchronised at 21.40 hrs. Set was on load at 21.56 hrs at 90 MW with two coal cycles – B & C in service and necessary oil support. During loading, the set tripped on turbine protection of "Axial Shift Very High" when it was found increased to +1.00 mm.<br>GCB opened on "Reverse Power Protection".   |                        |           |   |                               |
| <b>5 B) Remedial Action/work done :</b> Internal inspection of turbine bearing no.2 & 4 carried out after dismantling the same. Heavy pitting marks observed on axial keys of generator side & adjacent side faces where the axial keys are located and also on the pedestal of bearing no.2. Heavy pitting marks observed also on torous & support of bearing no.2 & 4. Primary & secondary pressure grouting of bearing no.2 & 4 carried out. Complete matching of torous & support contact of both the bearings and blue matching of bearing no.2 axial keys & key faces done. LPT rear gland box centering done.<br>Separate enclosure is attached herewith showing detailed works carried out by TM, BM, EM & TIC during outage. |                        |           |   |                               |
| <b>6. Root Cause Analysis :</b> High shaft vibrations at bearing no.2. High pedestal vibrartions of bearing no.4.   |                        |           |   |                               |
| <b>7. Preventive action suggested (Short Term) :</b>  |                        |           |   |                               |
| <b>8. Preventive action suggested (Long Term) :</b><br>(1) LPT rotor CRO was on higher side @ 4.5 microns, which will be rectified during coming COH of the unit.<br>(2) IPT bump check valve correction will be carried out during COH of the unit.<br>(3) Bearing no. 4 catenary will be corrected by re-grouting of bearing pedestal no.4.   |                        |           |   |                               |
| 9. Similar event occurred last time:  | Unit No # 4 , 210 MW   |           | Time :                                  | Date :                        |
| <b>Event :</b><br><b>Remedial Action / work done :</b>  |                        |           |   |                               |
| <b>9A. Implementation Status of Long Term/Short Term measures stated at Sr No 7 &amp; 8 :</b>   |                        |           |   |                               |
| 10. Boiler lighted up   | Time - 18:40Hrs        |           | Date - 18/01/2017                       |                               |
| 11. T-A Set Synchronized  | Time - 01:54 Hrs       |           | Date - 19/01/2017                       |                               |
| <b>12. Remark :</b>   |                        |           |   |                               |
| <i>R712</i>   |                        |           |   |                               |
| Chief Engineer  |                        |           |   |                               |
| <b>13. Recommendations of Works Section:</b>  |                        |           |   |                               |
| 1. Procurement/Replacement Plan:  |                        |           |   |                               |
| 2. Operational Error:   |                        |           |   |                               |
| 3. Delay in Maintenance:  |                        |           |   |                               |
| 4. Delay in bringing back the Unit:   |                        |           |   |                               |
| 5. Training of Staff:   |                        |           |   |                               |
| 6. Whether remedial action is completed satisfactory & point is closed:   |                        |           |   |                               |
| C E/Dy C E (Works)  |                        |           |   |                               |

## **UNIT 4 -SHUT DOWN REPORT**

**FROM Dt. 09/01/2017 to 18/01/2017**

### **A] PRESSURE PART**

#### **1] Furnace:-**

- Furnace 1<sup>st</sup> & 2<sup>nd</sup> pass manhole doors opened.
- Furnace pressurization and arresting the leakages at cat house, dog house and pent house.
- Water lancing at re-heater slant portion & second pass zone is carried out.
- Erection of scaffolding at furnace bottom goose neck is carried out.
- Erection of sky climber is done & water washing of water wall panels is carried out and clinkers removed.
- Furnace 2<sup>nd</sup> pass inspection carried out
- Fin welding of steam cooled wall is carried out.
- Half round protective S. S. shields provided on the topmost tubes of the LTH coils and Economizer coils.
- Skin casing box of steam cooled wall welding done and pouring of refractory in the box is carried out.
- Hydraulic test is carried out at 150 kg/cm<sup>2</sup> pressure and found ok.
- Dismantled the sky climber, scaffolding at furnace bottom goose neck removed.
- Visual inspection of LTH inlet header SHH9 and Economizer intermediate header 2A, 2B & 2C carried out.
- D. P. test of LTH inlet headers SHH9 carried out.
- Erosion profile mapping of Economizer coil carried out By M/s. CPRI, Koradi.
- Tube thickness survey of Eco coil and Steam cooled wall carried out.
- All manhole doors of 1<sup>st</sup> pass, 2<sup>nd</sup> pass, pent house, cat house & dog house is closed.

#### **2] Pent house, dog house and cat house:-**

- Removing of ash and old cracked refractory carried out.
- Arresting leakages by welding is carried out.
- Application of refractory carried out.
- Repair of Boiler skin casing at pent house, crown plate, seal plate and scalloped bar by welding work.
- The leakages in crown plate areas in Pent house attended by pouring high temperature silicone sealant.

#### **3] Air Preheater :-**

- Air heater 4A & 4B water washing done.
- Air heater 4A & 4B all manhole door open and internal inspection done.
- Both APH seal setting work completed.
- Air heater 4A & 4B guide & support bearing checked found OK.



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- Sonic soot blower checked & repairing done.
- Air heater Soot blower 91, 92, 93, 94 internally checked, servicing done and manually trial taken found OK.
- Air heater Soot blower 93 swivel joint replaced and 92 leakage attended.
- APH 4A & 4B gear box leakage attended by replacing oil seal.
- APH 4A & 4B all LOP servicing done.
- APH 4A drive end fluid coupling replaced.

#### **4] Valves**

- Drain station valve checking & servicing done
- Atomizing station isolating valves servicing done.
- Atomizing station drain valves and steam traps replaced at Corner no. 3 & 4.
- AHSB interconnecting isolating valve bonnet leakage attended and interconnecting valves replaced by new valve.
- Eco vent, Air vent ( LHS & RHS) gland leakage attended.
- Drum vent B75,B76 & B77 valves servicing done manual trial taken found ok.
- S43 and S44 valve servicing done manual trial taken found ok.
- Feed station drain valve servicing done.
- WSB temp control thermal drain isolating valves replaced at corner no. 2&3.
- Steam leakages of oil guns CD2, EF2 & EF3 attended by welding.
- CBD valves gland leakage attended.

#### **5] Burner Tilt**

- Leakages arrested which is observed during Pressurization test.
- Wind box cleaning and leakages arrested by welding work.
- Auxiliary air damper servicing done and joint trial taken with operation and I&C staff.
- Coal nozzle 10 nos. removed, repair and refitting done.
- All Oil guns, Igniters & scanners servicing done.
- All oil guns cleaned by oxyacetylene flame and fitting done.

#### **6] APH outlet to ESP inlet duct :-**

APH outlet to ESP inlet duct cleaning done. APH outlet to ESP inlet duct repaired by welding to all the eroded duct plates, duct supports/bracings and laying of fire grate refractory in all four passes of APH outlet and ESP inlet duct including slant portion of APH outlet and ESP inlet.

#### **B] ROTARY PART WORKS**

**1] ID fan 4A & 4B :** Internal inspection and PM carried out.

**2] FD fan 4A & 4B :**

1. Internal inspection and PM carried out

2. Lub oil system servicing done.

**3] PA fans :**

**4A to 4F:** Internal inspection done. Lab oil system checked. Inlet dampers opening and closing trials taken.

**4] Coal mills :**

**Coal mill 4A :** PM work carried out.

**Coal mill 4B :** PM and Journal assembly C replaced. Trunion bush of journal assembly C replaced.

**Coal mill 4C :** PM work done and journal assembly C servicing done. Journal assembly C trunion bushes replaced. MDC (C<sub>2</sub>) repaired and refitted.

**Coal mill 4D :** PM and MPO work, C/M 4E PM work.

**Coal mill 4F :** C/M separate body liner modification done. Air port assembly installed. BRS & extension ring sets are replaced by new sets. Classifier vanes (9 nos.) replaced.

**Coal mill 4F :** PM work carried out.

**5] Raw Coal Feeders :**

**RCF 4C :** Feeder belt replaced by new belt. Main belt G/B replaced by spare G/B.

**RCF 4D :** Feeder inlet gate serviced.

**RCF 4A, 4B, 4E & 4F :** Inspection done & bearings greased. Coal pipes patching work carried out.

  
Ex. Engineer(BM-I)

### **Detailed report on Unit 4 Mini shutdown from dated 10/01/2017 to 18/01/2017**

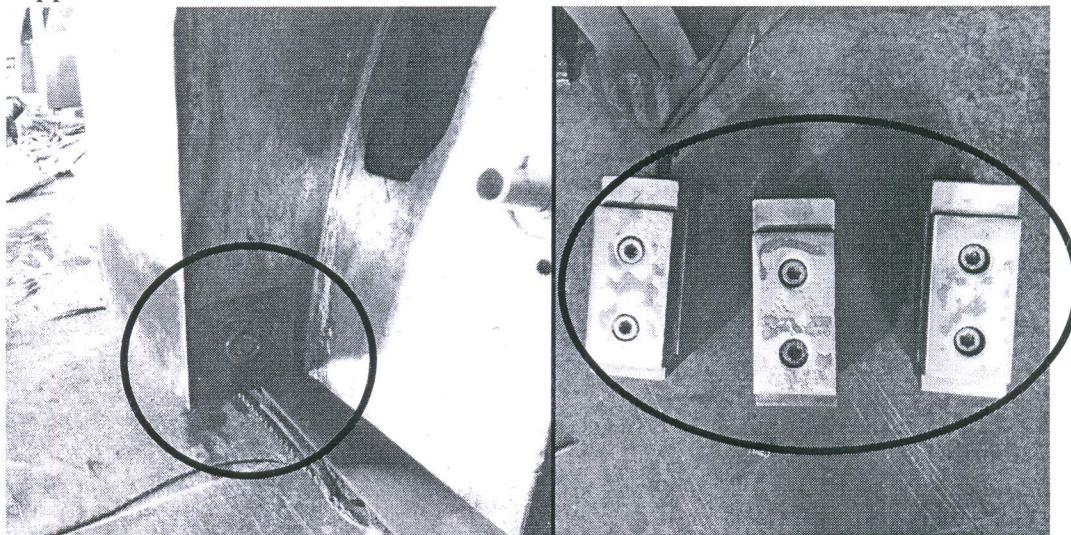
Unit 4 was withdrawn for attending CT oil leakage at GCR on dated 09/01/2017 at 16.30 Hrs. Unit was rolled and synchronized at 21.40 Hrs. During loading of Unit 4 @ 100 MW axial shift increases to +1.00mm and machined got tripped on high axial shift protection.

**It was decided to carry mini shutdown of unit to carry out following works.**

1. High axial shift at bearing no. 2.
  2. High pedestal vibration of bearing no. 4. And LPT rear gland box centering.
  3. Emergency stop valve 1 (ESV- 1) not opening from PCR prior to rolling of Unit.
  4. HRH strainer RHS steam leakage from seal ring.
- ESV-1 complete overhauling carried out and spindle and valve cone assembly is replaced with repaired one which was spare as the installed assembly was observed to be jammed.
  - HRS strainer complete overhauling carried out and bonnet seal ring is replaced with new one.

**Barring gear stopped on 14/01/2017 at 10.30Hrs.**

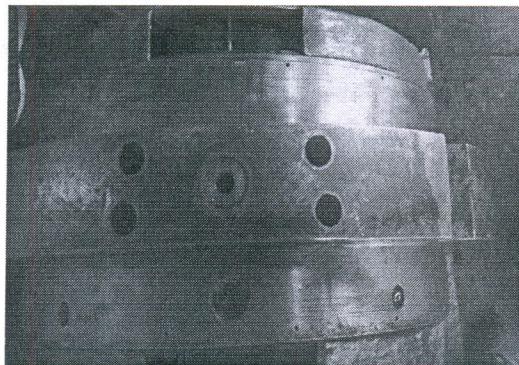
- Both the bearing dismantling works started on 14/01/2017 and completed on 15/01/2017.
- Bearing Journal, coupling CRO and bearing oil clearances noted on 14/01/2017.
- Bearing no 2 internal inspection carried out. After dismantling on bearing no 2 heavy pitting marks observed on axial keys of generator side and adjacent bearing side faces where the axial keys are located. Bearing pedestal also has pitting marks. The depth of pitting marks on bearing faces is of the range of 0.40 to 0.65 mm and that of pedestal is of the range of 0.20 to 0.40mm. Also the pitting marks are observed on torous and bearing support.



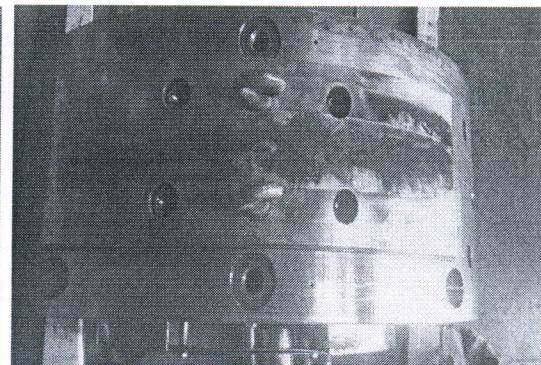
**Bearing no. 2 Axial Key side face Pitting**

**Axial Keys of Bearing no. 2**

- Bearing no. 4 internal inspection also carried out. Heavy pitting marks also observed on bearing torous and bearing support.

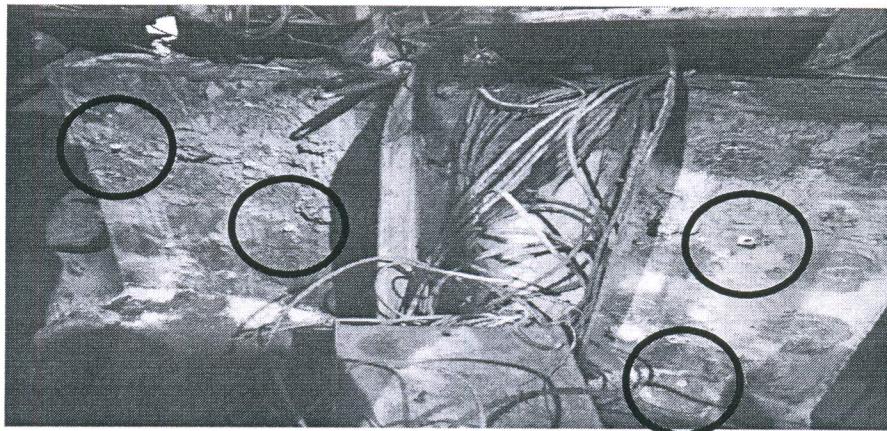


**Bearing no. 2 torous pitting marks**



**Bearing no. 4 torous pitting marks**

- After complete inspection of both the bearing it is decided to reuse these old bearing after complete matching of torous and support contact and blue matching of Bearing no. 2 axial keys and key faces.
- Bearing no 4 and Bearing 2 primary and secondary grouting UT was carried out. Bearing 4 pedestal secondary grout pressure grouting was also carried out.



**Pressure grouting of bearing no. 4 Pedestal grout.**

On dated 16/01/2017 blue matching of torous and support of both the bearings are finalized. Matching of Axial keys of bearing no. 2 and bearing key faces are also finalized. Bearing box-up works started on 17/01/2017 and completed on 17/01/2017. Rotor zero position given to C & I on 17/01/2017. Bearing pedestal box-up work started on 18/01/2017 along with LPT rear gland box centring.

- Unit 4 barring gear restore on 18/01/2017 at 16.30 Hrs.**
- Unit was rolled and synchronized on 19/01/2017 at 01.50 Hrs. Turbovisory parameters are observed to be normal and as follows.

Date & Time 19/01/2017 @ 01:46Hrs

Load 0.00 MW, RPM 3005 RPM

Axial shift: - (-0.16, -0.17 & -0.20)

| Bearing no | Shaft Vibration |    | Bearing pedestal Vibration |    |
|------------|-----------------|----|----------------------------|----|
|            | X               | Y  | X                          | Y  |
| 1          | 79              | 0  | 9                          | 13 |
| 2          | 116             | 20 | 6                          | 10 |
| 3          | 86              | 0  | 16                         | 24 |
| 4          | 66              | 82 | 14                         | 23 |

Date & Time 19/01/2017 @ 01:57Hrs

Load 25.00 MW, RPM 3005 RPM

Axial shift: - (-0.16, -0.17 & -0.19)

| Bearing no | Shaft Vibration |    | Bearing pedestal Vibration |    |
|------------|-----------------|----|----------------------------|----|
|            | X               | Y  | X                          | Y  |
| 1          | 80              | 0  | 8                          | 14 |
| 2          | 116             | 20 | 5                          | 10 |
| 3          | 95              | 0  | 18                         | 27 |
| 4          | 77              | 83 | 13                         | 22 |

Date & Time 19/01/2017 @ 01:57Hrs

Load 189.00 MW, RPM 3005 RPM

Axial shift: - (-0.17, -0.18 & -0.21)

| Bearing no | Shaft Vibration |    | Bearing pedestal Vibration |    |
|------------|-----------------|----|----------------------------|----|
|            | X               | Y  | X                          | Y  |
| 1          | 80              | 0  | 8                          | 14 |
| 2          | 116             | 20 | 5                          | 10 |
| 3          | 95              | 0  | 18                         | 27 |
| 4          | 77              | 83 | 13                         | 22 |

Following observations are as follows and to be rectified during COH of Unit.

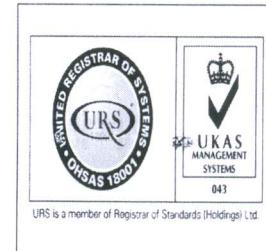
1. LPT rotor CRO was on higher side @ 04<sub>1/2</sub> microns and need to be corrected.
2. IPT bump check value to be corrected and can only possible during COH of Unit.
3. Bearing no. 4 catenary to be corrected by re-grouting of bearing pedestal no 4

*[Signature]*  
Executive Engineer TM-I

Supdt. Engineer (M-I)

**MAHARASHTRA STATE POWER GENERATION CO. LTD.  
KHAPERKHEDA THERMAL POWER STATION**

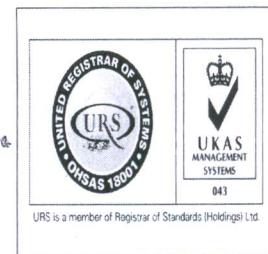
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Phone: (07113) 268168 to 172, 268236, 268131 FAX: 268239(Off)/268123(Site)  
Email - [cegenpkd@mahagenco.in](mailto:cegenpkd@mahagenco.in)



**Following works carried out during mini shutdown of Unit-4 during 10.01.17 to 18.01.17.**

- (1) Preventive maintenance of generator transformer, excitation transformer, field breaker carried out.
- (2) Hydrogen leakage from generator checked & attended.
- (3) UAT oil level topped up.
- (4) Preventive maintenance of motors of Vacuum pumps, BFPs, ID / FD fans, CEPs, carried out.

*H.B. Bhatge*  
**Exe. Engineer (EM-I)**



**Following works carried out during mini shutdown of Unit-4 during 10.01.17 to 18.01.17.**

- 1> Axial shift probe mounted and calibration done.
- 2> Differential expansion pick-up mounted and calibration done.
- 3> Bearing No. 2 & 4 vibration pick-up mounted & calibration done.
- 4> PRDS, AS-102 control valve and gland steam leak-off valve calibration done.
- 4> Other Shutdown defects attended as per defect list.

**Exe. Engineer (TIC-I)**