UNIT NO : 04	TPS : Khaperkheda TPS		Unit Capacity : 210 MW
1. *HO Code :	Station Code : T003	Time – 19:02 Hrs	Date - 22/07/2015	No. of days from last sync. : 2 days

2. Operating conditions at the time of Event :-

Load	Coal Cycles in service	Oil Support
80 MW	C	CD elevation guns

3. Nature of Event: Unit withdrawn at 19.02 Hrs on 22/07/2015 for turbine trim balancing.

4. Name of First Up , Main Protections & Protection on which GCB tripped :

Turbine Hand tripped**(First Up)**, MFT Operated, Turbine Tripped ,Generator Protection operated, GCB opened on RPP.

5 A) Observations:

1. Gland sealing leak off valve sluggish operation.
2. Bearing No.4 vibration are high -28/39 microns.
3. also shaft vibration x1-115 x2-139 micron on higher side.

5 B) Remedial Action/work done: -Trim balancing of HP & IP turbine rotor carried out, LP rear rotor weight added 1045 gm at 40 degree. so total weight at HP front-728 gms, IP -805 gms & LPT 1045gm.

6. Root Cause Analysis : High shaft / bearing vibrations. Bearing no.4-26/38 micron. shaft x2-120, y4-116 micron.

7. Preventive action suggested (Short Term) :-

8. Preventive action suggested (Long Term) :- Long term action plan recommendations by BHEL are enclosed here with.

9. Similar event occurred last time:-	Unit No # 4 , 210MW	Time : 18:00Hrs	Date: 20/07/2013

Event: : Unit withdrawn at 18:00 hrs on 20/07/2015 for turbine Trim balancing. Trim balancing programme completed on 22/07/2015.

Remedial Actions : - Trim balancing of HP & IP turbine rotor carried out. Weight added at HP front-728 gms at 25 degree. Weight added at IP -805 gms at 190 degree.

9A. Implementation Status of Long Term/Short Term measures stated at Sr No 7 & 8 :-

10. Boiler lighted up	Time – 13:32 Hrs	Date- 23/07/2015
11. T-A Set Synchronized	Time –16:51 Hrs	Date-23/07/2015

12. Remark :-

Chief Engineer

13. Recommendations of Works Section:

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)

Record Notes of discussion held on 24.07.15 between MSPGCL & BHEL on "Vibration Analysis &Trim Balancing of TG set at Khaperkheda TPS #4(210 MW)

MSPGCL

1.Shri.S.S.Jadhav,CE

2.Shri.S.M.Telang,Dy.CE-I

3.Shri.B.S.Wankhede,SE(M-I)

4.Shri.H.H.Rangari,SE.(O-I)

5.Shri.D.B.Mankar, EE(TM-I)

BHEL

Shri.V.Veerapandi,Sr.DGM

Shri.J.Mehta,Vibrn Expert.

Shri. GauravMahajan, Engr

1.0 During present AOH (19.06.2015 To 17.07.2015), Generator overhauling, bearing inspection, alignment of TG rotors & casing centering including bearing No.2 & 4 replacement works were carried out. After completion of all work Machine was synchronized to grid on 17.07.15. Vibration levels were found higher side at various loads. Maximum vibration observed at 170MW load as HPF- 132/0, HPR-170/61,IPR-29/31,LPR-45/84 (x/y) zero-peak micron.

17.07.2015 at 19.59 Hrs. Load: 108 MW (micron zero-peak)			20.07.2015 at 17.25 Hrs. Load: 171 MW (micron zero-peak)		
Location	Shaft Vibration (x/y)	Pedestal Vibration (x/y)	Location	Shaft Vibration (x/y)	Pedestal Vibration (x/y)
B1	122 / 0	11 / 10	B1	138 / 0	12 / 0
B2	172 / 47	11 / 6	B2	162 / 67	12 / 5
B3	32 / 38	4 / 16	B3	24 / 28	8 / 16
B4	45 / 57	25 / 20	B4	47 / 87	25 / 27
B5	-	0 / 0	B5	-	0 / 0
B6	-	20 / 0	B6	-	34 / 0
B7	-	6 / 11	B7	-	8 / 15

2.0 In view of high vibration, MSPGCL requested BHEL to rectify the problem, in response to this BHEL mobilized the vibration expert at site on 18.07.15. Vibration analysis was carried out during run up & in the speed range of 2950 to 3000 rpm on 19.07.2015.

3.0 Balancing Trials were taken from 20/07/2015 to 23/07/2015 and final configuration of Balancing weight are as follows,

- HP Front gland plane 8 x 91(546gms at 25 deg).
- IP Front gland plane 7x 115(805gms at 190 deg)
- LP Rear plane 11x 95 (1045gms at 40 deg).

4.0 After carrying out Balancing, considerable reduction in shaft vibration at HPF,HPR and LPR bearing was achieved. Bearing No.4 Pedestal vibration also found reduced. Vibration levels recorded at control room before & after trim balancing are as follows: (Balancing Trial reading attached in Annexure-I)

Location	Vibration at 158MW Load on 19/06/15 before balancing & before AOH (micron zero-peak)		Vibration at 172MW Load on 24/07/15 after balancing (micron zero-peak)	
	Pedestal Vibration	Shaft Vibration	Pedestal Vibration	Shaft Vibration
	X /Y	X /Y	X /Y	X /Y
B1	7/0	155/0	8/2	103/0
B2	8/6	173/92	10/8	132/49
B3	17/0	14/0	13/22	32/22
B4	32/34	0/109	27/33	27/78
B5	16/17	-	No measurement	
B6	23/28	-	33/0	-
B7	12/26	-	10/20	-

5.0 The machine behavior during coast up and coast down is very smooth and max. vibration recorded was less than 100 microns.

6.0 The machine should be run at lube oil cooler outlet temperature of 46 deg C and Main Steam parameters may be maintained as per design values.

7.0 There is no measurement at Brg 5 for bearing vibration. The same may be installed at the very earliest opportunity to monitor this vibration level.

8.0 The bearing vibration level at Brg 4 is considered high. Natural frequency test of the foundation particularly in Vertical and Axial direction should be carried out.

9.0 As a special case, the alarm value for Shaft Vibration for this unit may be kept at 170 microns and trip value may be kept at 200 microns. Pedestal alarm value 45micron (zero-peak) and Trip value pedestals 55 micron(zero-peak)

10.0 The machine may be run continuously after charging all the heaters at higher load.

11.0 The balancing weights have already been locked. However, they may be inspected jointly once again during next available opportunity for their proper positioning.

12.0 All the parameters of the TG Set are well within permissible limits and machine can be run safely as per requirement of the grid. There is no further scope of reduction of vibration level by in-situ balancing. For further reduction long term action plan recommended by BHEL may be carried out for trouble free operation.

13.0 Long term action plan recommendations:

- Capital overhauling of all three modules & Generator and catenary adjustment.
- Rated speed balancing of HP,IP,LP& Generator rotor at BHEL-Hyderabad/Haridwar.
- LP rotor run out correction at works as this rotor is having high run out of 0.19mm.
- Bearing 4 pedestal re-grouting &foundation anchor bolts re-stretching.
- Procurement of one set of all bearings for Replacement if required.
- Procurement of complete assembly of Hydro motor barring gear.

MSPGCL

24/7/15
Chief Engineer
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