

“ONSITE REFURBISHMENT OF POWER TRANSFORMER” AN EXPERIENCE.....

BY :

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1.0 Introduction:

Talcher Thermal Power Station (TTPS) was taken over by NTPC from Orissa State Electricity Board (OSEB) on 3rd June -1995. TTPS is having 4 x 60 MW (Stage-I) and 2 X 110MW (St-II) units having a total capacity 460MW . Stage-I was commissioned during 1967-70 & Stage-II was commissioned during 1982-1984. After taken over by NTPC, the R&M of electrical system started. 132/220KV switchyard (total 29nos of bays) & GRP were completed during the year -2009-11. But in this R&M , refurbishment of GT / procurement of new GT were not being considered.

1.1 Abstract :

At present scenario maintaining the healthiness of electrical capital equipment and running the power plant smoothly by use of different available diagnosis tools like Preventive ,Predictive and Proactive Maintenance is a key challenge for a maintenance engineer. This paper focus the use of maintenance tools and skilled manpower at site to tackle the situation .

There was sudden rise of Acetylene (C₂H₂),Methane(CH₄) ,Ethane(C₂H₄) ,Hydrogen (H₂) gases in stage-1 75MVA unit-1 GT (In December-2015 sample). In that time ,all six units were running in full load,Unit-1 Annual Overhaul(AOH) just completed in Oct-2015 ,the available spare GT was sent to M/s TELK , Kerala for repairing. To mitigate the situation , with the help of NTPC-Kaniha and NETRA ,the DGA analysis was done in weekly basis for monitoring the severity of fault condition . In between acetylene gas was stabilized but increase trend of other gases were observed. GT at TELK was refurbished and received at NTPC/TTPS site before time and replaced in unit-1 location during scheduled AOH-2016-17 and faulty GT was removed for internal inspection ,fault identification and rectification at site.

1.2 DGA test report by NETRA

Dissolved Gas Analysis Results - ASTM D3612/IED 60567																		
	Date	H ₂	CH ₄	CO	CO ₂	C ₂ H ₄	C ₂ H ₆	C ₂ H ₂	O ₂ : N ₂	C ₃ S:	Moist	T.Delta	BDV:	Sp.Res:	IFT	FLASH:	ACID	TGAS
	Limits->	100	120	350	2500	50	65	1	0	0	10	1	60	0.1	25	120	0.3	***
Present	21/12/15	187	650	60	1498	1780	291	4	0.4	4.2								5.1
1st Prior	10/09/15	82	65	470	8508	112	31	0	0.5	5								6.5
2nd	30/06/15	30	51	313	4780	105	30	0	0.5	3.3								4.4
3rd	12/06/15	37	53	262	3920	105	28	0	0.5	3.2								4.2
4th	16/03/15	13	5	59	503	10	4	0	0.6	2.6		25						3.3
5th	31/12/14	9	3	36	285	4	1	0	0.6	2.3		27	32	5.98				3
6th	12/09/14	37	10	248	2830	20	8	0	0.8	4.3		35	0.027	26	5.58			5.5
	09/06/14	45	12	220	2710	21	10	0	0.8	4.2		28	0.014	24	5.78			5.3

Recommendations:

DGA results show high amount fault gases violating all limits. It shows severe overheating/bad joints/arcng etc. Thorough internal inspcion is recommended to find out the source of the fault.

2.0 Detail History of GT-1 :

Location of GTs	GT Descriptions	Remarks
GT-U #1 (75MVA , 13.8/145KV , Ynd1)	SL NO:60004086, Make:BHEL Year of Mfg:1965 Year of repair:1987	This GT was re-wounded in year 1987 from BHEL ,Bhopal and replaced in unit-1 location in 2010. There was sudden increase of acetylene gas (C ₂ H ₂)-4ppm and subsequently stabilized ,But increasing trend of H ₂ and other gas is still persisted.

2.1 Procedure (Step-1) :

The transformer core-coil assembly were untanked and internal inspection of the GT 75 MVA, 13.8/145 KV, GT BHEL make Sl.no. 60004086, was carried out at site.

Following points were checked:

1. Visual inspection of HV outer winding portion
2. Condition of HV leads (R,Y,B & neutral leads)
3. Tightness of supports carrying HV leads
4. Brazing & clamping of HV leads
5. Brazing & clamping joints of Delta formation on LV side
6. Brazing & clamping joints of HV-Neutral formation
7. Connection of tap changers.
8. Visual inspection of core.

2.2 Followings were the observations (Step-2) :

1. No deformation observed in HV winding
2. IR values measured between Core Bolt to Core and Core to frame & found OK.
3. HV lead paper insulation came out at few places and bare conductor is visible.
4. In W- Phase tap changer area - carbon deposition was observed on the surface of main HV winding lead clamp which was connected to the bottom portion of tap changer unit. Upon disconnection of the lead from the joint, it was found that some portion of copper was worn out. Pitting marks were observed on that area.(Photos attached)
5. WTI CT secondary side found opened.

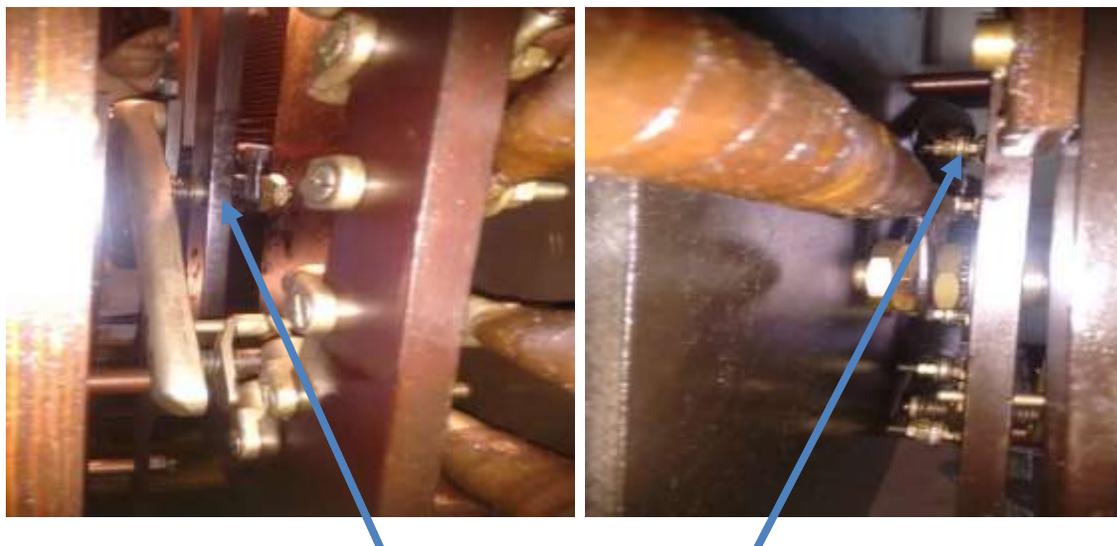


Figure-1 Carbon deposit observed on HV Leads coming out from the windings.



Figure-2 After disconnection of lead wire it was observed that some portion of copper got worn out and pitting mark was observed.

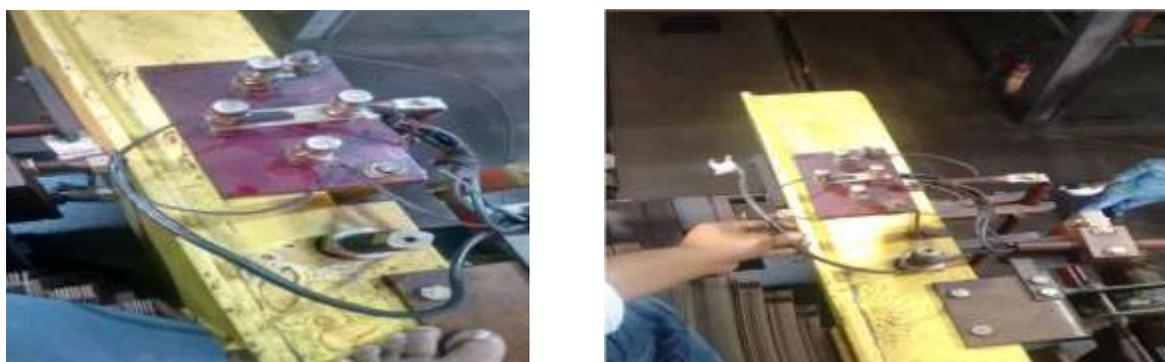


Figure-3 WTI CT secondary side opened

2.3 following actions were taken (Step-3):

1. Silver brazing at the pitting area was done. After brazing, grinding of the surface and blue matching of the joint was carried out to ensure proper contact.
2. Winding resistance measured at all taps and found OK.
3. Supports carrying HV leads were tightened properly.
4. All the three phase leads are re-tapped with paper insulation.
5. All clamps checked for tightness including core coil assembly supports.
6. WTI CT checked for healthiness and found OK. Secondary side of CT shorted with 2mm rigid copper strips



Figure-4 Silver brazing at the pitting area was done. After brazing ,grinding of the surface and blue matching of the joint carried out to ensure proper contact.

2.4 Normalization (Step-4) :

1. The core coil assembly put inside the main tank.
2. Gasket of main tank and other valve and pipes were replaced.
3. Assembling of LV torrid , LV ,HV ,Neutral bushing , conservator , WTI , OTI etc.
4. GT drying out done .
5. Oil filling and filtering done upto required BDV & Moisture .
6. After reaching required BDV and Moisture , Electrical Test were carried out.
7. The test results are within the limit and transformer kept in spare bay for emergency requirement.

3.0 Conclusion :

Uninterrupted power supply to grid is main goal of a power plant operation, GT plays an important role on achieving it. As GTs of TTPS are in continuous operation of more than 50years , hence an experience of “onsite refurbishment of GT ” will be an added advantage to the organization which saves money and time and increased the reliability and stability of power plant.
