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DATE 08.08.2018

**TO,
SUPERINTENDING ENGINEER,
RAJIV GANDHI THERMAL POWER PROJECT
(RGTPP), KHEDAR
HARYANA, PIN – 125121**

**SUB:-STUDY & ANALYSIS OF TG#1 TURBINE VALVES STUCK-UP & ITS
SERVICING & OVERHAULING**

Dear Sir,

Thanking you for giving an opportunity to “NIMDC Private Limited” to carryout study & analysis of Turbine Valve stuck-up problem, experienced during short shutdown.

TG#1 was running normal, since 16th July to 21st July 2018 and it was stopped on 21st July on no load demand. As a routine check, considering the criticality of valves, RGTPP has checked for the smooth functioning of Turbine valves, but both the valves found in stuck-up conditions i.e TV-1 at 97% & TV-2 at 32 % respectively.

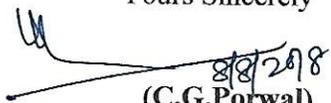
During the stay, stuck-up problem was studied and a preliminary report was submitted to RGTPP on 31st July 2018, wherein, it was recommended to overhaul & service these valves immediately as these valves are provided for the safety of the Unit.

Subsequently, undersigned was called on 3rd August 2018 again for the inspection of these valves during overhauling & servicing. The TV valves have been assembled, commissioned and tested as per OEM's recommendations.

Our observations and recommendations are enclosed herewith for your reference and records please.

With kind Regards,

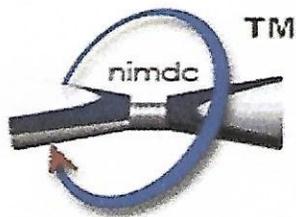
Yours Sincerely


(C.G.Porwal)
Chairman & Managing Director

Copy for kind information pl

→ **SHRI V.K SETHI
CHIEF ENGINEER,
RAJIV GANDHI THERMAL POWER PROJECT
(RGTPP), KHEDAR
HPGCL, HISAR
HARYANA, PIN – 125121**

STUDY REPORT
ON
TURBINE VALVES (ESV) OF TG#1
AT RGTPP



Prepared By

“Nitish Industrial Machinery Diagnostics Centre Private Limited”

(31st & 3rd August to 6th Aug 2018)

RAJIV GANDHI THERMAL POWER PROJECT
HISAR, HARYANA

A handwritten signature in black ink, consisting of a stylized 'W' followed by a horizontal line.

REPORT ON TV OF RGTPP TG#1

SUBJECT:-STUCK –UP PROBLEM OF TUEBINE VALVE ATRGTPP

1.0 INTRODUCTION

Rajiv Gandhi Thermal Power Project (RGTPP) is located at Khedar in the Hisar district of Haryana. The installed capacity of RGTPP is 2X600 MW (1200 MW). The Unit #1 & Unit#2 have been commissioned on 24th August 2010 and 1st March 2011 respectively. TG #1 comprises of several valves but especially Turbine Valves (ESVs) are having utmost important role to play in the protection system. The last lap of the unit operation was between 16th July 2018 to 21st July 2018 and the unit was stopped on 21st July at 16.53 HRS on no power demand. During the visit of consultants on 31st July 2018, it has been observed that TV-1 & TV-2 were found in stuck-up condition at 97% and 32% respectively. These TVs are provided for the safety of the Turbine & its system.

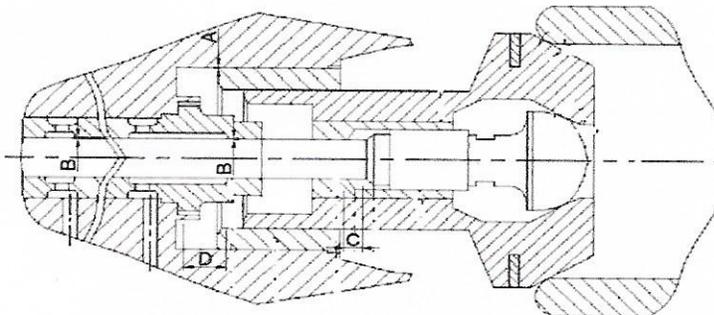
2.0 TURBINE VALVES

The TV is the main shut-off element between the steam network and the turbine. It interrupts the steam flow to the turbine within the shortest of times. This is particularly important in the event of a malfunction. The valves are designed to be leak tight otherwise any steam leakage may keep the turbine turning at low speed after shutdown or causing an over speed because the valve did not close completely after a shutdown or trip.

Turbine valve is most critical as the entire turbine protection system is operated through proper functioning (closing) of these valves. It is reiterated that complete closure of these valves are essential in order to cut-off the supply of steam completely to avoid any over speeding of the machine during actuation of turbine protection. The over speed protection command is executed through full closure of these valves.

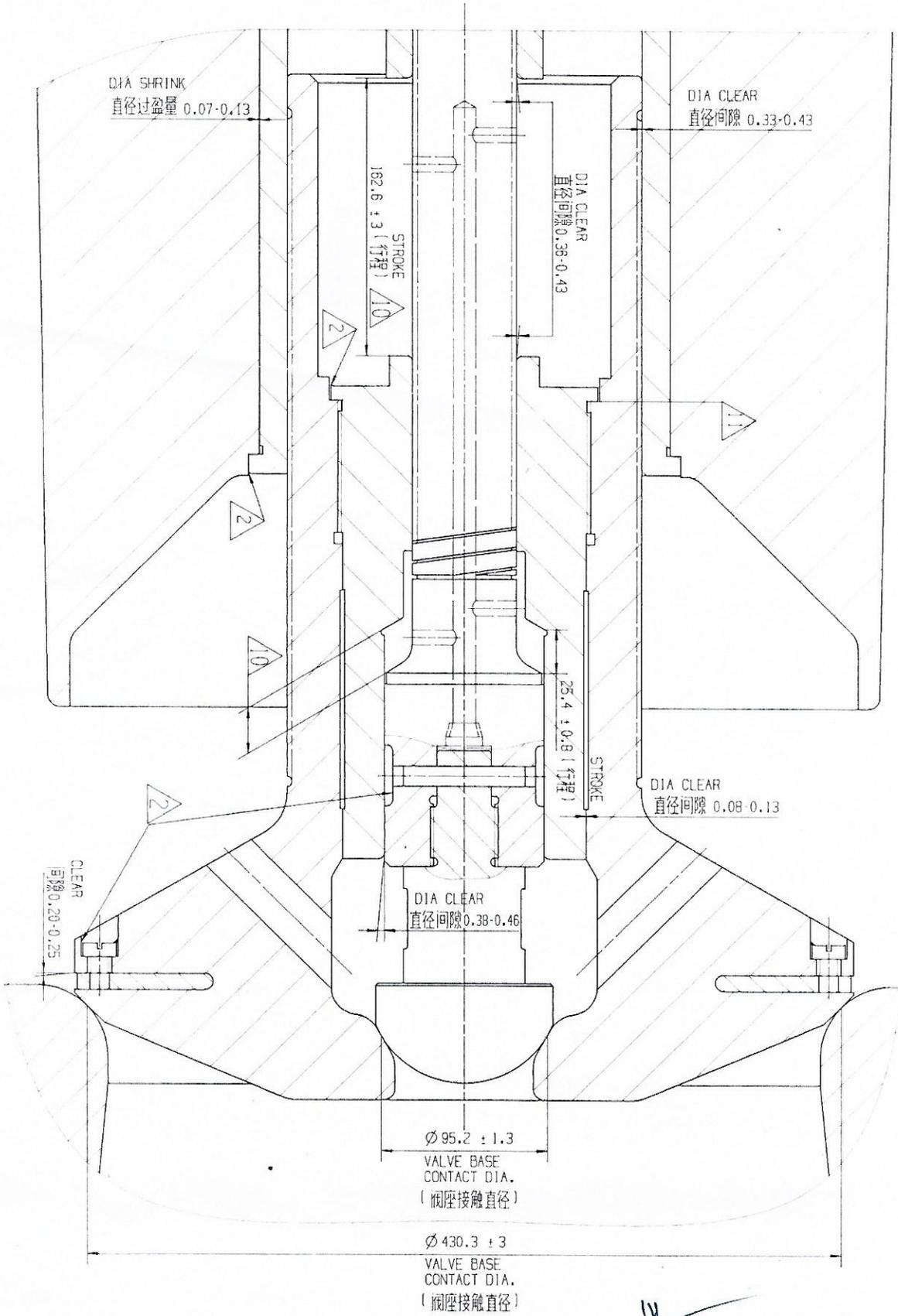
2.1 TURBINE VALVE TESTING –ITS SIGNIFICANCE

When a turbine valve fails to shut properly during an emergency turbine trip or normal shutdown, a turbine over speed event can take place, resulting in catastrophic failure of the turbine and generator components; as well as endangering the lives of plant personnel. These kinds of events can be avoided by careful periodic testing, inspection and maintenance of valves and proper valve testing.



Although steam turbine over speed events seldom happens, when they do, their effects can be very catastrophic and potentially dangerous to life, causing millions of Rupees in destruction to turbine generator components. In hydrogen-cooled generators there also is an added risk of explosions from the generator hydrogen.

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The key to avoid all these undesired outcomes is **a properly scheduled steam turbine valve inspection carried out on predetermined intervals.** Most valve inspection outages vary between a **two- to a four-year cycle,** depending on the original equipment manufacturer (OEM) recommendations and **operating conditions of the individual plant (depending on PLF and running hrs).**

3.0 RECOMMENDED PROCEDURE ADOPTED FOR ASSEMBLY & INSPECTION

The valve disassembly, inspection and re-assembly were performed according to recommended procedures. The inspection can be summarized as follows:-

- Inspecting for defects and foreign deposits on the valve strainer
- Checking for contact areas between the valve and the valve seat
- Looking for any deposited substances on the valve stem and the bushings
- On sliding parts of the valve stems, checking for wear, seizure and damage
- Checking to see if defects were present in the bolts and nuts of the valves

3.1 INSPECTION BEFORE ASSEMBLY

Following points have been checked before assembly

- (i) Status of corrosion
 - (ii) Measurement of clearance between the valve stem and the seal head or the bushing,
 - (iii) Wear and clearance between the sliding parts,
- Thorough visual checks were performed for (i) contact areas (ii) clearance (iii) run out (not done), and dye penetrant tests were used to determine whether any types of cracks were present.

3.2 OBSERVATIONS & ACTIVITIES

Following points observed before and after dismantling:-

- Both the valves were found in stuck-up position. Subsequently, it was attempted to close the valves, which was not successful.
- During our visit on 31st July, it was suggested no further attempt is advisable as it may cause internal damages on valve components.
- In view of the criticality of valves, it was advisable to service /overhaul these Turbine valves (TV) by OEM to ensure the smooth operation of the valves for safety of machine.
- The valves dismantling work started by the OEM's agencies on 2nd Aug 2018 and stud heating was carried out to open out bonnet. The valve internal assemblies were checked and brought out for the further dismantling for detailed inspection.
- As a precautionary measure no foreign object entry in the inlet steam pipe of TVs was covered by blanks. Spindle leak-off flanges of the both the valves were also blanked.
- TVs & GVs loop drain lines before MAA-11 & MAA-12 were checked for accumulation of condensate. Few drops of condensate found in the TV-2 loop whereas no condensate observed in TV-1 loop.
- Deposit sample was collected for analysis.
- Blue matching was checked and found ok.
- After opening of TV valves, following were observed :



A) Turbine Valve #1:-

- No visible rubbing marks noticed in plug portion.
- Rusting was found on the bush & cylindrical portion of the plug.
- No blocking in the strainer found.

B) Turbine Valve #2:-

- Weldment (fused weld material) was found entangled in few strainer holes.
- Minor scratch marks were observed on the plug portion.
- Noticeable Rusting was found on the bush, stem and cylindrical portion of plug.
- The entire sub-assemblies were cleaned and DPT was carried out on stem & plug to ensure the integrity of mechanical components.

C) CLEARANCES & TRAVELS:-

Turbine Valve (TV1/TV2)	Permissible clearances	TV1	TV2
Clearance between sleeve & stem	0.33-0.43 mm	0.32	0.31
Clearance between plug & bush	0.36-0.43 mm	0.36	0.39
Travel of pre-inlet valve	25.4±0.8 mm	25	25
Travel of main plug	162.6± 3 mm	159	162

* All the clearances were found within the acceptable limits.

4.0 ANALYSIS: -

- The unit was last overhauled in Mar-Apr, 2015 and since then no servicing /overhauling was done. This is too long a time gap for the servicing of the valves.
- It is important to understand the probable reasons of sticking of plug and stem which could be due to the following reasons:-
 - i) Deposits of the salt carried over by steam especially when temperature of steam cools down after stoppage of turbine for a longer period.
 - ii) In case the drains are not through, moist steam from the drain lines can cause deposits/rust in presence of salts.
 - iii) It is also to note that plant cannot be operated with no steam contamination at the same time lower the contamination time interval for stick-free operation would be longer.

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- Under such situation we may address the issue in two folds
 - Strict adherence to steam quality.
 - Ruling out possibilities of condensate accumulation in the drain lines.

Fortunately, CPU units are installed at RGTPP, wherein the water chemistry for the entire steam cycle can be maintained in most effective manner. ACC should be measured at condensate outlet, CPU outlets, Feed water and steam and maintained below 0.2 micromho, which will ensure minimum steam contamination.

To rule out the possibility of condensate accumulation in the associated drain lines we may check in every overhauling

- Servicing of NRV spindle leak off line.
- Servicing of NRV and ensuring no blockage of orifice in main stream drain lines after LBA - 31AA701, LBA-32AA702 and LBA-33AA703.
- Servicing of NRV and ensuring no blockage of orifice in TV to GV loop drain after MAA 11 & 12
- Weldment found in the strainer is suspected to be from super heaters.
- Collected sample of deposits needs to be chemically analyzed which will reveal concentration of containments.

5.0 RECOMMENDATIONS: -

- Unit#1 has completed around three & half years since last overhaul, it is recommended to overhaul the Unit at the earliest to avoid impending problems.
- During shutdown, irrespective of hot or cold condition, Turbine protections (electrical/mechanical) should be checked **once in three months** and complete closure of TV/GV valves should be ensured by draining protection oil.
- After overhauling of TVs, closing time should be recorded to make a reference for subsequent tests. If any increase in closing time observed in subsequent tests, overhaul/servicing of the valve should be planned to carry-out at the earliest opportunity.
- In view of the observation of entanglement in strainer, it is proposed to procure one set of temporary strainer for the coming overhauling of the unit, installation of which can be decided on actual observation of nozzle box and vanes of HP cylinder.
- As a routine, these valves should be **serviced once in two years,(refer 2.1)**
- The periodicity of CBD drains should be reviewed to keep the steam conductivity always below the 0.2 micromho.
- In super heater& re-heater the Tig welding should be done to minimize the possibility of Weldment entry in the tubes.

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- Boiler chemistry plays an important role in the buildup of deposits; therefore it should be maintained as per recommended norms. In higher temperature units, there is a potential for binding of valve shafts due to rusting /containment build-up from either the super heater tubes or reheater tubes in the boiler. This buildup closes up the operational clearance between the shaft and its bushing, resulting in potential binding of the shaft and preventing freedom of the valve to close in an emergency shutdown or trip.

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6.0 CONCLUSION

The development of buildup due to oxidation is a gradual process. As the thin layer begins to develop, it appears as a film on the components of the valves. Over time, this concentration of the oxidized material can lead to the degradation of the valves themselves, possibly to the point of a failure. In order to minimize the chances for this type of event, it is not unusual for the valves to be checked on a regular basis and steps taken to remove the buildup from the surface of the valve components. If left untreated, the oxidation can weaken the valve components over time, making the possibility of stuck-up which will result in some sort of industrial accident.

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08/08/2018
(C.G.PORWAL)

*****END*****