MINOR ISSUES - MAJOR CONSEQUENCES

LEARNINGS OF KOLDAM MECHANICAL MAINTENANCE DEPARTMENT

Authors:
01. Pawan Dev Jamta (Employee no. -009953)
02. Chetanpreet Singh (Employee no. – 102712)

Case -1: Spiral Casing Winter Kennedy Tap Leakage

Defect Identification

During routine inspection bulging of the Upper pit liner as shown in Fig.1.1 of Unit #01 was observed. The Bulging resulted in pressing of the governing oil lines and hydraulic Lock oil lines. This pressing of oil lines was leading to unsafe condition. Calcite formation was also observed on upper pit liner walls due to the water seeping out of the concrete.

Upper Pit liner which bulged due to spiral leakage.

Fig.1.1

Solution adopted

Temporarily, to release pressure, 8 mm holes were drilled in the upper pit liner. High pressure, small volume water jets appeared. Jet disappeared as unit was shut down and appeared again on opening MIV Bypass valves and during the unit running, linking the source of water to the water conductor after the Main inlet valve.

Arrangements made for pumping dye in to the cavity during unit # 01 shut down from upper pit liner side. During inspection of spiral casing after spiral dewatering, water was observed continuously seeping in from High Pressure side tap of Winter Kennedy discharge measurement (SECTION A-A). As shown in Fig1.2

Air pressure given from upper pit liner, observed seepage of water in spiral increased confirming this as the defect location. Thread Tapping done at Section A-A High pressure and low pressure taps, plugged and welding done to further eliminate any chances of leakage in future.

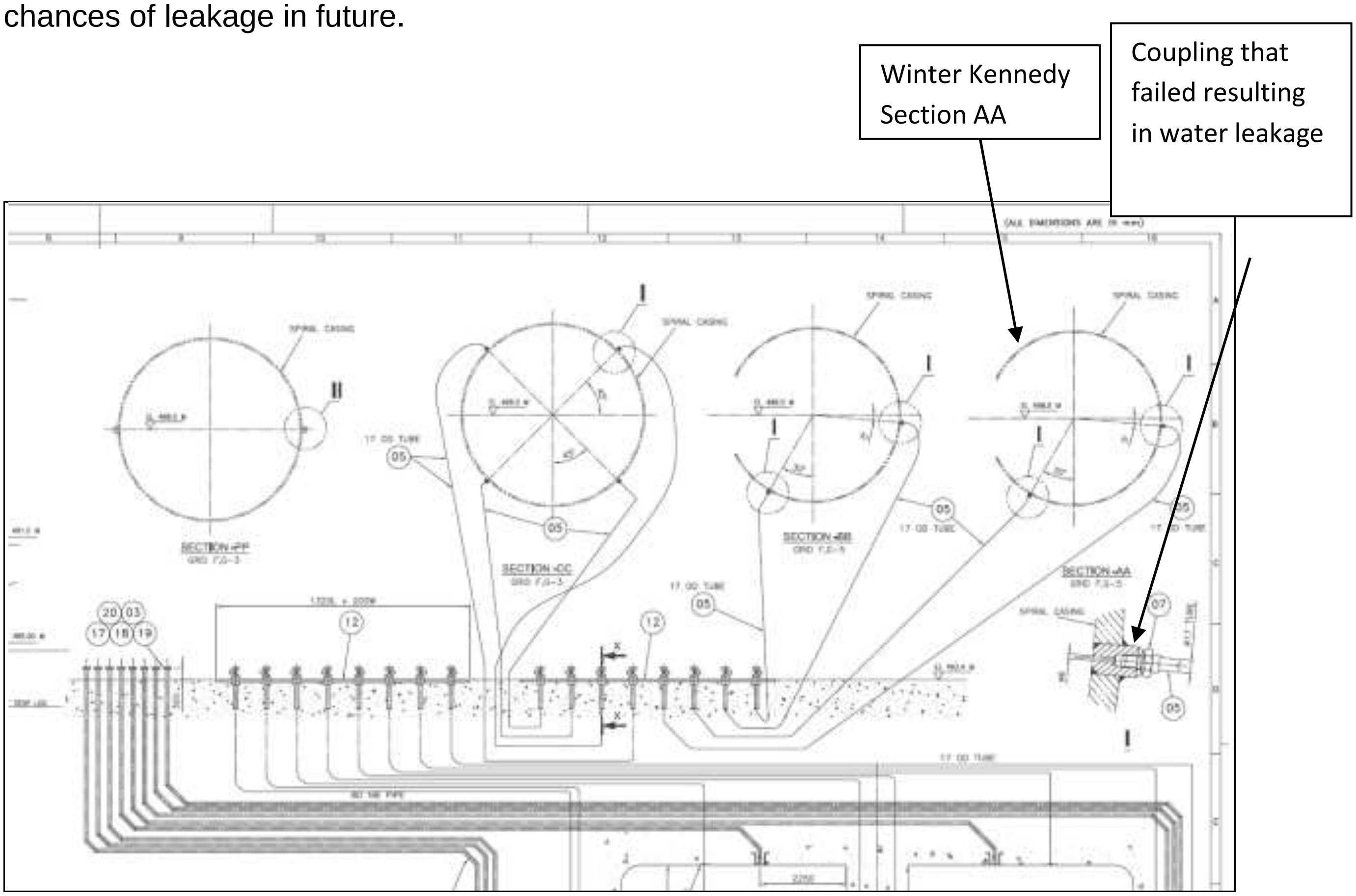


Fig.1.2

Case -2: Water leakage on Slip Ring

Defect Identification

Draft tube and spiral casing was drained to attend a defect in MIV bypass valve. After attending the problem, Draft tube filled as per the standard procedure after shut down. Unit #03 Slip ring /rotor IR value deteriorated to zero. Water was observed in slip ring area and upper guide bearing area. Water was also dripping from runner aeration system housing at the top of Slip ring area shown in Fig 2.1 . Tail race level at the time of draft tube filling moment was – 503.00 M, Aeration system housing level is – 512.40 M, Runner bottom level is - 496.37 M.

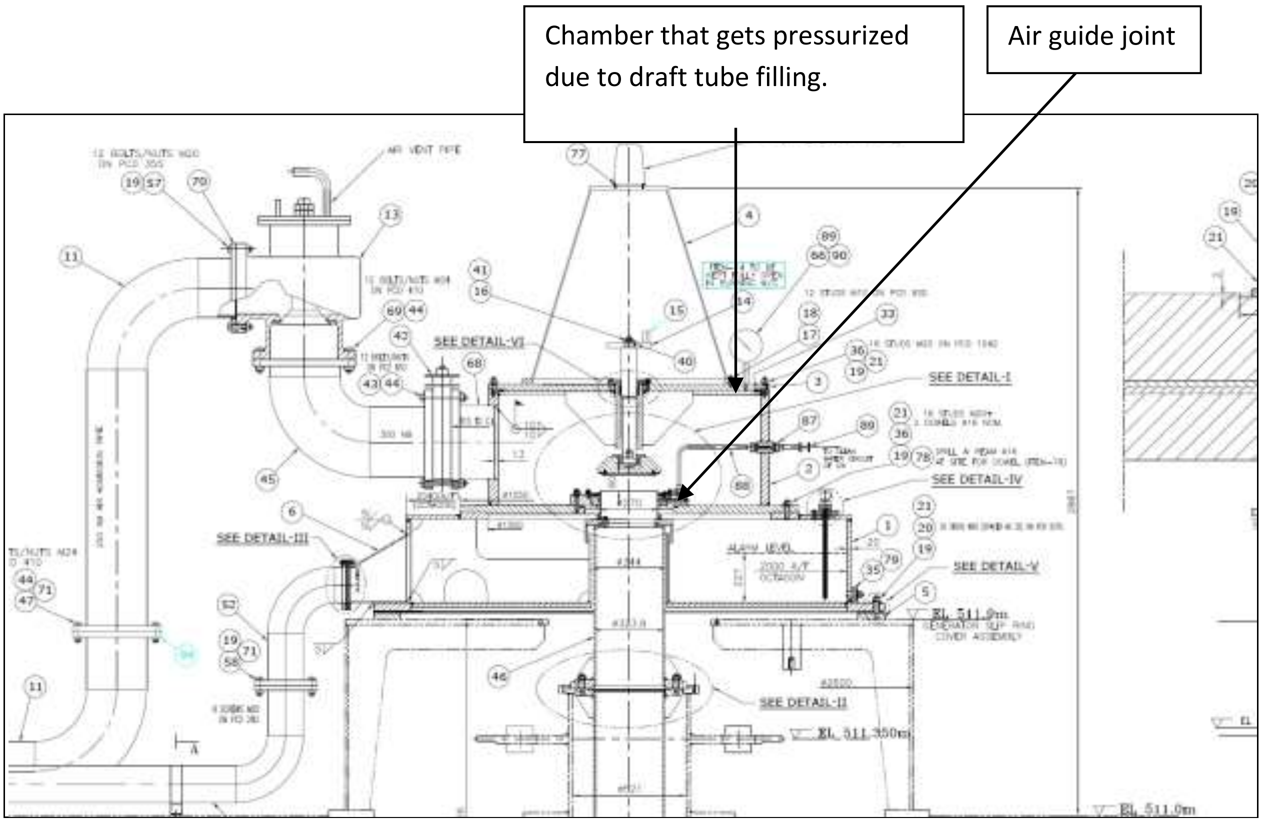


Fig. 2.1

Solution Adopted

Sealing ring cooling water accumulated above housing was drained off. It was observed that there was no air venting arrangement at the top of runner aeration housing. It was suspected that
During draft tube filling area gets pressurized leading to leakage from the Air guide joint. The O-Ring of the air guide joint was suspected to be damaged. O –Ring of the Air guide joint to be replaced.To avoid the pressurization of the runner aeration housing, two solutions could be adopted:-

01. Bypass of the Runner aeration NRV to be installed and opened during draft tube filling to release air pressure.
02. Hole of M20 could be tapped in the bottom of upper chamber, connecting the two chambers of the Runner aeration housing. This connects upper chamber to atmospheric pressure and avoid accumulation of water and pressurization during back filling.

Since the root cause of the problem was the air pressurisation, servicing of spiral air release valve and its availability was of utmost importance.

Case 3: High pressure water mixing in Hydraulic oil

Defect Identification

Abnormally slow movement of hydraulically operated MIV Bypass valve Fig.3.1 of Unit#03 was observed during the normal start-up of the machine. Hydraulically operated MIV bypass valve shown in fig 3.1 has a leakage ring, water was found to be coming out of the leakage ring. Water content increased in Hydraulic oil. It was inferred that the cup seal of the water side was damaged and high pressure water from the penstock (14 ksc) was ingressing into the opening chamber of the cylinder which was connected to the Power pack set return line when the valve was in the closed position.

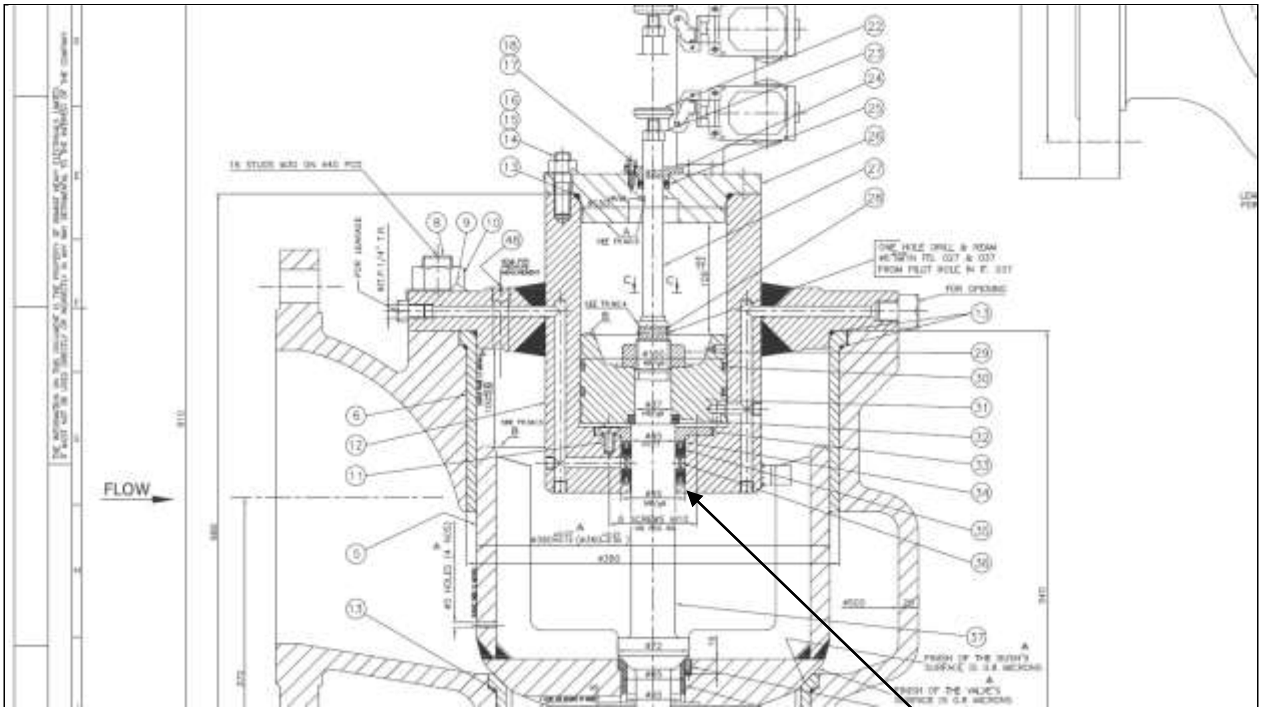


Fig.3.1

Solution adopted

In order to immediately stop the further mixing of water in the hydraulic oil and ensuring availability of unit in peak hours, upstream manual MIV bypass valve was closed so that water pressure is reduced.
Unit # 03 shut down taken after peak hours, Bypass valve dismantled for assessing the water side cup seal condition, cup seal found damaged. Cup seal replaced. Unit made available before the next peak hours.

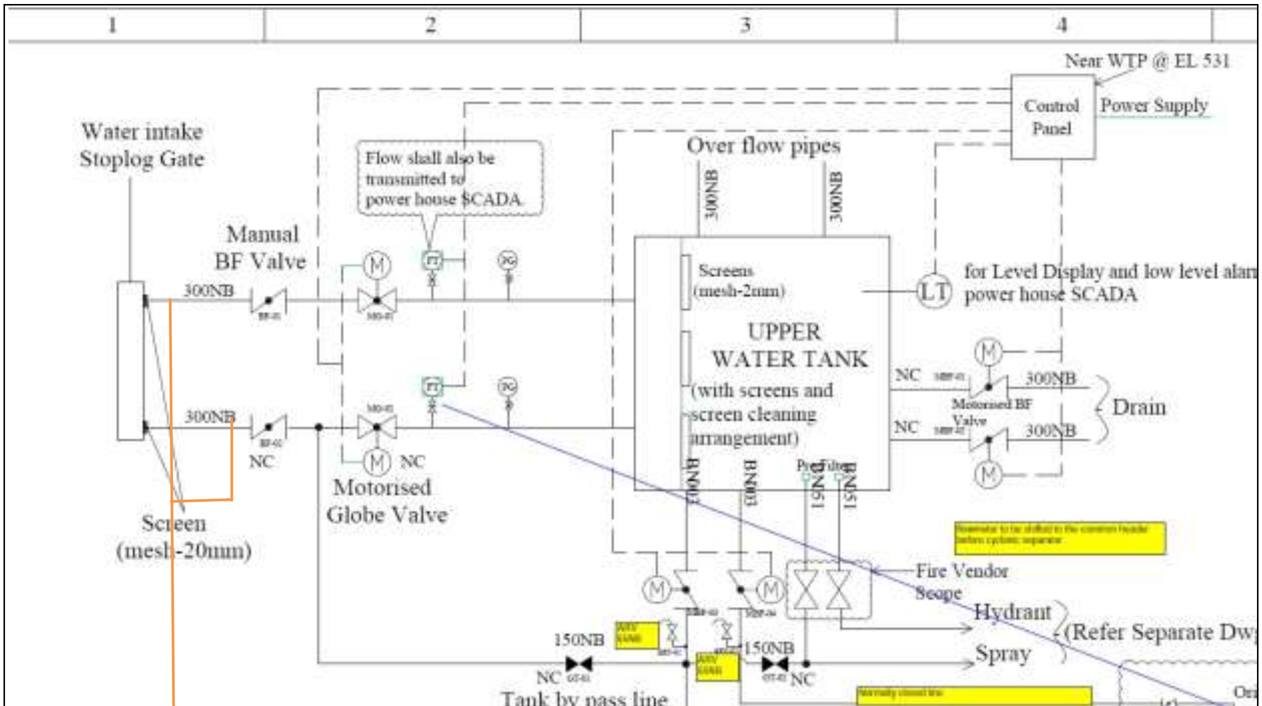
Design issue discussed with OEM – M/s BHEL. Isolation of oil circuit from water circuit may be done by design modification.

Case :4 Industrial line back flushing arrangement

Defect Identification

Industrial water supply for Koldam Power House is directly from Dam at EL 635.50 m which is below MDDL of EL 636.00 m Fig. 4.1
Inlet mesh/filter provided at the suction of these lines chokes frequently with debris from the river causing reduced flow of the industrial water used for various purposes in power house such as treated water formation for generating unit requirements, fire fighting system, and various other critical applications.

As the inlet is not accessible, diver services were employed to clean the suction from debris but the diver services cannot be employed when units are running which may have lead to emergency industrial water crisis situation during peak season. The matter was taken up with Engineering, and the solution given was to apply the pressurized air at the inlet from dam side with help of the fabricated nozzles, but solution did not solve the problem.



Industrial lines punctured for backflushing through Portable compressor (Modification)

Fig.4.1

Solution adopted

Both the lines installed with back flushing arrangement by compressed air from downstream side. Valves in the downstream to be closed when back flushing, line gets pressurized, and throwing away the debris from the inlet mesh.

Case 5: Guide vane servomotor cup seal replacement

Defect identification

Oil leakage observed from Guide vane servomotor. The problem was prominent at particular opening of the Guide vane servomotor.

Solution adopted

Cup seal is to be replaced in minimum possible time to minimize unit non-availability.

For maintaining Guide vane bedding, locking of the regulating ring is required. The turn buckle opening Fig 5.1 was not possible without the individual movement of the servomotors. Hydraulic

Isolation of the faulty servomotor from the hydraulic circuit is done by blanking the opening closing lines to that servomotor. The faulty servomotor was operated for replacement of cup seal through 4-5 bar air pressure of service air. Use of air for servomotor movement lead to reduced downtime of the servomotor. Restoration of guide vane servomotor done in six hours, and making unit available.

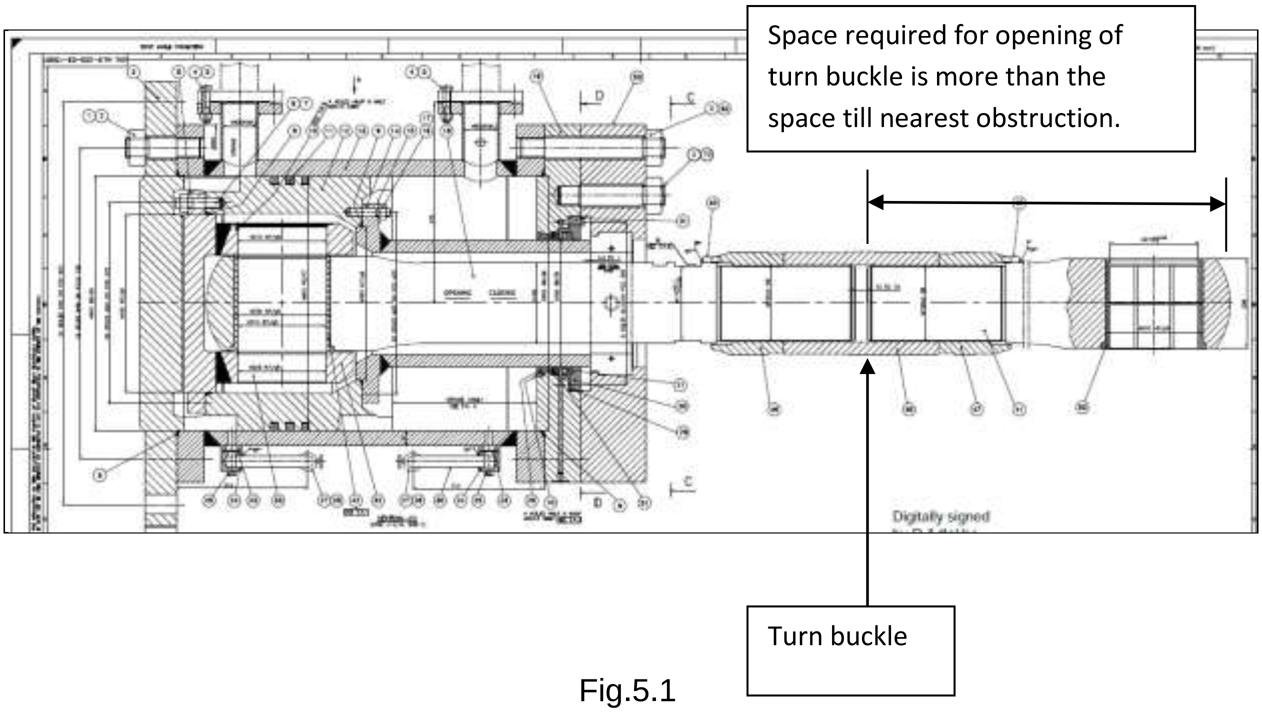


Fig.5.1

Case 6: Unit # 03 Shaft Seal Leakage

Defect identification

During routine inspection of Unit # 03, TGB oil level found increased, water PPM in Oil also found increased. Enhanced shaft seal leakage observed with abnormal sound.

Solution adopted

During shaft seal assessment vertical high pressure jet observed which crossed the centre piece to the TGB oil housing Fig. 6.1

Since problem observed in peak season immediate solution was required to ensure Unit availability. The water jet was diverted by fixing a diversion plate. Shaft seal leakage was continuously observed.

O-ring being replaced in Unit shut down for annual maintenance.

Water Entered into oil housing after crossing the centre

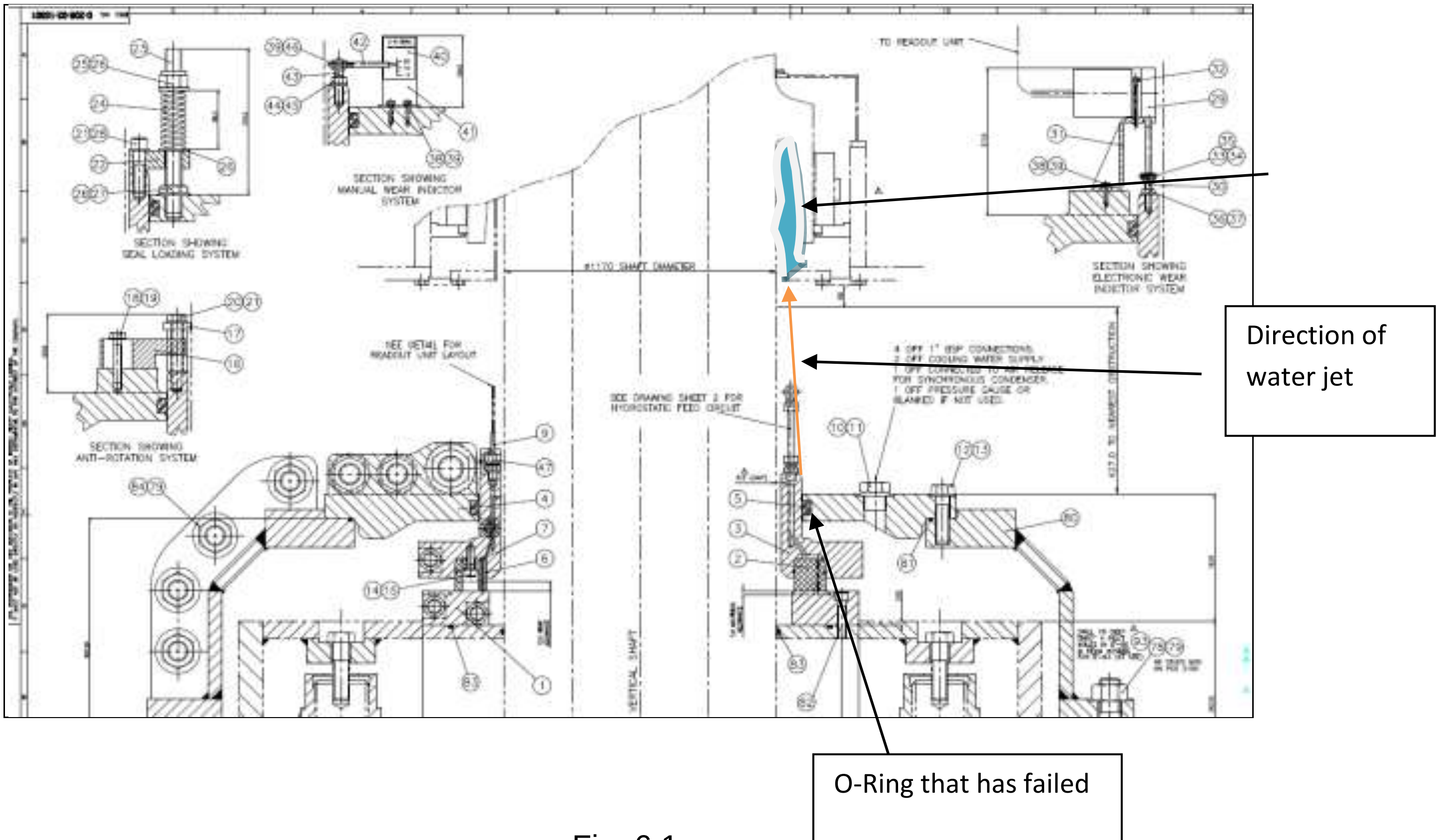


Fig. 6.1

Case 7: Unit # 02 Hydraulic Oil carbon content

Defect Identification

During routine inspection of Unit # 2, hydraulic oil colour found black.
Sample of oil sent to NETRA (NTPC Energy Technology Research Alliance) for testing.
As per report oil properties intact except for deterioration in NAS value due to suspended carbon particles. Fig .7.1

Solution adopted

Centrifuge type filtration machine supplied under EM package used for oil filtration but it was not able to clear the oil from the carbon particles. Depth filtration type machine being employed for cleaning of the oil.
Source of carbon particles to be identified.

(B) Analysis result:

Sl. No.	Test Parameters	Unit of Measure	Method reference	Safe Limit (ISO VG 46/32)	Sample name / NETRA sample Id	
					OST#2	PP#2
					572	573
00	**Appearance**	Visual obs.	BIS-1012	*	Clear	Dark / with suspended carbon particles
01	**ASTM Colour**	*	ASTM D1500	5.0 (Max.)	1.0	2.2
02	**Moisture content**	mg/kg	ASTM D6304	100 (Max.)	125	40
03	**Total Acid No. (TAN)**	mg KOH /gm	ASTM D974	0.3 (Max.)	0.06	0.07
04	**Kin. Viscosity@ 40 C**	centistokes	ASTM D445	41.4-50.6	42.8	42.3
05	**Kin. Viscosity@ 40 C**	centistokes	ASTM D445	*	N/T	N/T
06	**PQ Index**	*	Custom	<50	7	8
07	**NAS-1638**	*	ISO-4406	12	10	>14 / Out of range
08	**Impurity**	ppm	Membrane filtration	50	16	24

Legend : 'N/T' means 'Not Tested'; 'N/R' means 'Not Required'; BDL means 'below detectable limit'

Note: Recommended safe limits are as per COS-ISO-00-OGN/OPS/CHEM-009 or 015 or BIS-1012 or as applicable

REMARK: Power pack (PP#2) oil sample contains suspended carbon particles. No other wear metals were found in oil. Oil requires filtration only as rest quality parameters are normal. Source of such contamination may be identified for corrective action.

Tested by: G.D. Vani (E3)

Group-In-Charge

(Dr. R. Das) / AGM (NETRA)

Fig.7.1