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KALOL UNIT



PLANT TURNAROUND REPORT

(MARCH - APRIL - 2010)

INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

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PREFACE

The Annual Plant Turnaround for the year 2010 was taken from 22nd of March, 2010, for carrying out Preventive maintenance of Static & Rotary equipments, Statutory IBR inspection, Preventive maintenance of Electrical & Instrument systems, Civil related jobs and for attending jobs which were pending for Shut down.

After ensuring availability of all the required material for shutdown and awarding contracts for various shut down jobs, it was decided to stop Ammonia Plant and Urea Plants on 21st March, 2010. This shutdown report contains Plant wise and section wise details of the jobs carried out. Ammonia plant was restarted on 5th of April, 2010 and regular production resumed on 5th April, 2010. Similarly, Urea plant restarted on 5th April, 2010 and production resumed on 5th April, 2010.

Critical jobs like, replacement of Tube bundle of Waste Heat Boiler 101-CA was replaced with available spare tube bundle , RLA Study of BHEL Boiler conducted by M/S Alstom Projects , Preventive Maintenance of all Cooling Water Pumps, BFW Pumps and Turbines.

The Turnaround was carried out smoothly due to meticulous planning of all activities like planning of manpower, material and other resources. Due to exemplary efforts put in by all Personnel at all levels, turnaround jobs could be completed in the scheduled period of 15 days for Ammonia Plant and Urea Plant.

Safety was one of the major aspects, which was given top most priority during the execution of various jobs. All the jobs were carried out considering all safety aspects and the use of safety equipments was ensured during execution of jobs. Necessary training for safe working in the Plant was given to the Manpower employed by all Contractors and strict vigilance was kept by Fire & Safety section during execution of Critical jobs.

MECHANICAL

AMMONIA:

- Tube bundle of Waste Heat Boiler 101-CA was replaced with available spare tube bundle due to leakage from Inner to outer Tube sheet bolted joint, Gas Side joint, Elbow joint and Prolong use.
- The gasket between inner tube sheet & outer tube sheet face of 101-CB was replaced by removing the tube bundle from its position and installed after hydrotest of Tube Bundle.
- The Governors of Air Compressor Drive Turbine (101-JT) and Refrigeration Compressor drive Turbine (105-JT) was completely overhauled.
- ID Fan drives Turbine (101-BJT) Elliot make and CO2 Gas Recycle compressor (117-J) was overhauled.
- The plugged Bundle of 131-JC was replaced with New Tube Bundle having Duplex steel Tubes.
- The PGPL Governor of BFW Pump drive Turbine (104-JAT) was revamped with 505 Electronic governor.

- The Rotor of BFW Pump (104-J) was replaced with new rotor assembled with local manufactured shaft.
- Damaged Gearbox of SP-70 valve was replaced.
- NRV-ARVs of 115-JA, 115-JB, 104-J and 104-JA were overhauled.
- Routine preventive maintenance jobs of all rotary machines were carried out.
- Boilers 101-F, 112-C & 107-C were inspected by Boiler Inspector and got approval of CIB Gujarat.
- The Sys Gas piping loop of new convertor (S-50) was attended at three locations, where leakages were observed during plant operations.
- Piping work carried out for installation of Radar type Level Indicator in 106-F.
- Gas filters were installed at Gail Metering station for RLNG.
- 10 nos burner blocks of Primary Reformer were replaced.

UREA:

- Minor Overhauling of LP Case & HP case of Hitachi CO2 compressor, Siemens turbine and major overhauling of Gear box was carried out.
- Lube oil Tank of Hitachi compressor was cleaned after emptying the Tank. The same oil was re used.
- Lube oil turbine of Hitachi compressor Train was taken up for major overhauling for the first time after installation in 1997.
- Routine inspection of Autoclave (V-1201), HP Condenser (H-1202) & HP Stripper (H-1201) was carried out. Flush grinding and rewelding of liner welds was performed in compartment no. 2nd and 4th. Repairing in V-1201 was carried out as per inspection report. Eddy current testing of tubes of H-1202 and H-1201 was carried out and found OK.
- Shell of Flash Tank condenser, H-1421 was replaced with new one.
- M-1403-1 drive Geared Motor (M/s PBL make) was replaced with double reduction helical gear box of M/s Ingeco make.
- The fluid couplings of scraper (M/s Hansen, Belgium make) were replaced with new indigenous fluid coupling (Make-M/s Premium Energy Transmission Ltd).
- Scraper Gear box M-1402-1 was replaced with reconditioned Gear Box.

OFFSITES:

- Preventive Maintenance of all Cooling Water Pumps, BFW Pumps and Turbines.
- RLA Study of BHEL Boiler conducted by M/S Alstom Projects.
- IBR inspection of BHEL Boiler (GT-2068)
- Removal of Rubber Expansion Bellows from 42" CW supply & Return lines.
- Overhauling of Automatic Recirculation Valve (ARV) of BFW Pump, P-5111.
- Complete Revamping of Ammonia Cooling Tower Cells (H-4401/4 to 6)

B & MH:

- Overhauling of Reclaim machine was carried out.
- All conveyor and drive gear boxes were taken for preventive maintenance .
- Preventive maintenance of all packer scales and stitching machines.
- New complete S.S. structure Flap assemblies, weighing receptacle assemblies & Sack grip assemblies replaced along with main frame in Packer Scale No. 2, 4 , 8 & 9 B.
- Replaced damaged conveyor belt of M 2142.
- Semi automatic bagging and weighing machine was installed in train no. 9A. Now two nos. of packer scales 9A and 9B are operating on this train with single slat conveyor, departmentally manufactured and installed to suit the speed of two bagging machines.

ELECTRICAL:

Annual plant turnaround-2010 was carried out during March-April 2010. During this period various preventive maintenance jobs and modification jobs were carried out which are illustrated as below.

- All the feeders of MCC panels were thoroughly cleaned. Burnt out/ damaged components of feeder were replaced. Tightness of connector was checked.
- Replacement of MCC-2B/2E was carried out.
- Preventive maintenance of all the transformers was carried out. Marshaling boxes were checked. Insulation resistance between HV to earth, LV to earth and Between HV and LV windings were checked and recorded. Oil having low BDV values in transformers was filtered.
- Complete Overhauling of TR-4A, TR-4B, and TR-5B was done by lifting the core. Radiators and radiators valve were replaced in TR-
- Servicing of the Siemens make HT VCBs and L&T and Siemens make LT ACBs were carried out. Closing and tripping time of all the VCBs were checked and calibrated.
- All the HT motors installed at various locations in plants were overhauled
- All the critical motors installed at various locations in plants were overhauled.
- All the MOVs were thoroughly checked in various plants.
- Actuators of following MOVs were replaced by Rotork actuators and modified control wiring accordingly.
- Preventive maintenance carried out on all rope switches installed on conveyors.

INSTRUMENTATION:

AMMONIA:

- Replaced the existing obsolete control valves ARCV-3 and LCV-134 with new KOSO make control valves . The new valves were taken in line and is functioning well.
- Replaced old LCV-21 with redundant valve LCV-860A (800-J hotwell level control valve) and it is functioning well.
- FRCV- Control valve stroke was adjusted to the original value (4”) to overcome the limitation of maximum flow capacity.
- The installation of TV-484 control valve was changed from Vertical to horizontal for ease of maintenance.
- Electronic Governor for BFW pump was commissioned.
- Digging work for new cable trench to accommodate additional cables of integrated control system. was carried out in Marshalling as well as Control Room.
- AMC services of DCS/PLC systems/Analysers/UPSS were carried out with the help of supplier’s service engineers.
- Preventive maintenance of control valves was done.
- Calibration of all quality affecting instruments were carried out.

UREA:

- Replaced the control valve HICV-1201 with BHDT make new control valve.
- Preventive maintenance of Nucleonic gauge LRC-1201 were carried out.
- FS-1101(Old FS)- Micro motion Ammonia mass flow meter was removed and sent to FCRI, Palakkad for calibration. He instrument was installed back after calibration and put in line.
- Corroded MS Instrument air headers of Hydrolyser area were replaced by SS headers for maintaining good air quality and for better reliability.
- Servicing of DCS/Omron PLC system for Hitachi compressor was carried out by suppliers’ engineers.
- Servicing and overhauling of the control valves was done .

UTILITY AND OFFSITE:

- Maintenance of control valves was done.
- Servicing of DCS/PLC system for Boiler & DM Plant was carried out by suppliers’ engineers.

BAGGING PLANT:

- Road Weigh Bridges and weighing machines were overhauled and calibrated. Replaced all the six load cells (Cap. 25T each) of Ashbee Weigh Bridge with new 'Flintek' make (Capacity- 40T).
- Commissioned New PBL make bagging Machine No. 9B

CIVIL:

Following jobs were executed during annual turn around.

- Repairing of damaged plywood sheets for Urea cooling tower cell no. 1 & 2 and for Ammonia cooling tower cell no. 3, 5 & 6.
- Construction of open channel for Urea cooling tower and construction of brick wall work inside the Urea cooling tower.
- Excavation & Grouting work for damage Cooling tower pipe line risers.
- Epoxy plaster for Belt conveyor gallery for M -2112 and M-2117 suspenders.
- IPNET coating inside the Silo and B & MH plant and Hopper floor area.
- Epoxy paint work for transformer tower, outside portion of M.C.C building and for Bagging plant.
- Repairing of damage bitumastic lining work of Silo, top floor of Prill tower and also at conveyor belt and Offsite / D. M. Plant.
- Ceramic tiles fixing at top floor in side wall in B& MH plant. Repairing of Damage Plaster In B & MH Plant.
- Repairing of damaged insulation bricks for Auxiliary Boiler.

TECHNICAL:

The annual turnaround of about 15 days, provide opportunity to Technical Department to undertake execution of the jobs related to EWRs and various modification schemes.

Following jobs were carried out by Technical Department in various Plants in Annual Turnaround - 2010 these included major jobs of replacement of Boiler Burners and HTS bottom Grid Modification.

AMMONIA:

- Installation of Vent Control Valve manifolds at LTS exit process gas line
- Installation of Filters at Main RIL gas supply line and its Bypass at GMS (Feed gas Line Modification)
- Modification of lines for Heating of fuel gas (AG + RIL gas) in 172- C with LP steam
- Modification of lines for Heating tail gas in 151-C with LP steam
- FICV-002 , 2 No isolation valves and its bypass to be removed and pipe to be provided at GMS. (Feed gas Line Modification)

- 1st Vent Valve -PIC-1A removal, feed line isolation valve removal and gas feed pipe line modification at pipe rake. Removal of PIC-1 A down stream pipeline connection to vent header. (Feed gas Line Modification)
- Removal of PIC-004 loop. Direct connection of PIC-006 down stream line to Separator 178-F inlet. Fuel gas connection to Pre-reformer (3") to be modified from 178-F inlet line. Removal of redundant pipelines. (Fuel gas Line Modification.)
- New fuel gas line for primary reformer tapping (8") from 178-F separator d/s pipe line near 178-F. Connection of 8" tapping with 12" gas header near PIC-004 with Elbow. Removal of 12" fuel line. (Fuel gas Line Modification)
- Interconnection piping for Gas firing in Naphtha tip of arch burners (DBA-16) in Ammonia Plant
- 4" Interconnection from Tail Gas to Syn. gas Line to BHEL BOILER.
- 156 F Boiler blow down control Valve LC-21 to be replaced and bypass line to be relocated/ modified.

UREA:

- Shifting of Vapour line of Ammonia water and Urea solution tank to Vent stack.
- PICV-1129 (23 to 4 ata steam) Installation.
- Air- Blower Piping Modification.

OFFSITE:

- Provision of filter in common outlet header of ACF's in DM plant.
- Installation of Orifices in Burner Gas inlet Lines

Above jobs have been completed within stipulated time because of meticulous planning, procurement of material at right time and also completion of major prefabrication work well before start of the shut down. We completed all these jobs through our SOR contractor at site and no additional agency was engaged for carrying out these jobs except for the LTS Vent Line modification and related piping Job.

Emphasis was also laid on cost savings in all possible ways. More and more Piping materials and valves etc were used out of our existing stocks. Piping were so designed, so as to use material out of our stocks in most cases thereby minimizing Procurements, by meeting the requirements with in-house availability. All NG line modification jobs were completed with no additional procurement. Efforts were also made to recondition Valves and retrieve Pipes, Fittings and Flanges from lines which were removed in earlier years due to modifications.

As lots of rigging work was involved during execution of above jobs, safety was given top most priority in and thus jobs were completed with no unsafe occurrence.

PLANT TURNAROUND MARCH - APRIL - 2010

GENERAL - DETAILS

EQUIPMENT UTILISED (IFFCO) :

MANPOWER UTILIZED:

IFFCO MANPOWER:

HIRED - CONTRACT MANPOWER:

Sr. No.	Category	Man days
1	General Fitter	550
2	Rigger	692
3	S.S. Rigger	1731
4	Fabricator	115
5	Grinder	161
6	Gas Cutter	78
7	Welder (HP)	37
8	Welder (ARC)	52
9	Carpenter	78
10	Mason	65
11	Machinist	39
12	Draftsman	13
13	Forklift Operator	26

THE PLANT TURNAROUNDS AT A GLANCE										
SR. NO.	YEAR	AMMONIA PLANT				UREA PLANT				REASON IF ANY
		PERIOD FROM PRODUCTION TO PRODUCTION								
		FROM	TO	DOWN TIME		FROM	TO	DOWN TIME		
				DAYS	HRS			DAYS	HRS	
01	1975	06-05-75	21-05-75	16.00	-	06-05-75	21-05-75	16.00	-	Planned
02	1976	26-03-76	20-04-76	26.00	-	26-03-76	20-04-76	26.00	-	Planned
03	76-77	05-12-76	22-01-77	49.00	-	05-12-76	24-02-77	51.00	-	101-JT B/D
04	1978	21-02-78	15-03-78	23.00	-	21-02-78	25-03-78	31.00	-	101-BJ B/D
05	1979	21-05-79	30-06-79	41.00	-	10-05-79	01-08-79	82.00	-	K-1101/2, 3rd Stage Cylinder
06	1981	12-04-81	10-05-81	29.00	-	08-04-81	12-05-81	35.00	-	101-B Headers Planned
07	1984	01-01-84	25-01-84	25.00	-	01-01-84	25-01-84	25.00	-	Planned
08	1986	19-03-86	03-05-86	45.00	-	04-03-86	01-05-86	59.00	-	Reformer Revamping / HP Scrubber B/D
09	1987	12-04-87	03-05-87	21.00	-	12-04-87	02-05-87	20.00	-	Planned
10	1988	18-04-88	14-05-88	27.00	-	18-04-88	13-05-88	26.00	-	Planned
11	1990	05-02-90	05-03-90	29.00	688.67	31-01-90	07-03-90	35.00	829.00	Planned
12	1991	24-02-91	13-03-91	18.00	429.08	23-02-91	14-03-91	20.00	459.25	Planned
13	1992	03-11-92	03-12-92	30.60	734.91	03-11-92	04-12-92	31.00	744.75	Planned
14	1993	12-09-93	23-10-93	42.00	986.50	12-09-93	29-10-93	47.00	1120.58	Revamp-II
15	1995	14-01-95	27-01-95	14.00	311.34	11-01-95	26-01-95	16.00	352.18	Scrubber H-1203 -B/D
16	1996	14-06-96	13-07-96	30.00	712.00	13-06-96	13-07-96	30.00	694.25	Autoclave V-1201 Leakage
17	1997	12-05-97	17-06-97	35.60	875.00	12-05-97	17-06-97	36.20	870.50	Planned
18	1998	22-04-98	19-05-98	27.50	660.00	20-04-98	19-05-98	30.00	720.00	Planned
19	1999	12-04-99	30-04-99	18.00	434.50	11-04-99	28-04-99	17.00	409.75	Planned
20	2000	03-04-00	27-04-00	24.42	586.25	03-04-00	28-04-00	25.43	610.50	Planned
21	2001	25-03-01	14-04-01	20.90	501.50	25-03-01	15-04-01	21.26	510.25	Planned
22	2002	20-03-02	22-04-02	33.40	801.58	20-03-02	23-04-02	34.31	823.50	Planned
23	2003	28-05-03	25-06-03	28.04	673.00	28-05-03	25-06-03	28.33	679.83	Planned
24	2004	20-05-04	09-06-04	20.00	495.17	20-05-04	09-06-04	20.00	480.25	Planned
25	2005	22-05-05	29-06-05	38.75	930.50	22-05-05	24-06-05	33.85	812.50	Planned
26	2006	31-03-06	06-05-06	35.93	862.42	29-03-06	06-05-06	37.06	889.50	Planned
27	2007	14-04-07	08-05-07	23.72	569.25	14-04-07	05-05-07	21.38	513.0	Planned
28	2008	24-03-08	14-04-08	20.26	486.25	24-03-08	14-04-08	20.40	489.50	Planned
29	2009	16-03-09	10-04-09	25.31	607.33	16-03-09	09-04-09	24.63	591.00	Planned
30	2010	21-03-10	05-04-10	15.07	361.50	21-03-10	05-04-10	15.25	366.00	Planned

SHUT DOWN RELATED CONTRACT

SR. NO.	PLANT	WO NO. & DATE	DESCRIPTION OF JOB	VENDOR'S NAME
1	Mech(A)	20081017 14.01.09	Commissioning of Electronic Governor of 104-JT	M/s Goodwill Governors Mumbai
2	Mech(A)	20090324 30.06.09	Installation & commissioning of "Rotark" make valve actuator for SP-70	ROTORK CONTROLS (INDIA) PRIVATE LIMITED[R00494
3	Mech(A)	20091315 08.03.10	Major overhauling of rotary Machines of Ammonia Plant	M/s.SPIC-SMO Limited Navi Mumbai
4	Mech(A)	20091316 08.03.10	Major overhauling of rotary Machines of Urea & utility Plant	M/s.Rotodyne Engineering Service Pvt.Ltd,Hyderbad
5	Mech(A)	20090973 21.12.09	Overhauling of relief Valves	M/s Flotech Engineering Surat
6	Mech(A)	20091029 28.12.09	Scaffolding & Blinding - Deblinding jobs	M/s. MAHAVI ENGINEERING WORKS, VADODARA.
7	Mech(A)	20090956 15.12.09	Overhauling of 117-J	M/s Malhan Enterprises A'bad
8	Mech(A)	20091175 15.02.10	Services for Replacement, Repair & Testing of Tube Bundle of 101-CA/CB during Shut-down -2010.	M/s. Shree Ganesh Engg. Co. A'bad
9	Mech (U)	Trail basis	Installation of Vibropriller on Trial Basis	M/s Casale, Italy
10	Mech (U)	20090458 19/08/09	Installation of SIMCO Prill bucket	M/s SIMCO, Mumbai
11	Mech (U)	20081036 17/12/09	Vertical Type Hydraulic / Fluid Couplings for Prill Tower Scrapper M-1402 1/2	M/s Premium Energy Transmission Ltd., Ahmedabad
12	Mech (U)	20091026 28/12/2009	Repairing of Weld joints of Autoclave liner	M/s Ganesh Engg Co., Ahmedabad
13	Mech (O)	20091313 08/03/10	RLA Study of BHEL Boiler	M/s.Alstom Project India Ltd, Vadodara
14	Mech (O)	20091133 21/01/10	Fabrication & erection of Tube sample during RLA study	SHREE GANESH ENGG COMPANY
15	Mech (O)	20090923 05/12/09	Services for In-situ gland re-packing of valves	AMRUTHA ENGINEERING
16	Mech (O)	20091033 02/01/10	Services for In-situ machining , Overhauling and Testing of HP/MP Steam / Gas / Liquid services Safety Valves / Relief Valves / Pilot Operated Valves	EFCO Maschinenbau
17	Mech (O)	20090940 08/12/09	Removal of Rubber Bellows from CW Header	J&J Engineers.
18	Mech (B&MH)	20091072 02/02/2010	Contract for overhauling of Reclaim machine	M/s Emtici engg,VV Nagar
19	Mech (B&MH)	9920457 04/04/2007	Contract for overhauling of tracking roller	M/s Hosch Equipments, Kolkata
20	Mech (B&MH)	9920534 13/04/2007	Servicing of stitching machine	M/s Gabbar Engg Ahmedabad
21	Mech (B&MH)	20091187 02/02/2010	Hot vulcanizing of conveyor belts	M/s J.K.Rubber works, Ahmedabad

22	Civil	20091073 28-01-2010	Repair and maintenance of Bitumastic Lining, Acid and Alkalis proof brick lining in Strong / Week effluent pit, Water Treatment Plant, Prill Tower-top floor, Bagging Plant and other Plant areas.	Indochem Engineering Company
23	Civil	MPR No- 2009112	Providing and applying IP net protective coating on RCC structures of Silo, B & MH plant area, Conveyor Gallery, Prill- Tower etc.	Ms.Krishna chem
24	Civil	20091146 28-01-2010	Maintenance of damaged cooling tower deck covering by water proof plywood sheet.	Sudama Furniture Pvt. Ltd.
25	Civil	20091062 06-01-2010	Shifting of debris, malva, scrap etc from various locations in plant site.	Roshni Construction Co.
26	Civil	20091059 08-01-2010	Providing and applying Epoxy painting & White wash to RCC structure of Bagging Plant and Urea Plant.	Vaidehi & Company
27	Civil	20091060 18-01-2010	Repairing of plaster in Bagging plant.	I.M.NAIK
28	Civil	20091061 08-01-2010	Construction of open channel near Cooling Tower.	Jalaram Construction Co.
29	Civil	20091096 15-01-2010	Strengthening and retrofitting of RCC columns by jacketing & repairing of flooring in Bagging plant & WTP at Narmada Project.	Gayatri Construction Co.
30	Civil	20091156 28-01-2010	Repairing of Refractory lining work for Primary Reformer,Auxiliary and BHEL boiler area.	M H DETRICK (INDIA) Pvt.Ltd
31	Inspection	20091022 30-12-09	NDT Teams for carrying out dye penetrant testing.	NDT Services, Ahmedabad
32	Inspection	20090987 21-12-09	NDT Teams for Ultrasonic thickness measurement work.	NDT Services, Ahmedabad
33	Inspection	20090985 17-12-09	NDT Teams for carrying out Ultrasonic flow detection.	NDT Services, Ahmedabad
34	Inspection	20091032 01-01-10	NDT Teams for carrying out Radiography work.	NDT Services, Ahmedabad
35	Inspection	20091025 30-12-09	IN-SITU Metallographic work.	TCR Advanced Engg. Vadodara.
36	Inspection	20081276 31-01-09	NDT Teams for carrying out magnetic particle work.	NDT Services, Ahmedabad
37	Inspection	20090842 23-11-09	Eddy current testing of HP Condenser tubes.	Testex NDT, Mumbai
38	Electrical	20090883 1/12/2009	Servicing of Chhabi battery charger	Chhabi Electrical Pvt. Ltd.
39	Electrical	20091196 03/02/10	Overhauling of HT motors	M/s Electrodyne Mohali,Punjab
40	Electrical	20090955 18/12/09	Servicing of Siemens HT breakers	M/s Siemens Ltd. Vadodara

41	Electrical	20091263	Servicing of L&T make LT Air circuit breakers	M/S L & T
42	Electrical	20091020 29/12/09	Maintenance of Transformers	M/s Unique Transformers Ahmedabad
43	Electrical	20091090 18/01/10	Servicing of BHEL make MOCB	M/s Sun Gentech PVT. Hyderabad
44	Electrical	20091004 23/12/09	Servicing of Siemens LT circuit breakers	M/s Pradip power Tech Ahmedabad
45	Electrical	20091082 08/01/10	Contract for services of electrician for shutdown jobs	M/s A N Electricals Gandhidham
46	Electrical	20091016 30/12/09	Servicing of Rotork MOVs	M/s Rotork Controls (India)
47	Electrical	20091153 28/01/10	Rerouting of electrical cables in Urea plant	M/s Parikh Electric Corporation, Ahmedabad
48	Electrical	20090280 & 20090282	Rotork make valve actuators	Rotork control India Pvt Ltd
49	Electrical	20090773 13/11/09	Revamping of MCC 2B/2E	Parikh Electrical Corporation
50	Electrical	20080261	Overhauling of LT motors	Indian Heavy Electricals
51	Instrument	20090768 04/11/2009	AMC for servicing of Analyzers	ABB Limited Ahmedabad
52	Instrument	20090691 10/10/2010	Service / modification of butterfly valve	KENT INTROL LIMITED, Nasik, Maharashtra
53	Instrument	20081068 15/01/2009	AMC for maintenance of DCS / PLC in Plant	YOKOGAWA INDIA Ltd., Vdodra
54	Instrument	20080984 08/12/2008	Maintenance of control valve	HI-TECH CONTROLS Vadodra
55	Instrument	20090378 23 JULY 2009	Occasional0 Temporary Jobs	SAYED AND CO SAIJ
56	Instrument	9921526 14/02/2008	AMC for UPSS System in Ammonia Plant	Instrumentation Limited Kota, Rajasthan
56	Instrument	20090180 27-05-2009	AMC for OMRON PLC	Kevin Technologies Pvt. Ltd., Ahmedabad
58	Instrument	20090794 14-11-2009	Assisting IFFCO during annual turn around	Santech Systems, Ahmedabad
59	Instrument	W.O. 20091021 26/12/09	Weigh bridge (40ton, Main Gate)	Ashbee systems Pvt Ltd.
60	Instrument	W.O. 20081377 17/02/09	Servicing of Allen Bradely make PLC	Pima control Pvt Ltd.
61	Instrument	PO.20090868 Dt : 09/12/09	Installation of P/S 9B and load meter	Prayas Engineering ltd.
62	Instrument	W.O.NO: 20081496	Servicing of Beltweigher System	EMTICI Engg Ltd V.V.Nagar
63	Instrument	20081044 Dtd. 5/1/2009	Work Contract for incidental Inst Job	Santech Systems, Ahmedabad
64	Mech (Plg)	20090531 29.09-09	Annual Rate Contractor for supplying & application of Anti-corrosive paints in Urea & B&MH plant	M/s.Vaidehi & Co, Baroda

65	Mech (Plg)	20090991 02-01-10	Annual Rate contract for Fabrication & Erection of piping & steel structure.	M/s.Smitha Engineers– Kalol
66	Mech (Plg)	20091248 19-02-10	Opening & Box-up of Heat Exchangers in Ammonia, Urea and Offsite plants.	M/s. General Engg. Bharuch
67	Mech (Plg)	20091064 21-01-10	Assisting IFFCO during Breakdown/Plant Turnaround jobs.	M/s. General Engg. Bharuch
68	Mech (Plg)	20091064 21-01-10	Assisting IFFCO during Breakdown/Plant Turnaround jobs.	M/s. Ram Bahadur & Co, Pali Babu ganj
69	Mech (Plg)	9921620 07-12-09	Annual Rate Contract for Hydro jet cleaning of Heat Exchangers.	M/s.Deluxe Hydroblasting Services,Mumbai
70	Mech (Plg)	20091177 08.02.10	Rate contract for carrying out various insulation jobs.	M/s. Balaji Insulation
71	Mech (Plg)	20091179 08.02.10	Rate contract for carrying out various insulation jobs.	M/s. Khandelwal Insulation
72	Mech (Plg)	20080636 19.09.08	Rate contract for carrying out various Petty Maint. jobs.	M/s. Ram Bahadur & Co, Pali Babu ganj

MECHANICAL

AMMONIA PLANT

AIR COMPRESSOR TRAIN (101-J)

101-JT Air Compressor Drive Turbine Preventive Maintenance:

Turbine was decoupled and both ends Journal bearings and Thrust bearings were taken for inspection. Gauss readings of the bearing pads were measured and found within limits. The pads were visually inspected as well as dye penetration tested and found OK. One of the RTD embedded thrust bearing pad was not transmitting data. The RTD was inspected by the instrument section and found not working. Hence this pad was replaced by a new pad. Bearing clearances were taken and found within the design range. The governor drive gear assembly were also inspected and found OK.

101-JT Governor overhauling:

The 8 ½ CM governor was taken for overhauling. The Governor output piston maximum and minimum travel positions were noted under linked as well as de-linked condition. It was observed that the total travel achievable was only 30.90 mm which was less than the desired travel of 40 mm. Hence the governor was dismantled. A major discrepancy was observed in the head assembly. The roller guide plate (Part No 9) was found just below the roller (Part. No 6) while it should have been just above the roller. The angular contact ball bearings were also found with high clearance and abnormal noise. The Thompson ball bushings were also replaced by new one. The head assembly comprising of the following components was replaced by a completely new one.

- Governor body with key.
- Governor weight plate
- Governor weight and fasteners.
- Roller and hardened washers.
- Roller guide plate.
- Spring and spring seat (Top & Bottom)
- Governor stem and pin.
- ND ball & separator assembly with snap ring

After assembly, the output piston total travel was measured and found as 40 mm as desired. The governor was installed and linked to the nozzle valve assembly. Under linked condition, the total travel was measured and found to be 40 mm.

CONDITION: Linked with nozzle valve assembly.				
Time	Max Travel Position	Minimum travel position	Total travel	Remarks
BEFORE O/H	94.7	63.8	30.9	Very less
AFTER O/H	108.4	68.4	40	O.K.

CONDITION: De- Linked with nozzle valve assembly.				
Time	Max Travel Position	Minimum travel position	Total travel	Remarks
BEFORE O/H	94.7	63.8	30.9	Very less
AFTER O/H	108.4	68.4	40	O.K.

101-JT Nozzle Valve Assembly Overhauling:

The nozzle valve assembly was taken to reset the following

- The spring tension
- Lifting bar positioning (Gap between lifting bar & gasket seating face of steam chest cover.)
- Lifting bar parallelism.
- Valve setting: This was not to be disturbed.

The complete governing valve assembly comprising of lifting lever, steam chest cover, lifting bar with valves, lifting spindle etc was removed and taken for dismantling. The lifting bar along with the valves was removed and placed inside the steam chest. By placing shims below the bar at one end the bar was made parallel to the steam chest gasket seating plane, while allowing all the valves to seat and resting the bar on one of the valve. The distance from the bar top face to the steam chest gasket seating face was measured and noted. The bar was then removed.

Now on the governing valve assembly, the lifting lever was made parallel to the steam chest cover, by maintaining the centre line to centre line distance at 13'. Under this condition the lever was locked using jack screw. Both the springs were installed and the eye to eye distance was maintained at 8.5". The lifting bar was now installed and made parallel to the steam chest cover gasket seating face by maintaining the calculated required distance of "X" = L - ½ T on both the ends. The valve total clearances with the lifting bar were measured for records.

101-JLP Air Compressor Preventive Maintenance:

101-JLP, gear box end was decoupled. Journal bearings and Thrust bearings were visually inspected and dye penetration tested and found in good condition. Gauss reading of the bearing pads and base rings were measured and found within limits. Bearing clearances were taken and found within the design range. The entire bag filters as well as Roll-O-Matic filters were replaced by new one.

101-JR Gear Box Preventive Maintenance:

101-JR, HP end was decoupled. All the bearings were inspected and found in good condition. Both the gear as well as Pinion were inspected and found to be O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances were taken and found within the design range.

101-JHP Air Compressor Preventive Maintenance:

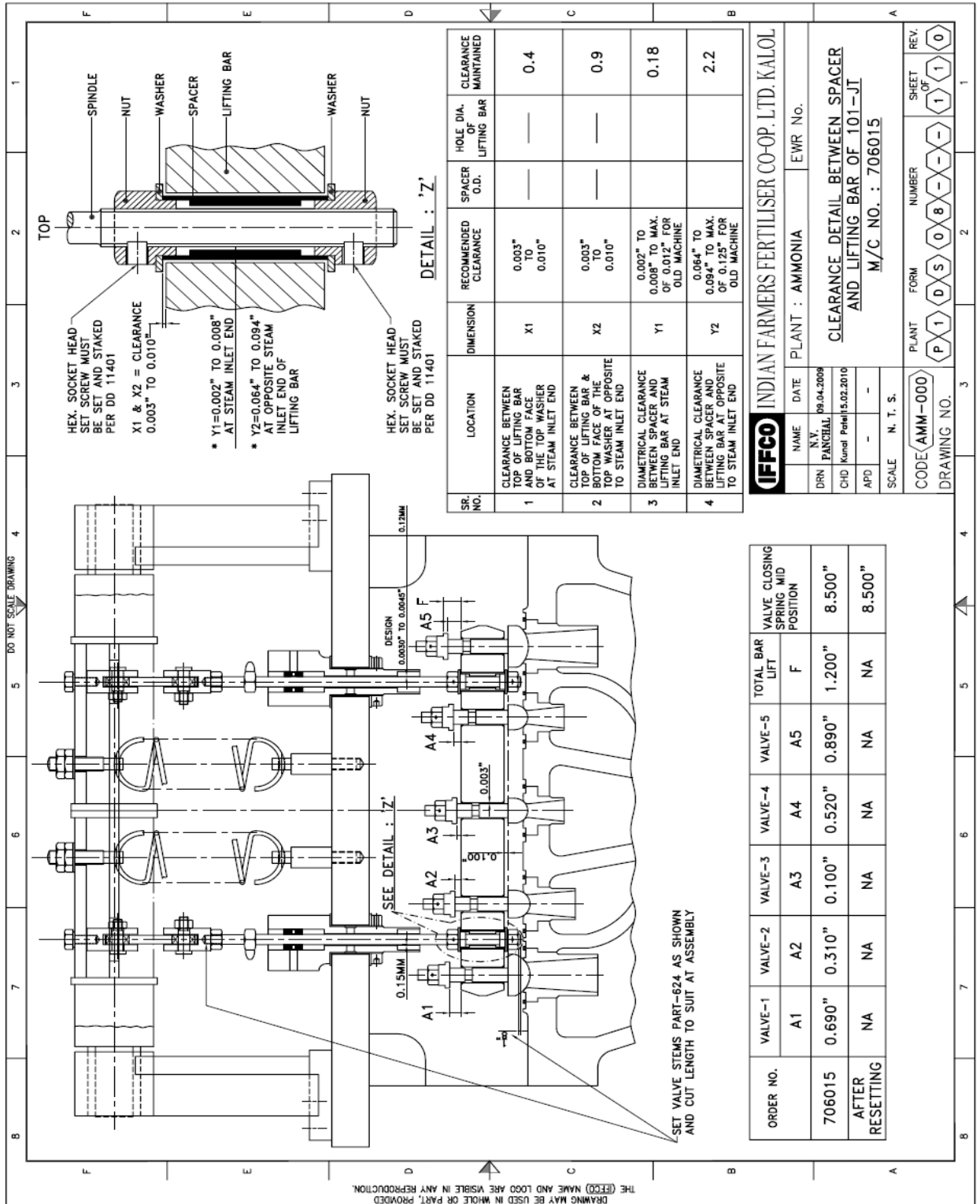
Drive end Journal bearing as well as thrust bearings were inspected and deep black burnt were observed on the inactive side thrust pads. The complete set was replaced by new one. One of the non drive end journal bearing pad was also having some burnt marks but since the clearances were within range, the same pads were used after dye penetration testing. Gauss readings of journal and thrust bearing pads and base ring, shaft journal, thrust collar were measured and found within limit.

101-JHP Suction bellow replacement:

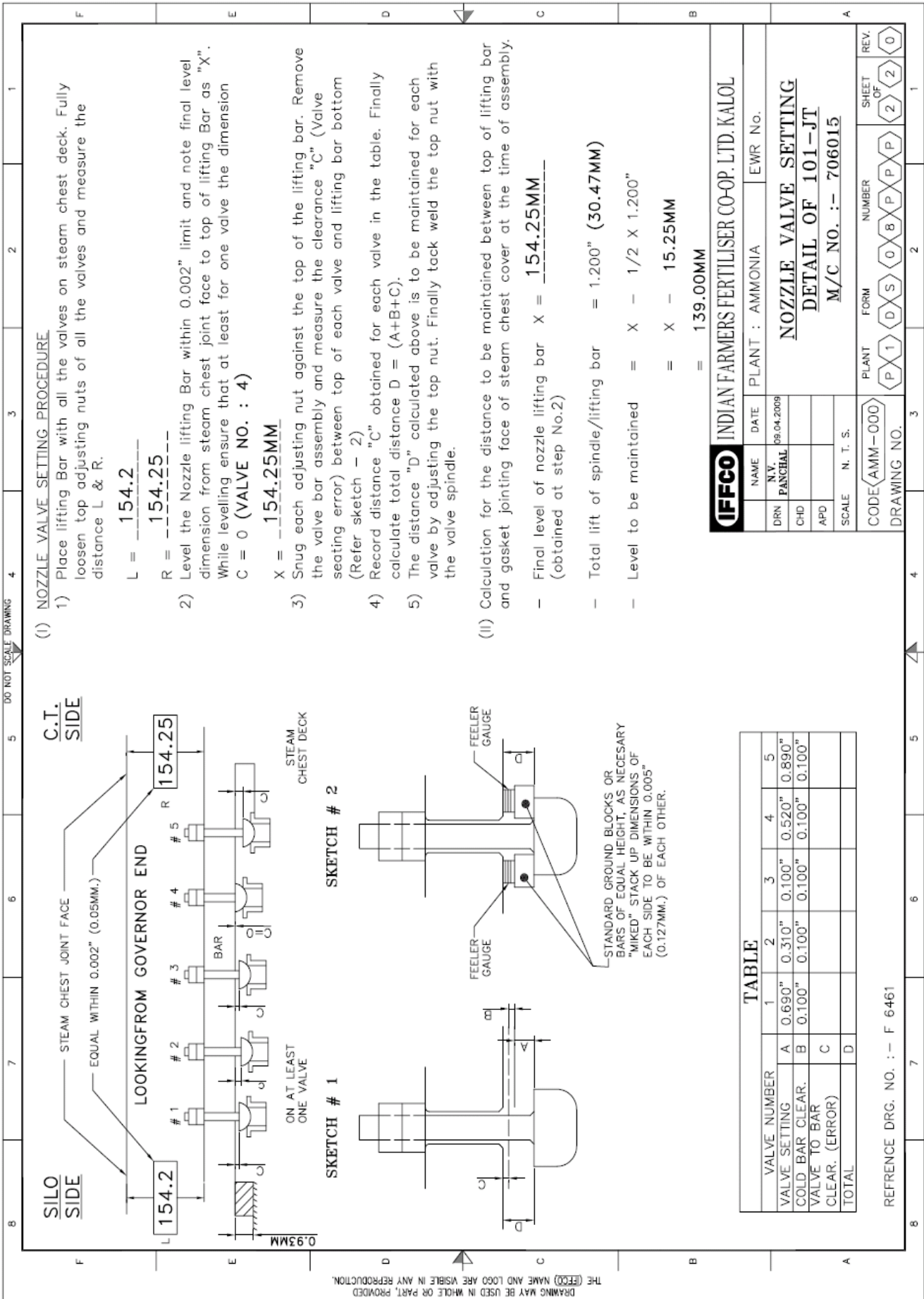
The suction bellow had leakage from the convolution and hence was replaced by new indigenous bellow manufactured at M/s Athulya Bellows.

Couplings Inspection:

All the couplings were visually inspected. The DBSE of all the couplings were measured and found OK. Wherever coupling hub locknuts have been provided, the coupling hub to locknut clearances were measured and found OK. Wherever locknuts are not provided, the coupling hub overhang/ override were measure and found OK except for 101-JR low speed gear coupling hub. This overhang of this hub had increased by 1 mm and hence the same was inserted by gas heating the hub to reduce the overhang by 1 mm.



101-JT Nozzle valve assembly clearances



101-JT Nozzle valve assembly settings

COUPLINGS INSPECTION REPORT – 101-J TRAIN

Description	Position	Design (Inch)	Before (mm)	After (mm)	
DBSE (With Rotor at extreme ends)					
101 JT-JLP	---	10.50	242.62	242.62	
101 JLP-JR	---	8.25	198.88	198.88	
101 JR-JHP	---	8.25	210.31	210.31	
Distance between Hub Face (With Rotor at extreme ends)					
101 JT-JLP	---	10.557	242.62	242.62	
101 JLP-JR	---	8.25	198.88	198.88	
101 JR-JHP	---	8.25	210.31	210.31	
Overhang (Hub / Shaft)					
101 JAT	LP End	Hub	---	Lock plate not removed.	
		Shaft	0.057		
101 JLP	JAT End	Hub	0.00	0.00	0.00
		Shaft	0.00	0.00	0.00
	JR end	Hub	0.00	Lock plate not removed.	
		Shaft	0.00		
101 JR	LP End	Hub	0.00	3.82	2.92
		Shaft	0.00	---	---
	HP End	Hub	0.00	0.55	0.55
		Shaft	0.00	---	---
101 JHP	JR End	Hub	0.00	---	---
		Shaft	0.00	0.11	0.11

PREVENTIVE MAINTENANCE RECORDS: 101 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JLP End					
Journal Bearing	Mandril	B	0.007-0.009	---	---
	Filler / lead wire			0.22	0.22
Oil Guard (For Jr. Brg Housing)	South	C	0.015-0.021	0.25	0.25
	North	G	0.058-0.097	0.26	0.26
Oil Guard (For Seal Housing)	---	D	0.077-0.109	NA	NA
Shaft Diameter	Jr. Brg.	---	4.993	126.78	126.78
Bearing Pinch	Jr. Brg.	---	---	0.04	0.04

Governor End					
Journal Bearing	Mandrel	B	0.007-0.009	---	---
	Filler / lead wire			0.26	0.26
Oil Guard (For Brg. Housing)	South	---	---	---	--
	North	C	0.015-0.021	0.22	0.22
Oil Guard (For Thrust Brg.)	South	A	0.002-0.04	0.2	0.2
	North	A	0.002-0.004	0.2	0.2
Oil Guard (For Seal Housing)	---	D	0.077-0.109	NA	NA
Axial Thrust.	With Top Housing	---	0.008-0.012	0.33	0.35
	Without top Housing	---		0.33	0.35
Shim thickness. (Thrust adjusting)	North	---	---	2.39	2.39
	South	---	---	5.2	5.2
Nozzle Clearance.	---	---	0.055-0.065	1.3	1.3
Shim thickness. (Nz. Cl. Adjusting)	North	---	---	7.56	7.56
	South	---	---	14.83	14.83
Total Float	---	---	0.180	4.46	4.46
Shaft Diameter	Journal bearing	---	4.993	126.79	126.79
Bearing Pinch	Jr. bearing	---	---	0.04	0.04

Journal Bearing Pads thickness : 101-JT				
PAD	NORTH SIDE BEARING (mm)		SOUTH SIDE BEARING (mm)	
	Before	After	Before	After
No 1	20.6	20.6	20.6	20.6
No 2	20.6	20.6	20.6	20.6
No 3	20.6	20.6	20.6	20.6
No 4	20.6	20.6	20.6	20.6
No 5	20.6	20.6	20.6	20.6
Thrust Bearing Pad Thickness : 101-JT				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	23.85	23.85	12.71	12.71
No 2	23.85	23.85	12.73	12.73
No 3	23.85	23.85	12.73	12.73
No 4	23.85	23.85	12.73	12.73
No 5	23.85	23.85	12.73	12.73

PREVENTIVE MAINTENANCE RECORDS: 101 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
TURBINE END					
Journal Bearing Clearance	Mandrel	D-1	0.005-0.008		
	Filler / lead wire			0.27	0.27
Bearing Pinch	Journal Bearing	-----	-----	0.02	0.02
Shaft Dia.	Journal Bearing	-----	4.493	NA	NA
Oil Guard (For Journal Bearing)	North	C-1	0.013-0.015	0.25	0.25
	South	C-1	0.013-0.015	0.15	0.15
Oil Guard (For Outer Housing)	North	A-1	0.021-0.027	0.3	0.3
	South	A-1	0.021-0.027	0.3	0.3
GEAR BOX END					
Journal Bearing Clearance	Mandrel	D-1	0.005-0.008		
	Filler / lead wire			0.3	0.3
Bearing Pinch	Journal bearing	-----	-----	0.02	0.02
Shaft Dia	Journal bearing	-----	4.493	NA	NA
Oil Guard (For Journal Bearing)	North	C-1	0.013-0.015	0.2	0.2
	South	C-1	0.013-0.015	0.2	0.2
Oil Guard (For Thrust bearing)	North	M-1	0.002-0.004	0.12	0.12
	South	S-1	0.002-0.04	0.12	0.12
Oil Guard (For Outer Housing)	North	A1	0.021-0.027	---	---
	South	A1	0.021-0.027	0.18	0.18
Axial Thrust	With Top Housing	-----	0.010 - 0.015	0.22	0.22
	Without Top Housing	-----		0.22	0.22
Shim Thickness (Axial Thrust adjusting)	North	-----	-----	11.29	11.29
	South	-----	-----	8.23	8.23

Journal Bearing Pads thickness : 101 – JLP				
PAD	NORTH SIDE BEARING (mm)		SOUTH SIDE BEARING (mm)	
	Before	After	Before	After
No 1	19.08	19.08	NA	NA
No 2	19.06	19.06	NA	NA
No 3	19.06	19.06	NA	NA
No 4	19.06	19.06	NA	NA
No 5	19.06	19.06	NA	NA
Thrust Bearing Pad Thickness : 101 – JLP				
Pad	ACTIVE (mm)		INACTIVE (mm)	
	Before	After	Before	After
No 1	19.89	19.89	19.86	19.86
No 2	19.87	19.87	19.87	19.87
No 3	19.85	19.85	19.84	19.84
No 4	19.86	19.86	19.86	19.86
No 5	19.86	19.86	19.86	19.86
No 6	19.91	19.91	19.86	19.86
No 7	19.89	19.89	19.85	19.85
No 8	19.91	19.91	19.87	19.87

PREVENTIVE MAINTENANCE RECORDS: 101-JR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (Low Speed drive gear)	North	0.008-0.010	0.3	0.3
	South	0.008-0.010	0.27	0.27
Axial Thrust	---	0.014-0.024	0.29	0.29
Journal Bearing (High Speed driven Pinion)	North	0.009-0.011	0.23	0.23
	South	0.009-0.011	0.27	0.27
Free float	---	---		
Backlash	---	---	0.15	0.15
Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	---	114.07	114.07
	South Side Bearing.	---	114.07	114.07
Shaft Diameter. (High Speed driven Pinion)	North Side Bearing.	---	88.75	88.75
	South Side Bearing.	---	88.75	88.75

PREVENTIVE MAINTENANCE RECORDS: 101 – JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Journal Bearing Clearance	Mandrel	C-1	0.004-0.007	0.2	0.2
	Filler / lead wire			0.05	0.05
Bearing Pinch	Journal Bearing	-----	-----		
Shaft Dia.	Journal Bearing	-----	2.996	0.15	0.15
Oil Guard (For Journal Bearing)	North	B-1	0.013-0.016	0.15	0.15
	South	B-1	0.013-0.016	0.15	0.15
Oil Guard (For Top Housing)	North	D-1	0.015-0.022	0.15	0.15
	South	D-1	0.015-0.022	0.15	0.15
NON DRIVE END					
Journal Bearing Clearance	Mandrel	D-1	0.015-0.022	---	---
	Filler / lead wire			0.19	0.19
Bearing Pinch	Journal bearing	-----	-----	0.05	0.05
Shaft Dia	Journal bearing	-----	2.996	76.08	76.08
Oil Guard (For Journal Bearing)	North	B-1	0.013-0.016	0.15	0.15
	South	B-1	0.013-0.016	0.15	0.15
Oil Guard (For Thrust bearing)	North	A-1	0.002-0.004	0.1	0.1
	South	A-1	0.002-0.04	0.1	0.1
Oil Guard (For Top Housing)	North	-----	-----	---	---
	South	D-1	0.015-0.022	0.1	0.1
Axial Thrust	With Top Housing	-----	0.008 - 0.012	0.3	0.3
	Without Top Housing	-----		0.3	0.3
Shim Thickness (Axial Thrust adjusting)	North	-----	-----		
	South	-----	-----		
Total Float	-----	-----	2.779 - 3.571	0.65	0.65

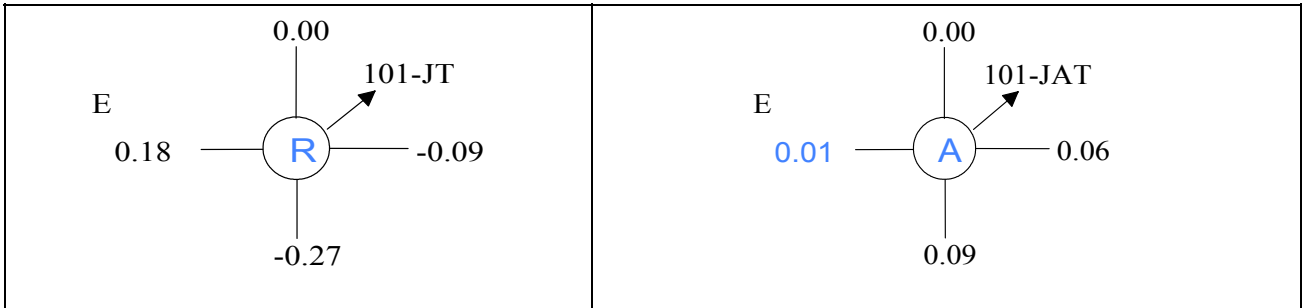
Journal Bearing Pads thickness : 101 – JHP				
PAD	NORTH SIDE BEARING (mm)		SOUTH SIDE BEARING (mm)	
	Before	After	Before	After
No 1	14.28	14.28	14.26	14.26
No 2	14.28	14.28	14.26	14.26
No 3	14.29	14.29	14.26	14.26
No 4	14.28	14.28	14.25	14.25
No 5	14.27	14.27	14.26	14.26
Thrust Bearing Pad Thickness : 101 – JHP				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	12.69	12.69	12.69	12.69
No 2	12.69	12.69	12.69	12.69
No 3	12.69	12.69	12.69	12.69
No 4	12.69	12.69	12.69	12.69
No 5	12.69	12.69	12.69	12.69

GAUSS MEASUREMENT: 101-J TRAIN

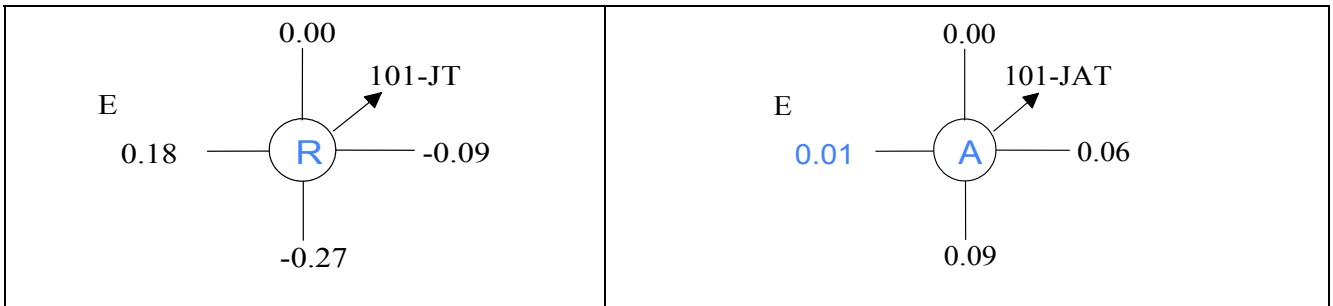
Description	Position	Before (Gauss)	After (Gauss)
101- JT			
Journal Bearing pads	Thrust End	1.6	1.6
	Non thrust end	0.5	0.5
Journal Bearing base ring	Thrust End	1.3	1.3
	Non thrust end	0.9	0.9
Thrust bearing pads	Active	1.3	1.3
	Inactive	1.1	1.1
Thrust Bearing base ring	Active	1.1	1.1
	Inactive	1.1	1.1
Shaft Journal	Thrust End	0.9	0.9
	Non thrust end	2.2	2.2
101 - JLP			
Journal Bearing pads	Thrust End	2.1	2.1
	Non thrust end	1.2	1.2
Journal Bearing base ring	Thrust End	1.8	1.8
	Non thrust end	1.4	1.4
Thrust bearing pads	Active	1.2	1.2
	Inactive	0.8	0.8
Thrust Bearing base ring	Active	1.1	1.1
	Inactive	0.9	0.9
Shaft Journal	Thrust End	2.1	2.1
	Non thrust end	2.4	2.4
101 - JR			
Gear Journal Bearing	North	1.2	1.2
	South	1.1	1.1
Pinion Journal Bearing	North	1.7	1.7
	South	1.9	1.9
Thrust bearing	Active	1.1	1.1
	Inactive	2	2
Oil Guard for Above	South	2.1	2.1
	North	1.1	1.1
Shaft Journal	Thrust End	1.5	1.5
	Non thrust end	1.1	1.1
101 - JHP			
Journal Bearing pads	Thrust End	0.9	0.9
	Non thrust end	1.7	1.7
Journal Bearing base ring	Thrust End	1.2	1.2
	Non thrust end	1.2	1.2
Thrust bearing pads	Active	0.9	0.9
	Inactive	0.7	0.7
Thrust Bearing base ring	Active	1.7	1.7
	Inactive	2.0	2.0
Oil Guard for Above	South	1.2	1.2
	North	1	1
Shaft Journal	Thrust End	2.7	2.7
	Non thrust end	2.4	2.4

Alignment: 101-JT to 101-JLP

Before Preventive Maintenance

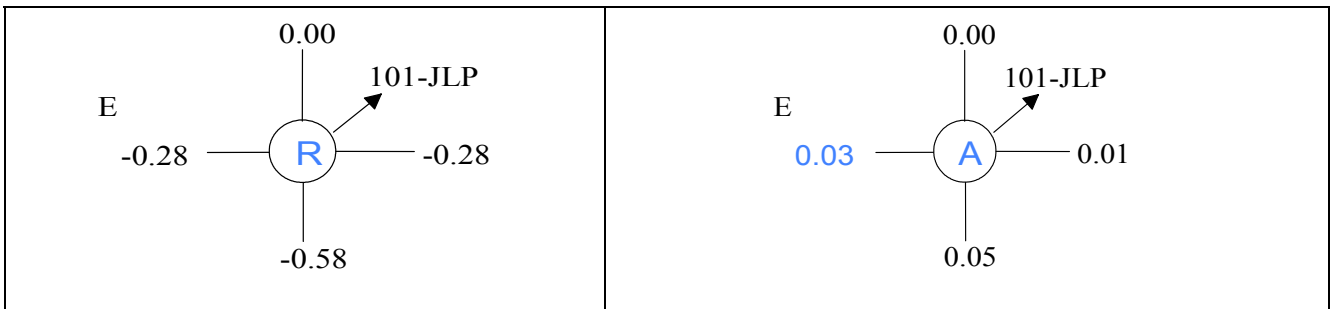


After Preventive Maintenance

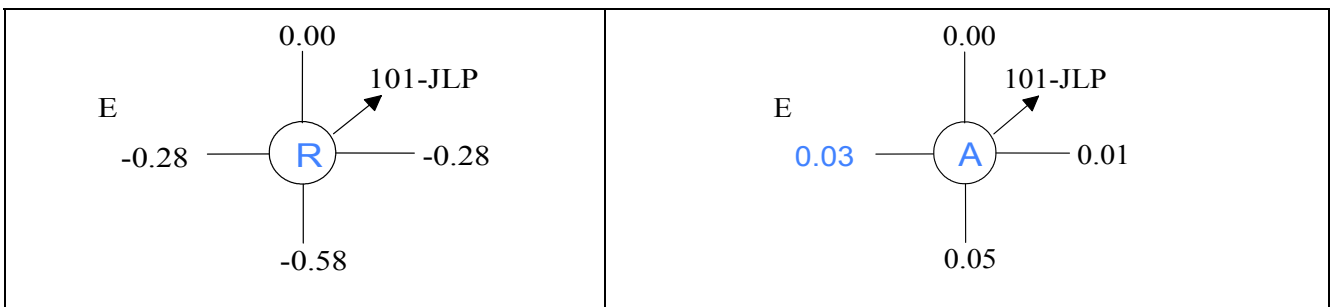


Alignment : 101-JLP to 101-JR

Before Preventive Maintenance

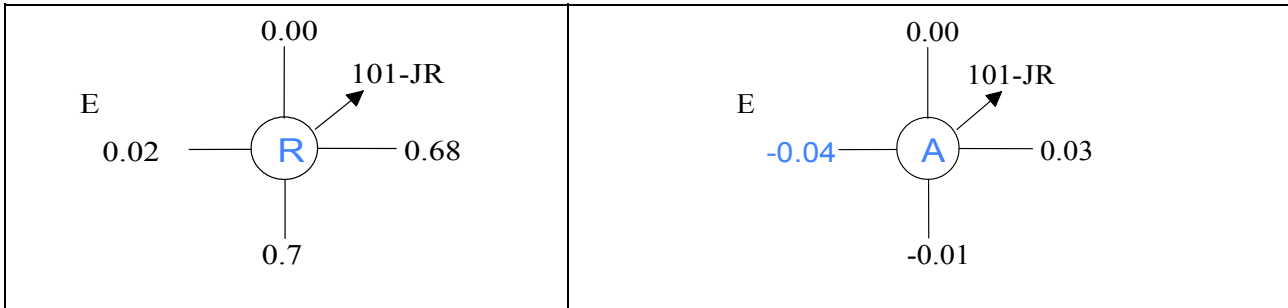


After Preventive Maintenance

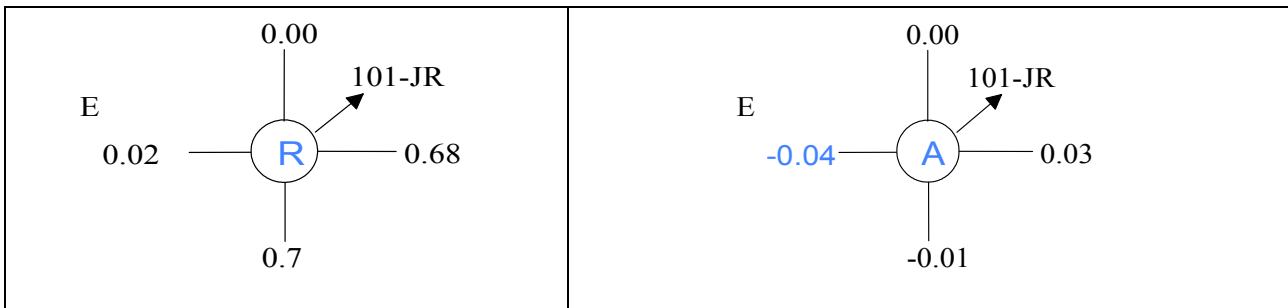


Alignment : 101-JR to 101-JHP

Before Preventive Maintenance



After Preventive Maintenance



SYNTHESIS GAS COMPRESSOR TRAIN, 103-J:

103-JAT, Backpressure turbine preventive maintenance:

Turbine was decoupled and both ends Journal bearings as well as Thrust bearings were inspected and found O.K. Gauss readings of end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found OK. Bearing clearances were taken and found within the design range.

103-JBT, Condensing turbine preventive maintenance:

Turbine was decoupled and both ends Journal bearings as well as Thrust bearings were inspected and found O.K. Gauss readings of end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found OK. Bearing clearances were taken and found within the design range.

The **three way valve** on the turbine trip oil line was facing oil leakage. The new spare valve available in store was of different construction and hence was modified to make it suitable for installation. The valve was then tested by operating it manually. The same was then installed.

Axial probe installed for 103-JBT rotor is clamped on the top half of the two piece ring (Part No 49) at the end of thrust bearing. Due to float of this guard, incorrect readings were being displayed on the DCS. Further calibration of this probe was getting difficult. This guard was inspected and it was observed that there was no float in the bottom half whereas there was float in the top half. This was because the top half was not getting tightened over the bottom half, due to longer length of stud. The stud length was then reduced to get proper tightness and zero float of the guard.

103-JLP, Synthesis Gas Compressor Preventive Maintenance:

The thrust bearing and top half pads of journal bearings were inspected and found O.K. Gauss readings of both end journal bearing were measured and found within limit. Dye penetration test was performed on all the pads and found in good condition.

103-JHP Synthesis Gas Compressor Preventive Maintenance:

The compressor was decoupled and thrust bearing and both end Journal bearing top pads were inspected and found O.K Gauss readings of both end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found within limit. All pads were Dye Penetration tested and no surface cracks were found.

COUPLING RECORDS 103-J TRAIN

Description	Position	Design (Inch)	Before (mm)	After (mm)		
DBSE (With Rotor at extreme end position)						
103 JBT - JAT	---		Not measurable due to insufficient gap for micrometer			
103 JAT - JLP	---					
103 JLP- JHP	---					
Distance between Hub Face (With Rotor at extreme end position)						
103 JBT - JAT	---		281.2	281.2		
103 JAT - JLP	---		341.6	341.6		
103 JLP- JHP	---		447.6	447.6		
Coupling Hub / Shaft Overhang						
103 JBT	JAT End	Hub	Lock plate present			
		Shaft				
103 JAT	JBT End	Hub				
		Shaft				
	JLP end	Hub				
		Shaft				
103 JLP	JAT End	Hub			12.6	12.6
		Shaft				
	JHP End	Hub	11.8	11.8		
		Shaft				
103 JHP	JLP End	Hub	12.7	12.7		
		Shaft				

PREVENTIVE MAINTENANCE RECORDS: 103 – JBT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JAT End					
Journal Bearing	Mandrel	A	0.010-0.012	0.29	0.29
	Filler / lead wire				
Oil Guard (For Jr. Brg Housing)	South	C	0.008-0.014	0.11	0.11
	North	-----	-----	-----	-----
Oil Guard (For Seal Housing)	---	D	0.039-0.071	0.11	0.11
Bearing Pinch	Jr. Brg.			0.032	0.032

Governor End					
Journal Bearing	Mandrel	A	0.010-0.012	---	---
	Filler / lead wire			0.29	0.29
Oil Guard (For Brg. Housing)	South	---	---	--	--
	North	C	0.008-0.014	0.41	0.41
Oil Guard (For Seal Housing)	---	D	0.039-0.071	0.81	0.81
Axial Thrust.	With Top Housing		0.008-0.012	0.18	0.18
	Without top Housing			0.31	0.31
Shim thickness. (Thrust adjusting)	North			4.53	4.53
	South			4.54	4.54
Nozzle Clearance.	---	H	0.055-0.065	2.84	2.84
Total Float	---			0.18	0.21
Bearing Pinch	Jr. bearing			0.04	0.04

PREVENTIVE MAINTENANCE RECORDS: 103 – JBT

Journal Bearing Sleeve thickness				
PAD	NORTH SIDE BEARING (mm)		SOUTH SIDE BEARING (mm)	
	Before	After	Before	After
No 1	19.1	19.1	19.02	19.02
No 2	19.06	19.06	19.06	19.06
No 3	19.4	19.4	19.04	19.04
No 4	19.05	19.05	19.05	19.05
No 5	19.07	19.07	19.07	19.07
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	15.9	15.9	12.7 (TOP)	12.7 (TOP)
No 2	15.86	15.86	12.68 (BOTTOM)	12.68 (BOTTOM)
No 3	15.88	15.88	---	---
No 4	15.88	15.88	---	---
No 5	15.86	15.86	---	---

PREVENTIVE MAINTENANCE RECORDS: 103 - JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JAT End					
Journal Bearing	Mandrel	N	0.006-0.008		
	Filler / lead wire			0.27	0.27
Oil Guard (For Jr. Brg Housing)	South	C	0.015-0.021	0.38	0.38
	North	---	----	----	-----
Oil Guard (For Seal Housing)	---	D	0.077-0.110	0.36	0.36
Bearing Pinch	Jr. Brg.	---	---	0.08	0.08

JBT End					
Journal Bearing	Mandril	B	0.010-0.012	0.3	0.3
	Filler / lead wire				
Oil Guard (For Brg. Housing)	South	---	---	---	--
	North	C	0.015-0.021	0.31	0.31
Oil Guard (For Seal Housing)	---	D	0.077-0.110	0.64	0.64
Axial Thrust.	With Top Housing	---	0.008-0.012	0.3	0.3
	Without top Housing	---			
Oil Guard (For Thrust Bearing)	North	A	0.002-0.004	0.1	0.1
	South	A	0.002-0.004	0.14	0.14
Shim thickness. (Thrust adjusting)	North	---	---	6.34	6.34
	South	---	---	6.34	6.34
Nozzle Clearance.	---	---	0.035-0.045	3.06	3.06
Total Float	---	---	0.020	0.31	0.31
Bearing Pinch	Jr. bearing	---		0.17	0.17

PREVENTIVE MAINTENANCE RECORDS: 103 – JAT

Journal Bearing Sleeve thickness				
PAD	NORTH SIDE BEARING (mm)		SOUTH SIDE BEARING (mm)	
	Before	After	Before	After
No 1	19.06	19.06	20.63	20.63
No 2	19.0	19.0	20.66	20.66
No 3	18.99	18.99	20.61	20.61
No 4	19.01	19.01	20.60	20.60
No 5	19.0	19.0	20.60	20.60
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	25.29	25.29	15.94 (TOP)	15.94 (TOP)
No 2	25.27	25.27	15.91(BOTTOM)	15.91(BOTTOM)
No 3	25.30	25.30	---	---
No 4	25.31	25.31	---	---
No 5	25.28	25.28	---	---

PREVENTIVE MAINTENANCE RECORDS: 103 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
NON THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002"-0.004"	---	---
	Filler / lead wire			0.16	0.16
Oil Guard (For Journal Bearing)	North	C2	0.008" - 0.013"	0.38	0.38
	South	C2	0.008" - 0.013"	0.44	0.44

THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002"-0.004"	---	---
	Filler / lead wire				0.16
Axial Thrust	With Top Housing		0.015" - 0.022"	0.41	0.41
	Without Top Housing			---	---

PREVENTIVE MAINTENANCE RECORDS: 103 – JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
NON THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.0023"-0.0033"	---	---
	Filler / lead wire				0.16
Oil Guard (For Journal Bearing)	North	A2	0.0085"- 0.0115"	0.43	0.43
	South	A2	0.0085"- 0.0115"	0.46	0.46
THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.023"-0.033"	---	---
	Filler / lead wire				0.17
Axial Thrust	With Top Housing		0.015" - 0.022"	---	---
	Without Top Housing			0.34	0.36

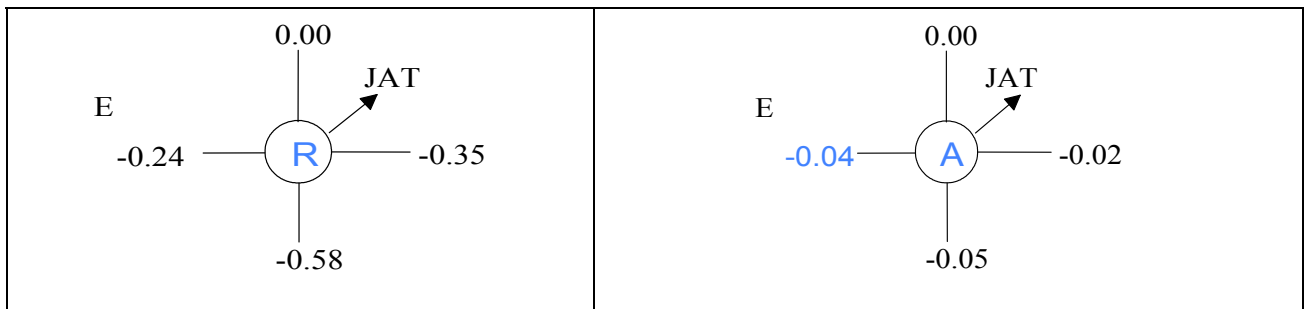
PREVENTIVE MAINTENANCE RECORDS: 103-J TRAIN GAUSS

Description	Position	Before (Gauss)	After (Gauss)
103- JBT			
Journal Bearing Sleeve	Thrust End	1.5	1.5
	Non thrust end	1.7	1.7
Thrust bearing pads	Active	1.4	1.4
	Inactive	1.6	1.6
Thrust Bearing base ring	Active	0.9	0.9
	Inactive	6.6	0.3
Shaft Journal	Thrust End	1.5	1.5
	Non thrust end	0.8	0.8
103 - JAT			
Journal Bearing Sleeve	Thrust End	2.0	2.0
	Non thrust end	1.3	1.3
Thrust bearing pads	Active	1.4	1.4
	Inactive	1.9	1.9
Thrust Bearing base ring	Active	1.7	1.7
	Inactive	2.0	2.0

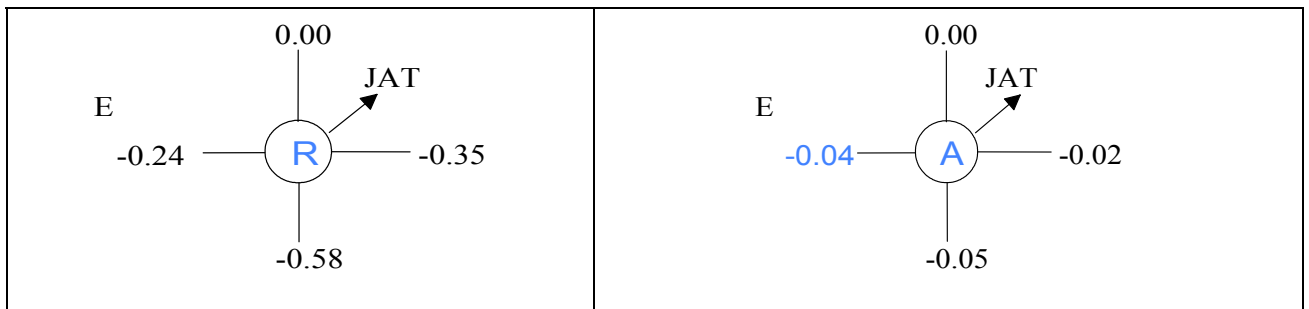
103 - JLP			
Journal Bearing Sleeve	Thrust End	1.4	1.4
	Non thrust end	1.9	1.9
Thrust bearing pads	Active	1.4	1.4
	Inactive	1.7	1.7
Shaft Journal	Thrust End	2.0	2.0
	Non thrust end		2.0
103-JHP			
Journal Bearing Sleeve	Thrust End	1.7	1.7
	Non thrust end	1.4	1.4
Thrust bearing pads	Active	1.9	1.9
	Inactive	1.9	1.9
Shaft Journal	Thrust End	2.0	2.0
	Non thrust end	2.0	2.0

Alignment: 103-JBT to 103-JAT

Before Preventive Maintenance

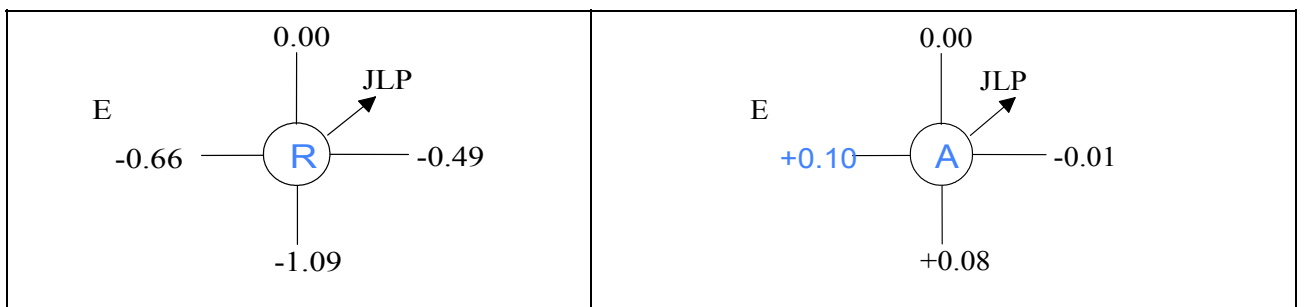


After Preventive Maintenance

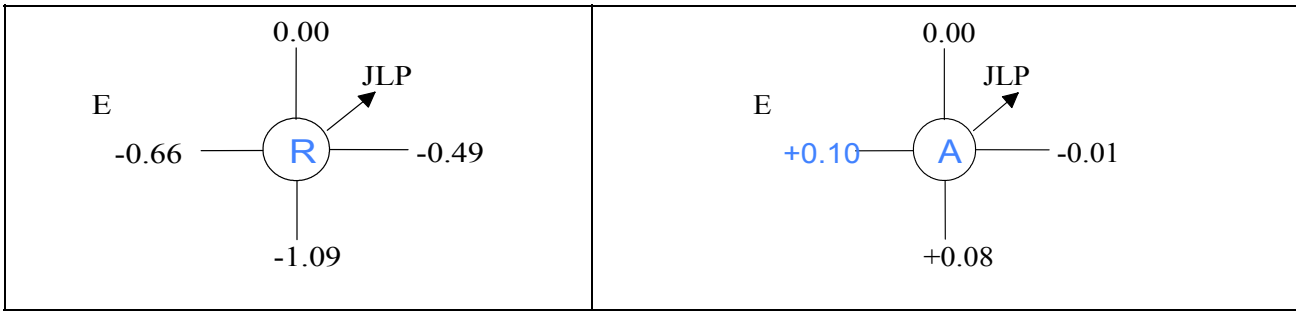


Alignment: 103-JAT to 103-JLP

Before Preventive Maintenance

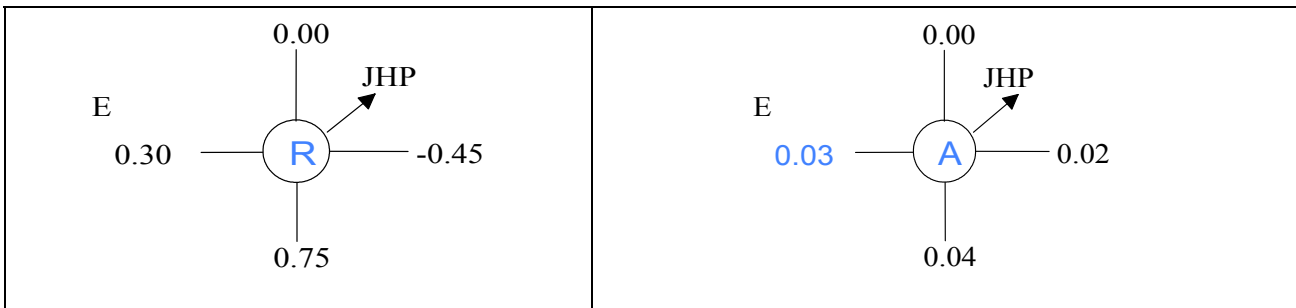


After Preventive Maintenance

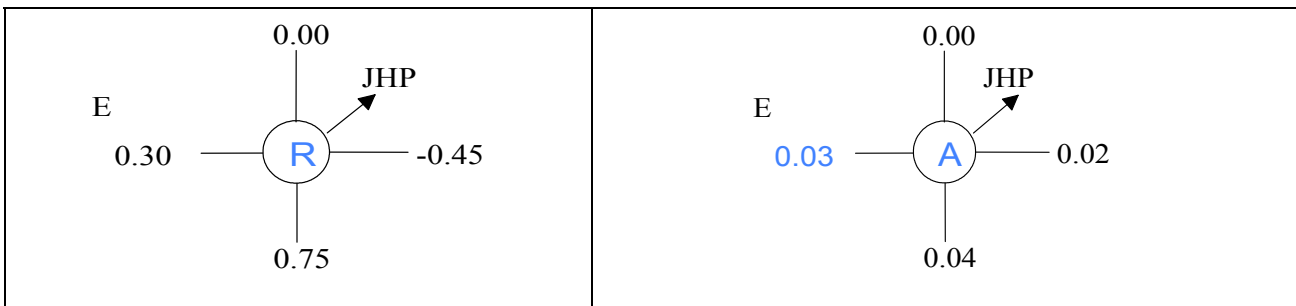


Alignment : 103-JLP to 103-JHP

Before Preventive Maintenance



After Preventive Maintenance



REFRIGERATION COMPRESSOR TRAIN 105-J:

105-JT, Refrigeration Compressor Drive Turbine Preventive Maintenance

Turbine was decoupled and both ends Journal bearings and Thrust bearings were taken for inspection. Gauss readings of the bearing pads were measured and found within limits. The pads were visually inspected as well as dye penetration tested and found OK. Bearing clearances were taken and found within the design range. The governor drive gear assembly were also inspected and found OK.

105-JT Refrigeration Compressor Drive Turbine Governor overhauling:

The 8 ½ CM governor was taken for overhauling. The Governor output piston maximum and minimum travel positions were noted under linked as well as de-linked condition. It was observed that the total travel achievable was only 30.7 mm which was less than the desired travel of 40 mm. Hence the governor was dismantled. A major discrepancy was observed in the head assembly. The roller guide plate (Part No 9) was found just below the roller (Part. No 6) while it should have been just above the roller.

The following spares were replaced and the governor was assembled as per drawing.

- Governor head assembly ball bearings
- Roller bearing
- Spring
- ND ball & separator assembly
- Pin for governor stem
- Thompson ball bushing.

After assembling the output piston total travel was measured and found 40 mm as desired. The governor was installed and linked to the nozzle valve assembly. Under linked condition, the total travel was measured and found to be 40 mm.

CONDITION: Linked with nozzle valve assembly.				
Time	Max Travel Position	Minimum travel position	Total travel	Remarks
BEFORE O/H	104.91	74.21	30.7	Very less
AFTER O/H	102	62	40	O.K.

CONDITION: De- Linked with nozzle valve assembly.				
Time	Max Travel Position	Minimum travel position	Total travel	Remarks
BEFORE O/H	104.91	74.21	30.7	Very less
AFTER O/H	102	62	40	O.K.

105-JT, Refrigeration Compressor Drive Turbine Nozzle Valve Assembly Overhauling:

The nozzle valve assembly was taken to reset the following

- The spring tension
- Lifting bar positioning (Gap between lifting bar & gasket seating face of steam chest cover.)
- Lifting bar parallelism.
- Valve setting: This was not to be disturbed.

The complete governing valve assembly comprising of lifting lever, steam chest cover, lifting bar with valves, lifting spindle etc was removed and taken for dismantling. The lifting bar along with the valves was removed and placed inside the steam chest. By placing shims below the bar at one end, the bar was made parallel to the steam chest gasket seating plane, while allowing all the valves to seat and resting the bar on one of the valve. The distance from the bar top face to the steam chest gasket seating face was measured and noted as "L". The bar was then removed.

Now on the governing valve assembly, the lifting lever was made parallel to the steam chest cover, by maintaining the centre line to centre line distance at 13'. Under this condition the lever was locked using jack screw. Both the springs were installed and the eye to eye distance was maintained at 8.5". The lifting bar was now installed and made parallel to the steam chest cover gasket seating face by maintaining the calculated required distance of "X" = L - ½ T on both the ends, where "T" is the total travel. The valve total clearances with the lifting bar were measured for records.

105-JLP Refrigeration Compressor Preventive Maintenance :

101-JLP, gear box end was decoupled. Journal bearings and Thrust bearings were visually inspected and dye penetration tested and found in good condition. Gauss reading of the bearing pads and base rings were measured and found within limits. Bearing clearances were taken and found within the design range.

105-JR Gear Box Preventive Maintenance :

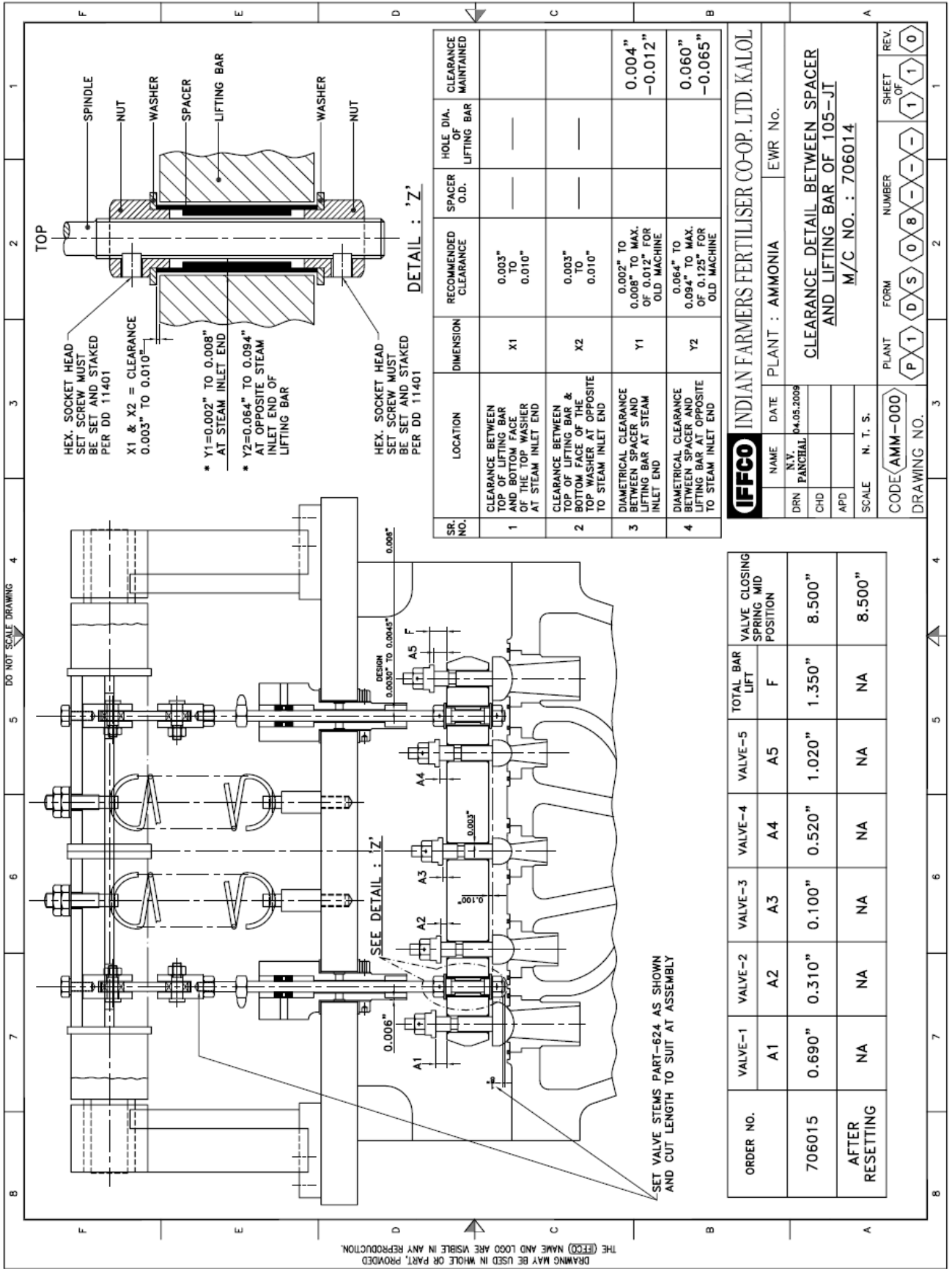
101-JR, HP end was decoupled. All the bearings were inspected and found in good condition. Both the gear as well as Pinion were inspected and found to be O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances were taken and found within the design range.

105-JHP Refrigeration Compressor Preventive Maintenance :

The Journal bearing as well as thrust bearings were inspected and dye penetration tested and found OK. The bearing clearances were within limit. Gauss readings of journal and thrust bearing pads and base ring, shaft journal, thrust collar were measured and found within limit.

Couplings Inspection:

All the couplings were visually inspected. The DBSE of all the couplings were measured and found OK. Wherever coupling hub locknuts have been provided, the coupling hub to locknut clearances were measured and found OK. Wherever locknuts are not provided, the coupling hub overhang/ override were measured and found OK.



105-JT Nozzle valve assembly clearances

PREVENTIVE MAINTENANCE RECORDS: 105-J TRAIN

COUPLINGS

Description	Position	Design (Inch)	Before (mm)	After (mm)
Distance between Hub Face (With Rotor at extreme ends)				
105 JT-JLP	---	---	222.15	222.15
105 JLP-JR	---	----	242.17	242.17
105 JR-JHP	---	---	185.83	185.83

PREVENTIVE MAINTENANCE RECORDS: 105 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
JLP End					
Journal Bearing	Mandrel		0.007-0.009	---	---
	Filler / lead wire			0.24	0.24
Oil Guard (For Jr. Brg Housing)	South		0.015-0.021	0.25	0.25
	North		0.058-0.097	0.85	0.85
Oil Guard (For Seal Housing)	---		0.077-0.109	1.13	1.13
Bearing Pinch	Jr. Brg.		---	0.07	0.07
Governor End					
Journal Bearing	Mandrel		0.007-0.009	---	---
	Filler / lead wire			0.25	0.25
Oil Guard (For Brg. Housing	South		---	--	--
	North		0.015-0.021	0.2	0.2
Oil Guard (For Thrust Brg.)	South		0.002-0.04	0.13	0.13
	North		0.002-0.004	0.10	0.10
Axial Thrust.	With Top Housing		0.008-0.012	0.28	0.28
	Without top Housing			0.26	0.26
Shim thickness. (Thrust adjusting)	North		---	---	---
	South		---	2.92	2.92
Nozzle Clearance.	---		0.055-0.065	1.35	1.35

PREVENTIVE MAINTENANCE RECORDS: 105 – JT

Journal Bearing Pads thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.63	20.63	20.66	20.66
No 2	20.63	20.63	20.65	20.65
No 3	20.64	20.64	20.64	20.64
No 4	20.65	20.65	20.67	20.67
No 5	20.66	20.66	20.63	20.63
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	19.09	19.09	15.90	15.90
No 2	19.09	19.09	19.92	19.92
No 3	19.09	19.09	----	----
No 4	19.10	19.10	----	----
No 5	19.09	19.09	----	----

PREVENTIVE MAINTENANCE RECORDS: 105 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
TURBINE END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	---	---
	Filler / lead wire			0.35	0.35
GEAR BOX END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	---	---
	Filler / lead wire			0.22	0.22
Oil Guard (For Outer Housing)	North	A	0.020-0.026	0.30	0.30
Axial Thrust	With Top Housing	----	0.011 – 0.015	0.31	0.31
	Without Top Housing	----		---	---
Shim Thickness (Axial Thrust adjusting)	North	----	---	9.48	9.48
	South	----	---	10.00	10.00

PREVENTIVE MAINTENANCE RECORDS: 105 – JLP

Journal Bearing Pads thickness in mm				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	19.28	19.28	19.28	19.28
No 2	19.27	19.27	19.27	19.27
No 3	19.26	19.26	19.26	19.26
No 4	19.26	19.26	19.26	19.26
No 5	19.27	19.27	19.27	19.26
No 6	19.26	19.26	19.26	19.26
No 7	19.27	19.27	19.27	19.27
No 8	19.27	19.27	19.27	19.27

PREVENTIVE MAINTENANCE RECORDS: 105-JR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (Low Speed drive gear)	North	0.014 – 0.016	0.46	0.46
	South	-- do --	0.62	0.62
Axial Thrust	---	0.014-0.024	0.28	0.28
Journal Bearing (High Speed driven Pinion)	North	0.013 -	0.4	0.4
	South	-- do --	0.54	0.54
Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	---	114.14	114.14
	South Side Bearing.	---	114.08	114.08
Shaft Diameter. (High Speed driven Pinion)	North Side Bearing.	---	126.54	126.54
	South Side Bearing.	---	126.56	126.56

PREVENTIVE MAINTENANCE RECORDS: 105 – JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (mm)	After (mm)
GEAR BOX END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	----	----
	Filler / lead wire			0.30	0.30
Oil Guard (For Top Housing)	South	A	0.018 - 0.024	0.25	0.25

NON DRIVE END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	---	---
	Filler / lead wire			0.3	0.3
Axial Thrust	With Top Housing	---	0.009 – 0.013	0.35	0.35
	Without Top Housing	---		---	---
Shim Thickness (Axial Thrust adjusting)	North	---	---	9.7	9.7
	South	---	---	9.8	9.8

Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	14.33	14.33	14.33	14.33
No 2	14.32	14.32	14.33	14.33
No 3	14.33	14.33	14.33	14.33
No 4	14.33	14.33	14.32	14.32
No 5	14.33	14.33	14.33	14.33
No 6	14.33	14.33	14.33	14.33
No 7	14.32	14.32	14.33	14.33
No 8	14.33	14.33	14.32	14.32

PREVENTIVE MAINTENANCE RECORDS: 105-J TRAIN

GAUSS

Description	Position	Before (Gauss)	After (Gauss)
105- JT			
Journal Bearing pads	Thrust End	2.3	2.3
	Non thrust end	1.9	1.9
Journal Bearing base ring	Thrust End	1.9	1.9
	Non thrust end	1.7	1.7
Thrust bearing pads	Active	1.7	1.7
	Inactive	0.5	0.5
Thrust Bearing base ring	Active	2.3	2.3
	Inactive	1.7	1.7
Shaft Journal	Thrust End	2.7	2.7
	Non thrust end	2.0	2.0
105 - JLP			
Thrust bearing pads	Active	0.9	0.9
	Inactive	1.3	1.3
Thrust Bearing base ring	Active	1.3	1.3
	Inactive	1.6	1.6

PREVENTIVE MAINTENANCE RECORDS: 105-J TRAIN

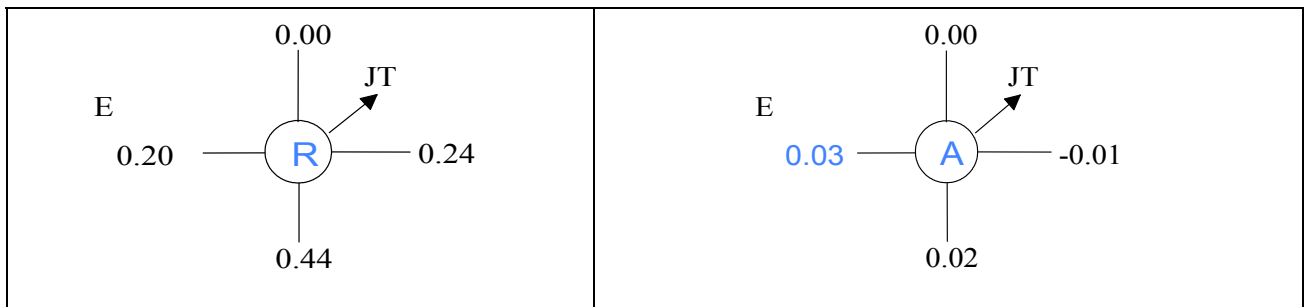
GAUSS

Description	Position	Before (Gauss)	After (Gauss)
105 - JR			
Gear Journal Bearing	North	1.0	1.0
	South	0.9	0.9
Pinion Journal Bearing	North	1.2	1.2
	South	1.1	1.1
Thrust bearing	Active	0.9	0.9
	Inactive	0.8	0.8
Oil Guard for Above	South	6.2	0.6
	North	5.9	1.2
Shaft Journal	Thrust End	0.9	0.9
	Non thrust end	1.2	1.2
105 - JHP			
Thrust bearing pads	Active	1.2	1.2
	Inactive	0.4	0.4
Thrust Bearing base ring	Active	1.4	1.4
	Inactive	2.0	2.0
Oil Guard for Above	South	5.7	0.6
	North	1.7	1.7
Shaft Journal	Thrust End	1.3	1.3

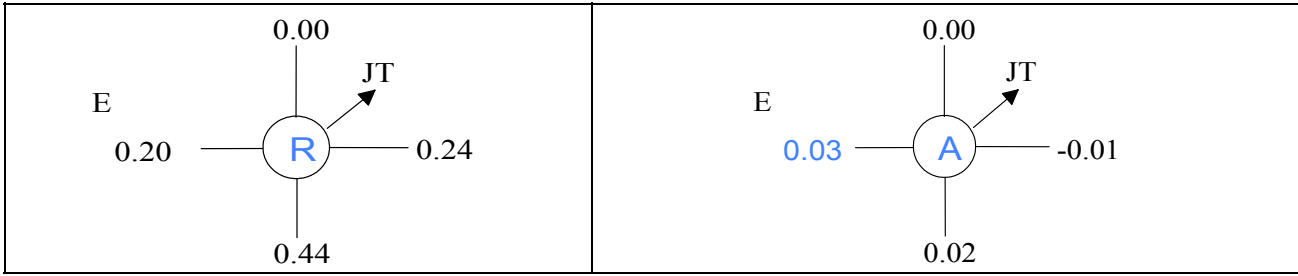
PREVENTIVE MAINTENANCE RECORDS: 105-J TRAIN

Alignment: 105-JT to 105-JLP

Before Preventive Maintenance

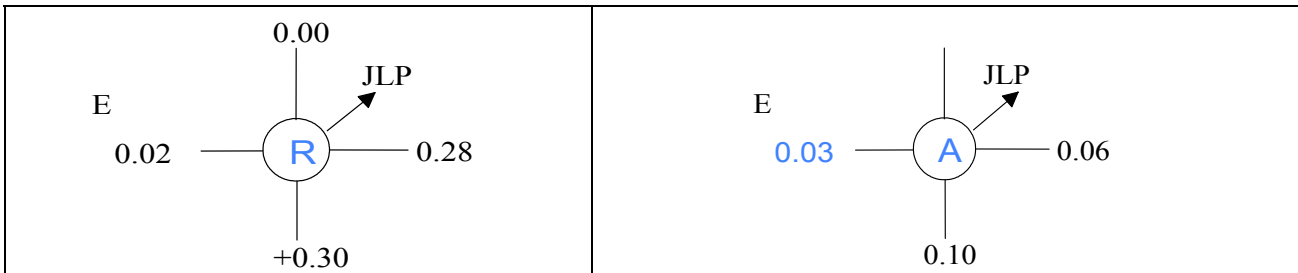


After Preventive Maintenance

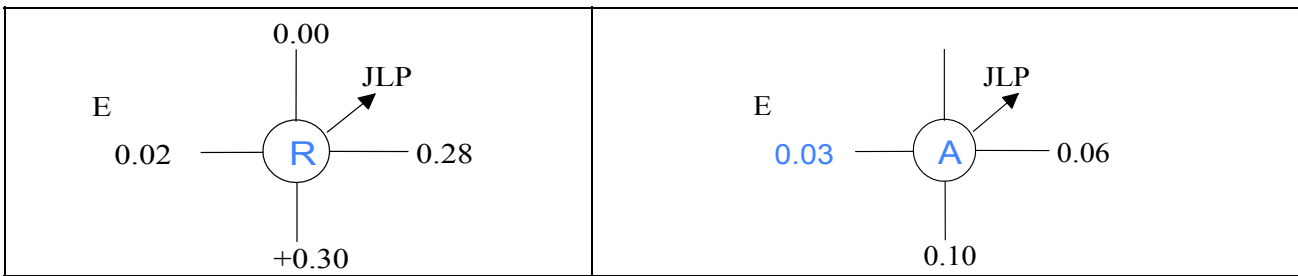


Alignment : 105-JLP to 105-JR

Before Preventive Maintenance

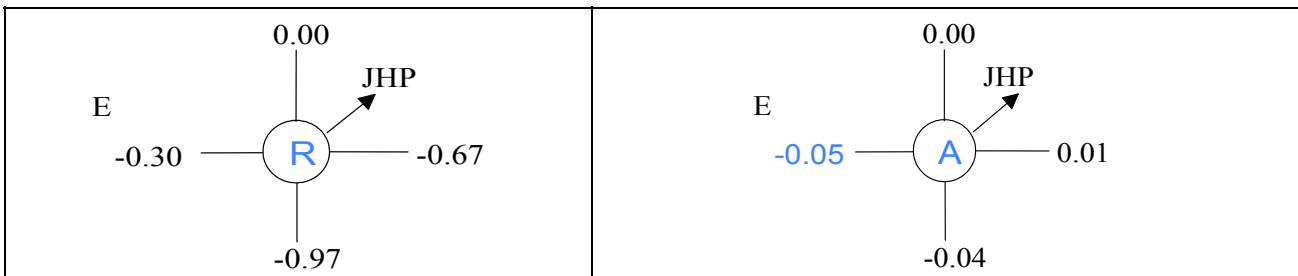


After Preventive Maintenance

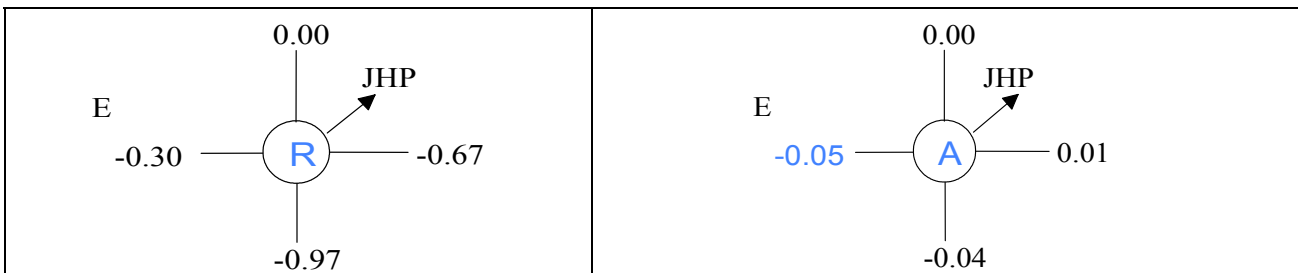


Alignment : 105-JR to 105-JHP

Before Preventive Maintenance



After Preventive Maintenance

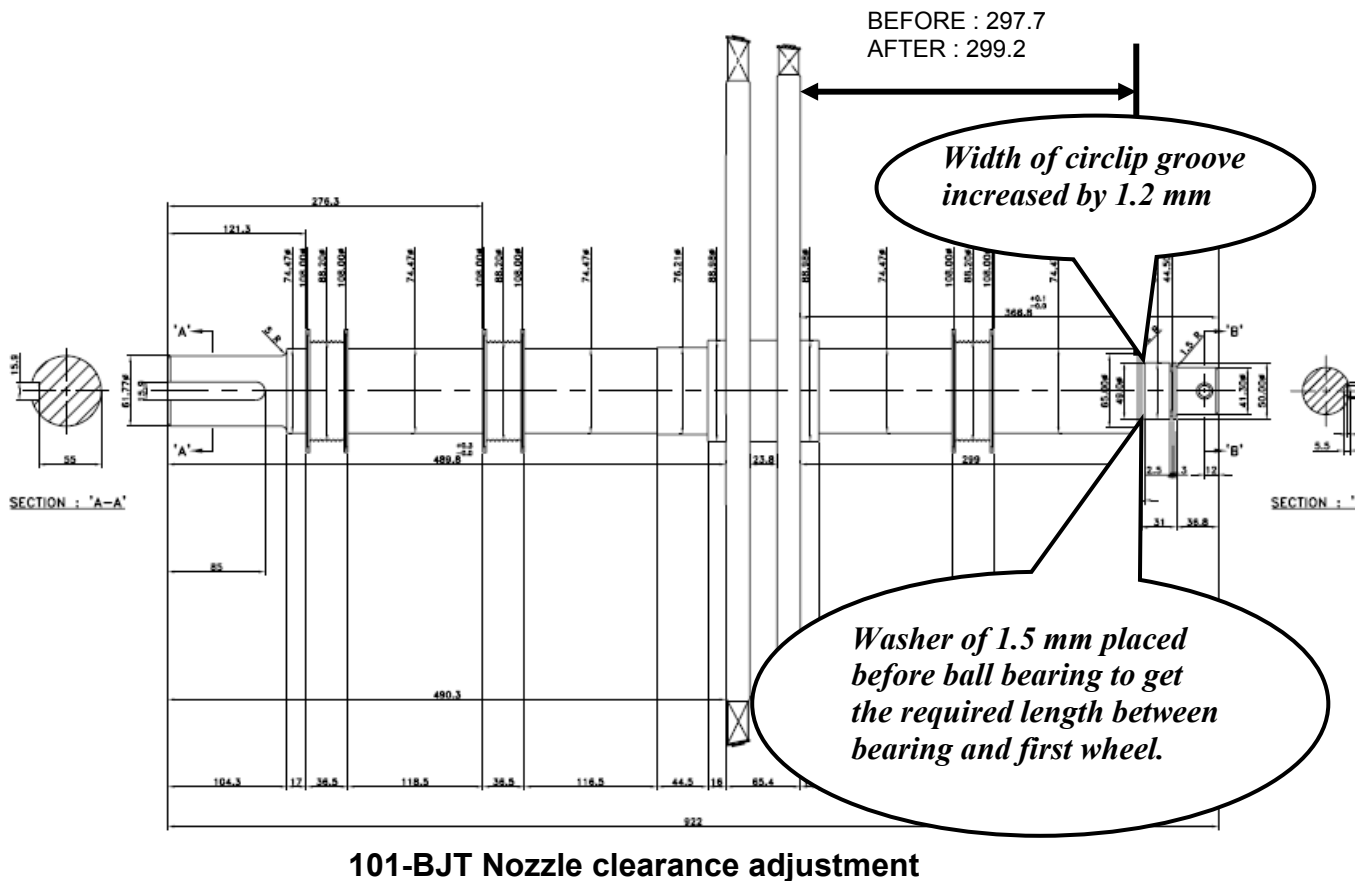


INDUCED DRAFT FAN 101-BJ TRAIN:

101- BJT Drive Turbine Overhauling :

Turbine was decoupled and the top casing along with the bearing and gland housing top covers were removed. The nozzle clearance and interstage clearances were measured for record. The bearing clearance were measured and found at higher side. The journal areas of the shaft were found to be having scorings and hence it was decided to replace the rotor. The refurbished rotor assembly was issued and visually as well as dimensionally checked. This rotor had new hard chrome plating at the gland area. It was observed that the length between thrust bearings to first wheel was "297.70 mm" as against required length of "299.16 – 299.30 mm". As a result of this , the rotor assembly was fouling while placing the same inside the bottom casing or in other words the nozzle clearance had become negative.

To increase this length, the thrust ball bearing was moved away towards the non drive end by 1.5 mm, by placing a washer of thickness 1.5 mm in between the bearing and the step on rotor shaft. The width of the groove for the circlip was also increased by 1.2 mm to accommodate the circlip.



The rotor assembly was placed inside the bottom casing and the nozzle clearance was measured and found within the design range. The top casing was installed and the carbon rings were replaced by new ones. The carbon packing top housing face groove was filed with 5 mm diameter packing made from grafoil tape. The both ends bearing liner, top as well as bottom were replaced by new ones. The trip assembly plunger was replaced by new one as it was having numerous dent marks.

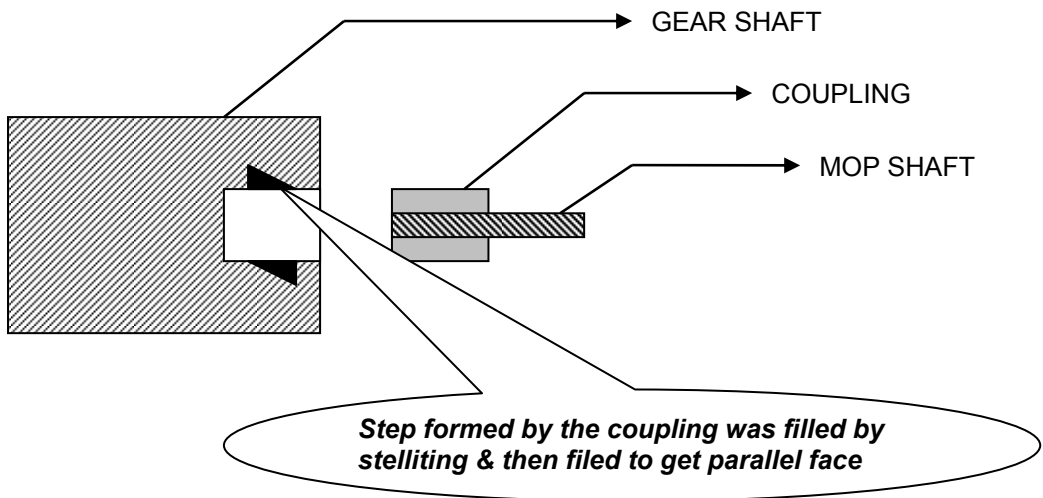
During start-up the turbine was taken for over speed trip and the same was achieved in one attempt at 4370 RPM. The electrical over speed trip was set at 4250 and achieved in one attempt.

101- BJ Fan Preventive Maintenance:

Journal bearings and thrust bearings were inspected and found O.K. Gauss reading was taken and found below maximum allowable limit. All the bearing pads were Dye Penetration tested and no surface cracks were found Bearing clearances were taken and found within the design range. Cooling water was circulated in lines and no leaks were observed. The final bearing clearance was measured and found within design range.

101-BJR Gear box Overhauling:

The gear box was taken for major overhauling as abnormal noise was reported during plant operation. The top cover as well as gear and pinion were removed and closely inspected. It was observed that there were deep hitting marks on the gear shaft end due to the main oil pump coupling. This had resulted in a clearance around the coupling causing the noise during running condition. These deep scorings were filled by stellite and filed to get the plane surface.




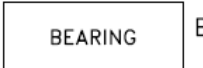

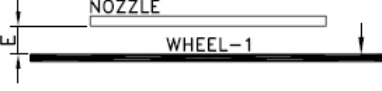
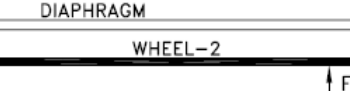
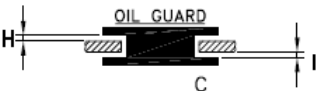

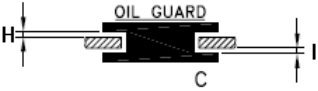
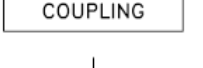
Damage on 101-BJR Gear shaft end

The ball bearing of the gear was replaced by new one. The “O” seal ring on this bearing was also replaced by new one. The gear as well as the pinion was installed and the clearances were found within design value.

Couplings Inspection:

Both the coupling i.e. between turbine to gear box and between gear box to fan were inspected and found OK.

IFFCO - KALOL					
DIAMETRICAL CLEARANCES – ELLIOT TURBINE 101-BJT					
REF.	CLEARANCE – INCHES		REF.	CLEARANCE – INCHES	
A	BALL BEARING		F	0.930" TO 0.950"	
B	0.007" TO 0.010" (DIAMETRICAL)		G	0.054" TO 0.064" (AXIAL)	
C	0.015" TO 0.0195" (RADIAL)		H	0.068" TO 0.098" (AXIAL)	
D	0.001" TO 0.0035" (DIAMETRICAL)		I	0.030" TO 0.040" (AXIAL)	
E	0.042" TO 0.072" (AXIAL)				

AFTER	BEFORE		BEFORE	AFTER
		 ROTOR LOCATING BALL BEARING A		NEW CARBON RINGS NEW ROTOR NEW BEARINGS
	0.25	 BEARING B		0.3
		 OIL GUARD C		1.65/1.65
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
	2.5	 NOZZLE E WHEEL-1 F		1.5/1.5
	4.35	 DIAPHRAGM WHEEL-2 F		28.3/28.3
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
		CARBON RING-D		0.065/0.07
		 OIL GUARD C		1.6/1.6
	0.30	 BEARING B		0.3
		 OIL GUARD C		1.65/1.65
		 COUPLING		
				IFFCO :- PARTY :- Date :-

COUPLING RECORDS: 101-BJ TRAIN:

Description		Before (mm)	After (mm)
COUPLING FLOAT			
101-BJ to 101-BJR		3.32	3.0

PREVENTIVE MAINTENANCE RECORDS: 101 - BJT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Gear Box End					
Journal Bearing	Mandrel	---	0.007-0.0010	---	---
	Filler / lead wire	---		0.34	0.34
Oil Guard (For Jr. Brg Housing)	CT Side	---	0.015"-0.0195"	0.25	0.30
	SILO Side	---	0.015"-0.0195"	0.25	0.30
Shaft Diameter	Jr. Brg.	---	2.9320"-2.9325"	74.46	74.46
Bearing Pinch	Jr. Brg.	---	---	---	---
Governor End					
Journal Bearing	Mandrel	---	0.007-0.0010	---	---
	Filler / lead wire	---		0.25	0.30
Oil Guard (For Brg. Housing)	CT Side	---	0.015"-0.0195"	0.3	0.30
	SILO Side	----	----	----	---
Axial Thrust.	With Top Housing	---	0.014"	0.30	0.40
	Without top Housing	---			
Nozzle Clearance.	---	---	0.042-0.072	1.5	1.5
Shaft Diameter	Journal bearing	---	2.9320"-2.9325"	74.45	74.45
Trip Lever - Plunger	---	---	0.0625"	1.8	1.6

Journal Bearing Liner thickness				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	3.20	3.20	3.17	3.17
Bottom	3.20	3.20	3.17	3.17

PREVENTIVE MAINTENANCE RECORDS: 101-BJR

Description	Position	Design Clearances (Inch)	Before (mm)	After (mm)
Journal Bearing (High Speed drive Pinion)	CT Side	0.005"-0.008"	0.16	0.16
	SILO Side	0.005"-0.008"	0.17	0.17
Axial Thrust	---		---	---
Journal Bearing (Low Speed driven Gear)	CT Side	0.005"-0.008"	0.17	0.17
	SILO Side	0.005"-0.008"	0.15	0.15
Backlash	---	0.013"-0.017"	0.29	0.32
Shaft Diameter (High Speed drive Pinion)	CT Side	---	114.15	114.15
	SILO Side	---	114.16	114.16
Shaft Diameter. (Low Speed driven Gear)	CT Side	---	114.21	114.21
	SILO Side	---	114.2	114.2

Journal Bearing Liner thickness (High Speed drive Pinion)				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	34.93	34.93	34.87	34.87
Bottom	34.92	34.92	34.88	34.88

Journal Bearing Liner thickness (Low Speed driven Gear)				
Liner	CT SIDE BEARING		SILO SIDE BEARING	
	Before	After	Before	After
Top	34.88	34.88	34.93	34.93
Bottom	34.87	34.87	34.93	34.93

PREVENTIVE MAINTENANCE RECORDS: 101 - BJ

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Gear Box End					
Journal Bearing	Mandrel	---	0.008" - 0.012"	---	---
	Filler / lead wire			0.21	0.21
Shaft Diameter	Jr. Brg.	---	---	177.75	177.75
Bearing Pinch	Jr. Brg.	---	---	0.05	0.05
Free End					
Journal Bearing	Mandrel	---	0.008" - 0.012"	---	---
	Filler / lead wire			0.22	0.22
Axial Thrust.	With Top Housing	---	---	0.75	0.50
Shaft Diameter	Journal bearing	---	---	177.72	177.72
Bearing Pinch	Jr. bearing	---	---	0.05	0.05

101-BJ TRAIN: GAUSS

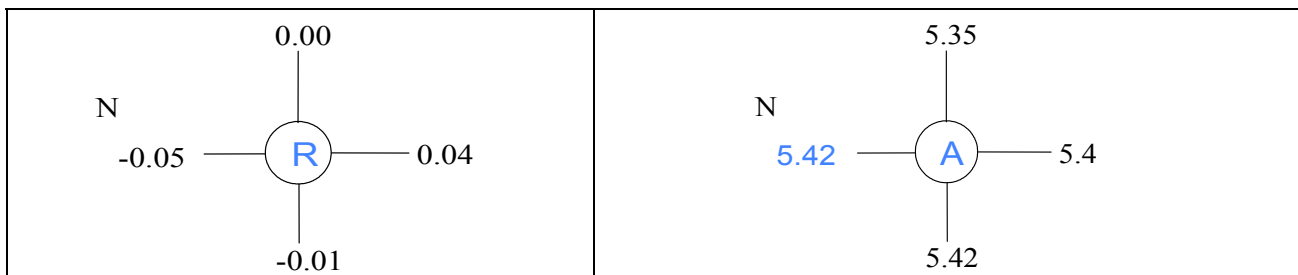
Description	Position	Before (Gauss)	After (Gauss)
101- BJT			
Journal Bearing liner	CT Side	1.2	1.2
	SILO Side	1.7	1.7
Shaft Journal	CT Side	3.0	1.2
	SILO Side	3.1	1.5
101 – JR (High Speed drive Pinion)			
Journal Bearing	CT Side	1.2	1.2
	SILO Side	1.3	1.3
Shaft Journal	CT Side	1.4	1.4
	SILO Side	0.5	0.5
101 – JR (Low Speed driven Gear)			
Journal Bearing	CT Side	0.5	0.5
	SILO Side	0.7	0.7
Shaft Journal	CT Side	0.3	0.3
	SILO Side	1.5	1.5
101-BJ			
Journal Bearing	CT Side	1.1	1.1
	SILO Side	1.3	1.3
Shaft Journal	CT Side	1.8	1.8
	SILO Side	0.9	0.9

PREVENTIVE MAINTENANCE RECORDS: 101-BJ TRAIN

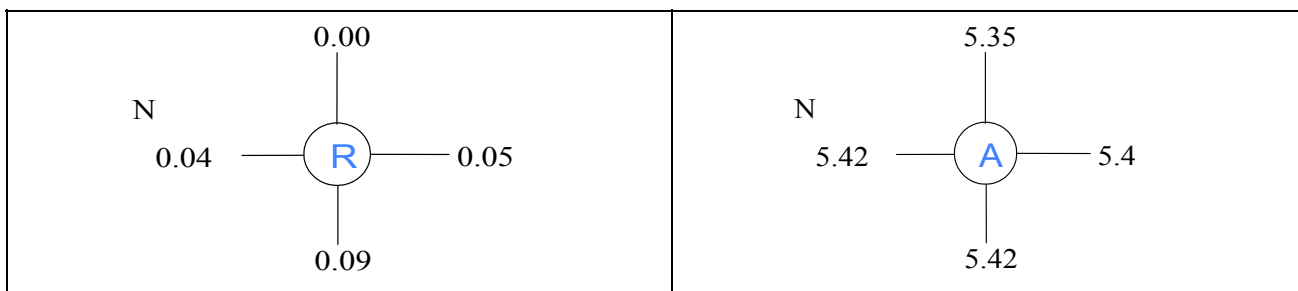
(Using either filler or micrometer)

Alignment: 101-BJT to 101-BJR

Before Preventive Maintenance

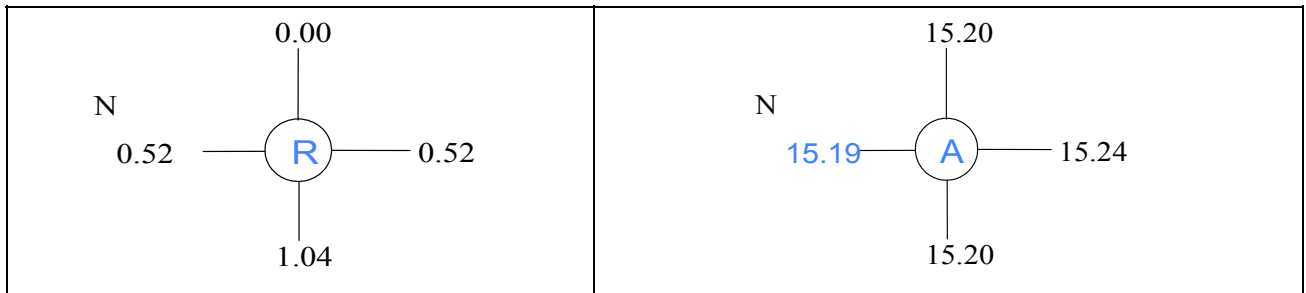


After Preventive Maintenance

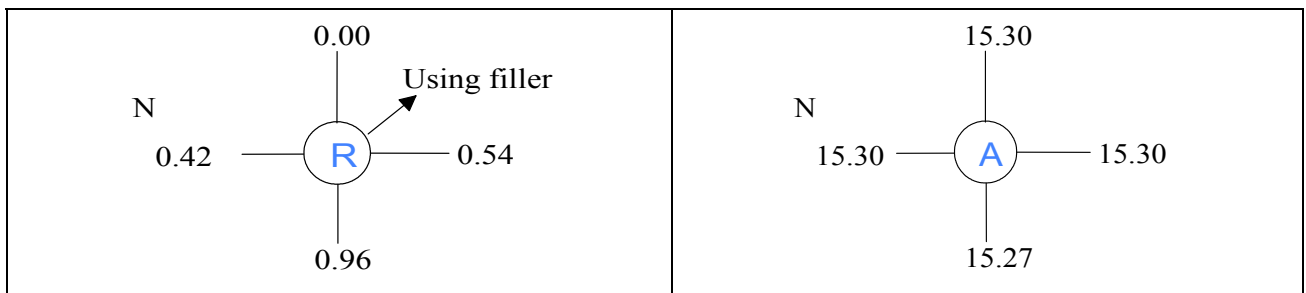


Alignment : 101-BJR to 101-BJ

Before Preventive Maintenance



After Preventive Maintenance



SEMILEAN SOLUTION PUMP115-JA TRAIN:

115-JA Semilean Solution Pump Preventive Maintenance:

The pump was decoupled and both end bearing housings opened. The thrust bearing and both ends radial bearings clearance were measured and found within limit. The bearing pads were visually inspected and DP inspected and found OK. The gauss measurement was taken and found within acceptable limit. The suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned. The ARV/NRV was overhauled, tested and reinstalled.

115-JAT Drive Steam Turbine Preventive Maintenance:

The turbine was decoupled and both ends bearing housing opened. The thrust bearing and both ends radial bearings clearance were measured and found within limit. The bearing pads were visually inspected and DP inspected and found OK. The gauss measurement was taken and found within acceptable limit. The TG 13E actuator was opened and flushed with oil. The filter was cleaned and boxed up. New lubricating oil SERVO ULTRA 40 was filled.

115-JAR Gear Box Preventive Maintenance:

All the bearings were inspected and found O.K. Both the gear as well as Pinion were inspected and found O.K. Gauss measurement of gear shaft and bearings carried out and found within limit. Bearing clearances and backlash were measured and found within the design range.

Preventive maintenance of Hydraulic Turbine 115-HT:

The hydraulic coupling was decoupled and both ends bearing housings opened. The thrust bearing and both ends radial bearings clearance were measured and found within limit. The bearing pads were visually inspected and DP inspected and found OK except for the active side thrust pads. These pads had burnt marks and the Babbitt lining had

cracks & peeled off at some locations. Hence the active pads were replaced by a set of new pads. The gauss measurement was taken and found within acceptable limit. The suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned.

PREVENTIVE MAINTENANCE RECORDS 115-JA

Coupling Records				
Description		Design Clearances (Inch)	Before (mm)	After (mm)
115-JAT to GB				
DBSE		---	----	----
115-JAT	Hub Overhang	---	0.00	0.00
	Hub Override	---	0.00	0.00
115-GB	Hub Overhang	---	0.00	0.00
	Hub Override	---	0.00	0.00
115-JA to GB				
DBSE		---	---	---
115-JAT	Hub Overhang	---	1.5	1.5
	Hub Override	---	--	--
115-GB	Hub Overhang	---	0.00	0.00
	Hub Override		0.00	0.00

SEMILEAN SOLUTION PUMP 115-JA

CLEARANCE RECORDS			
Description	Design Clearances (Inch)	Before (mm)	After (mm)
Thrust end bearing	0.005-0.0098 (0.217-0.249mm)	0.13	0.13
Opp. Thrust end bearing	--- do---	0.15	0.15
Axial Thrust	0.013 – 0.015 (0.35 - 0.40 mm)	0.30	0.30

Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	6.791	6.791	6.794	6.794
No 2	6.792	6.792	6.793	6.793
No 3	6.971	6.971	6.794	6.794
No 4	6.972	6.972	6.793	6.793
No 5	6.971	6.971	6.794	6.794
No 6	6.794	6.794	6.793	6.793
No 7	6.792	6.792	6.794	6.794
No 8	6.791	6.791	6.793	6.793

SEMILEAN SOLUTION PUMP 115-HT

CLEARANCE RECORDS			
Description	Design Clearances (mm)	Before (mm)	After (mm)
Journal bearing (Thrust bearing end)	0.124 – 0.148	0.18	0.16
Journal bearing (Opp Thrust end)	0.124 – 0.148	0.17	0.17
Axial Thrust	0.25-0.30	0.28	0.28

Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	18.43	18.43	18.36	18.36
No 2	18.43	18.43	18.36	18.36
No 3	18.43	18.43	18.36	18.36
No 4	18.43	18.43	18.36	18.36
No 5	18.43	18.43	18.36	18.36
No 6	18.43	18.43	18.36	18.36

DRIVE TURBINE : 115- JAT

CLEARANCE RECORDS				
Description	Design Clearances (Inch)	Before (mm)	After (mm)	
Axial Thrust	0.010 – 0.012	0.23	0.23	
Coupling side bearing	0.0055-0.008	0.37	0.37	
Governor side bearing	-- do --	0.24	0.24	
Oil Guard Coupling side (inboard)	Radial	0.0100-0.0125	0.25	0.25
	Axial	0.040-0.050	----	----
Oil Guard Coupling side (outboard)	Radial	0.0100-0.0125	0.26	0.26
	Axial	0.080-0.090	---	---
Oil Guard Governor side	Radial	0.0100-0.0125	0.29	0.29
	Axial	0.030-0.040	---	---

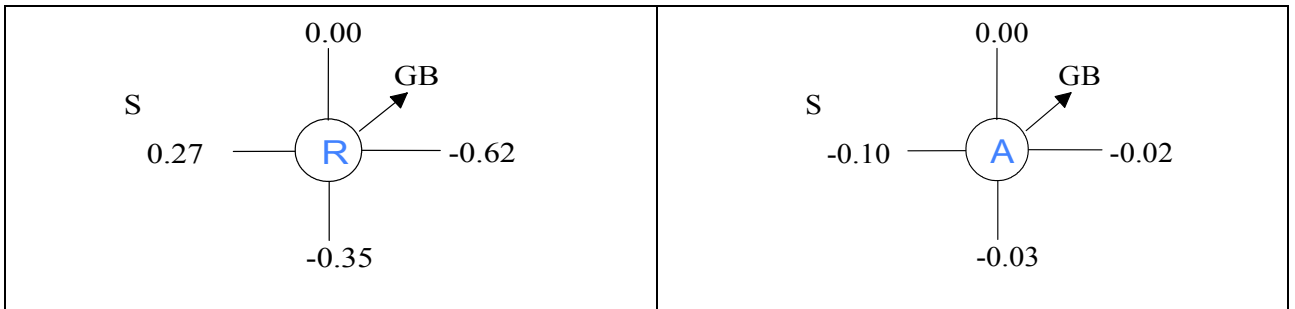
Thrust Bearing Pad Thickness,mm				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	17.46	17.46	17.47	17.47
No 2	17.46	17.46	17.47	17.47
No 3	17.46	17.46	17.47	17.47
No 4	17.46	17.46	17.47	17.47
No 5	17.46	17.46	17.47	17.47
	17.46	17.46	17.47	17.47

**PREVENTIVE MAINTENANCE RECORDS: 115-JA TRAIN
GAUSS**

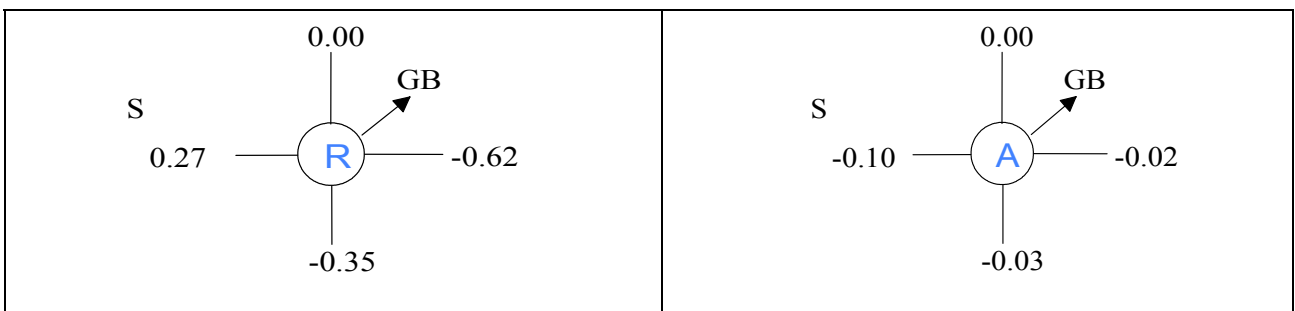
Description	Position	Before (Gauss)	After (Gauss)
115- JAT			
Journal Bearing liner	Thrust End	1.7	1.7
	Non thrust end	1.2	1.2
Thrust bearing pads	Active	1.3	1.3
	Inactive	1.8	1.8
Thrust Bearing base ring	Active	1.6	1.6
	Inactive	1.7	1.7
Shaft Journal	Thrust End	1.1	1.1
	Non thrust end	2.0	2.0
115 - JA			
Journal Bearing Sleeve	Thrust End	3.0	3.0
	Non thrust end	2.6	2.6
Thrust bearing pads	Active	3.0	3.0
	Inactive	2.8	2.8
Thrust Bearing base ring	Active	2.1	2.1
	Inactive	2.0	2.0
Shaft Journal	Thrust End	1.8	1.8
	Non thrust end	1.6	1.6
115-JR			
Gear Journal Bearing	North	1.5	1.5
	South	1.2	1.2
Pinion Journal Bearing	North	2.2	2.2
	South	1.9	1.9
Thrust bearing	Active	2.0	2.0
	Inactive	2.1	2.1
115 - HT			
Journal Bearing Sleeve	Thrust End	2.3	2.3
	Non thrust end	1.7	1.7
Thrust bearing pads	Active	0.6	0.6
	Inactive	1.7	1.7
Thrust Bearing base ring	Active	2.1	2.1
	Inactive	1.8	1.8
Shaft Journal	Thrust End	1.2	1.2
	Non thrust end	1.4	1.4

ALIGNMENT READINGS 115-JB TRAIN

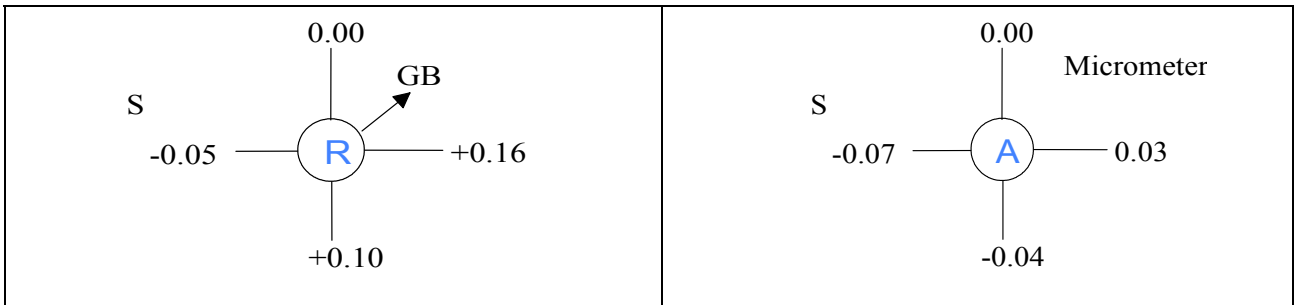
115-JAT to 115-GB : BEFORE PM



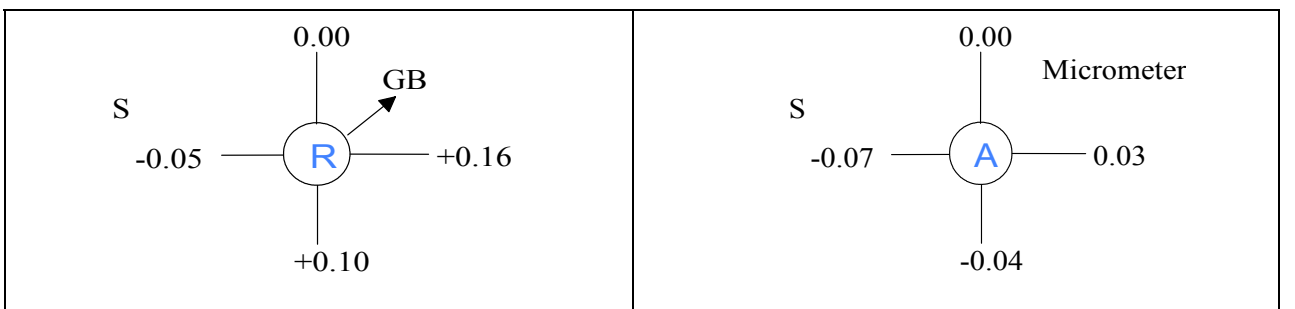
115-JAT to 115-GB : AFTER PM



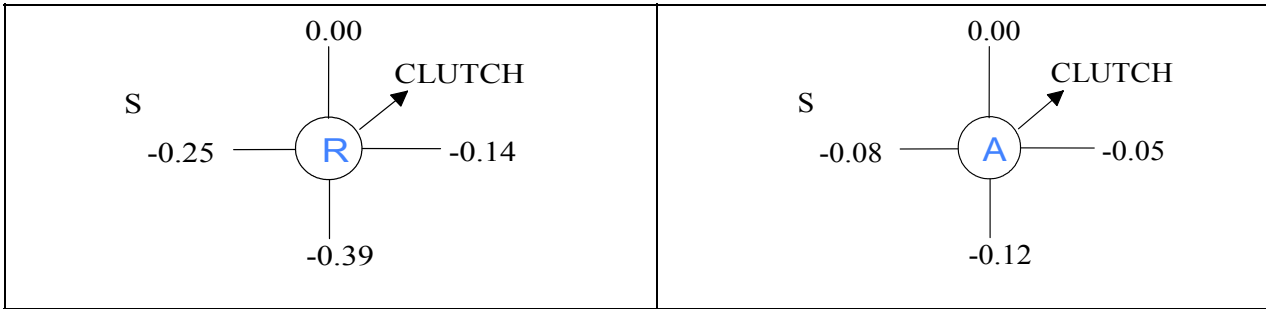
115-GB to 115-JA : BEFORE PM



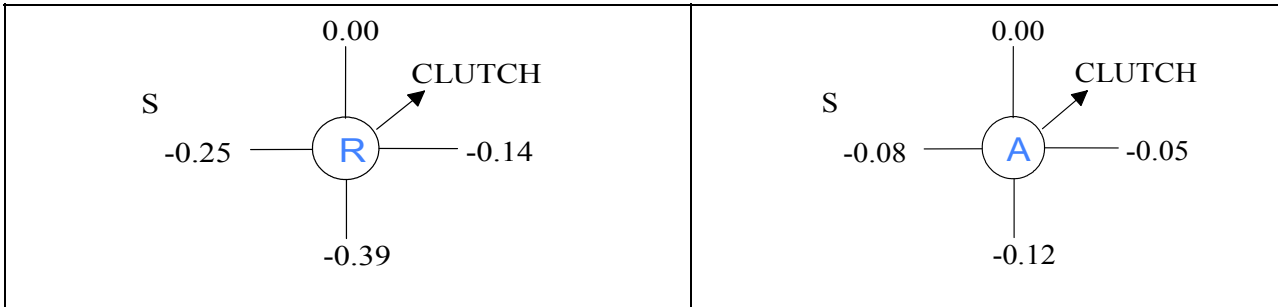
115-GB to 115-JA : AFTER PM



115-HT to 115-CLUTCH : BEFORE PM



115-HT to 115-CLUTCH : AFTER PM



BOILER FEED WATER PUMP, TRAIN 104-JA:

104-JA Boiler Feed Water Pump Preventive Maintenance:

Both ends journal bearing sleeves were visually inspected and dye penetration tested and found OK. The bearing clearance were measured and found within design range. Gauss measurement of the bearings was carried out and found within desired value. The main oil console and its console along with the filters were cleaned and installed. The seal flushing fluid coolers and strainers were cleaned. Spare refurbished ARV/NRV was installed.

104-JAT Drive Turbine Preventive Maintenance:

Coupling end journal bearing and non drive end journal cum thrust bearing was visually inspected and dye penetration tested and found OK. The axial clearance was measured and found within design limit. Gauss measurement of the bearings were carried out and found within desired value. The oil pump console was cleaned and filled with new oil. The governing valve stem carbons packing were replaced by new packing indigenously manufactured at Gujarat carbon from EK-40 grade.

Coupling inspection:

The coupling was inspected and one of the flexible element assembly was having broken shims. Hence a new flexible element assembly was installed. The DBSE and coupling hub / shaft overhang was measured and found within limit.

PREVENTIVE MAINTENANCE RECORDS: 104-JA TRAIN

COUPLINGS

Description	Position		Design (Inch)	Before (mm)	After (mm)
DBSE (With Rotor at extreme ends)	---		----	130.1	130.1
Distance between Hub Face (With Rotor at extreme ends)	---		---	130.1	130.1
Coupling Hub / Shaft Overhang	JAT	Hub	0.00	0.00	0.00
		Shaft	0.00	0.00	0.00
	JA	Hub	0.00	0.00	0.00
		Shaft	0.00	0.00	0.00

PREVENTIVE MAINTENANCE RECORDS: 104 - JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Coupling end					
Journal Bearing	Mandrel		0.005-0.007	----	----
	Filler / lead wire			0.14	0.14
Oil Guard (For Jr. Brg Housing)	South		---	0.26	0.26
	North		---	0.27	0.27
Bearing Pinch	Jr. Brg.		---	0.01	0.01
Governor end					
Journal Bearing	Mandrel		0.005-0.007	---	---
	Filler / lead wire			0.23	0.23
Oil Guard (For Brg. Housing)	South		----	0.24	0.24
Axial Thrust.	With Top Housing		0.011 - 0.016	0.27	0.27
	Without top Housing			---	---

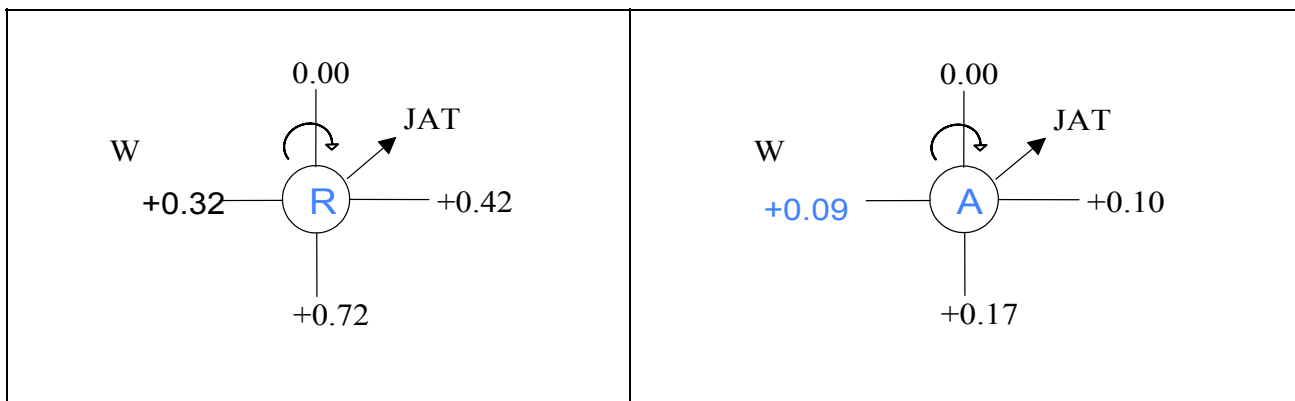
Thrust Bearing Pad Thickness ,mm : 104-JAT

Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	15.94	15.94	15.88	15.88
No 2	15.94	15.94	15.87	15.87
No 3	15.93	15.93	15.88	15.88
No 4	15.94	15.94	15.88	15.88
No 5	15.93	15.93	15.87	15.87
No 6	15.94	15.94	15.88	15.88

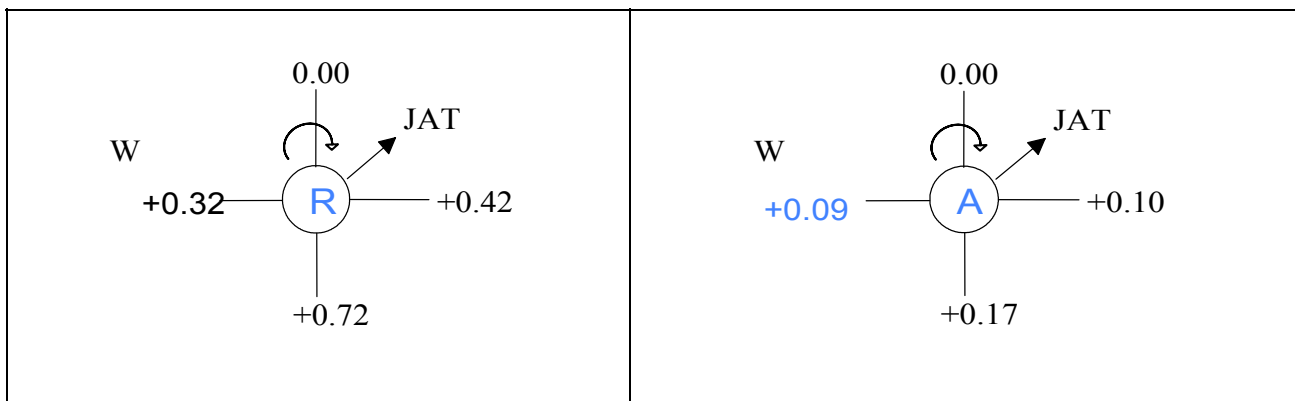
CLEARANCE CHART: 104-JA

Description	Design Clearance (Inch)	Before PM (mm)	After PM (mm)	
104 JA				
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.13	0.13	
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.12	0.12	
Axial Thrust	0.014	0.30	0.30	
Thrust Bearing Pad Thickness,mm : 104-JA				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	25.41	25.41	24.40	24.40
No 2	25.40	25.40	25.39	25.39
No 3	25.41	25.41	25.40	25.40
No 4	25.41	25.41	25.39	25.39
No 5	25.40	25.40	25.40	25.40
No 6	25.41	25.41	25.39	25.39

ALIGNMENT READINGS : 104-JAT to 104-JA (Before PM)



ALIGNMENT READINGS : 104-JAT to 104-JA (After PM)



RETROFITTING OF 104-JAT GOVERNING SYSTEM:

To have more precise speed control and improved reliability, the hydro-mechanical governor was replaced by new hydro-electronic governing system comprising of the following.

ITEM	PART NUMBER	SERIAL NUMBER
505 CONTROL	9907-163	16294321
PG-PL DRIVER	8251-451	16516926
PG-PL ACTUATOR	8251-468	16526522
MPU (2 Nos)	NA	NA
Inbuilt toothed wheel for MPU (2Nos)	NA	NA

On 28/03/10, the PG-PL Actuator (P/No: 8251-468, SI/No: 16526522) was installed on the turbine with the Teflon drive coupling and the linkage connected with turbine valve as follows:-

STEP-I: The original valve setting mentioned in the turbine manual was to provide **required initial opening of the governing valve & allow free movement of the valve spindle**. Keeping the above two in mind both the lock nuts of governing valve spindle was tightened at extreme end position of spindle and grub screw was tightened. Extreme end was preferred to keep the governing spindle spring compression at minimum and valve initial opening zero. The lock nuts were tightened sufficient enough to provide free movement of the valve spindle.

STEP-II: Keeping the servomotor piston at minimum position (upper most position) & governing valve at zero initial opening, the connecting rod was fitted.

STEP III: Connecting rod length was adjusted while keeping the servomotor piston at minimum position (Upper most position) manually to get initial governing valve opening of 1.5 mm. This opening was later reduced to 0.5 mm during commissioning. This opening is necessary for initial steam entry for developing governing oil pressure.

The cooling water lines were connected to the cooler to get a counter flow arrangement. The actuator was filled with SERVO ULTRA 40 oil. The MPU's were installed by the instrumentation section. The 505 controller along with the driver was installed inside the control room and hooked up with the PGPL actuator in the field. The 505 was then programmed as required. The details of the Governor settings are as follows:

1. Gear ratio (Turbine speed to PGPL actuator shaft speed) : 1: 4.166
2. Minimum Governing RPM : 1500
3. Maximum Governing RPM : 3750
4. Electrical over speed trip RPM : 4100
5. Over speed test limit RPM : 4300
6. Ramp rate to minimum governing RPM : 200 (During commissioning changed to)
7. The gap between both MPU's and gear teeth set at 0.5 mm.
8. The ohmic value of actuator and MPU'S were measured at 44 ohm & 1.1K ohm respectively.

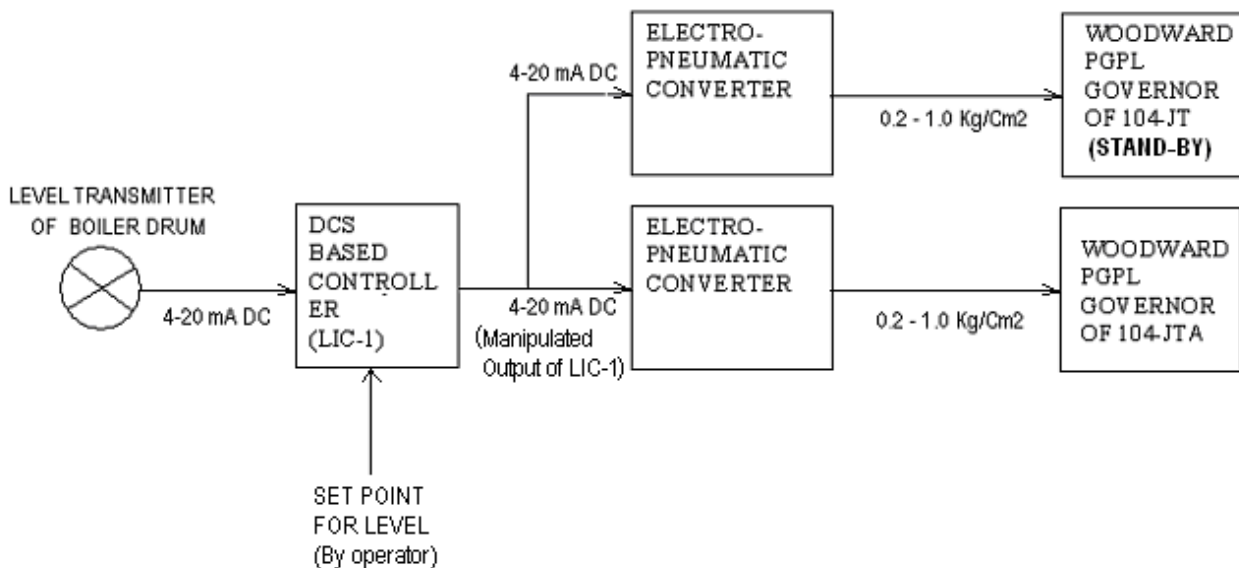
On 04/04/10 evening, the mechanical over speed was attempted and the turbine tripped at 4113 rpm. Finally a starting procedure for the governor was prepared and is as follows:

505 CONTROL STARTING PROCEDURE

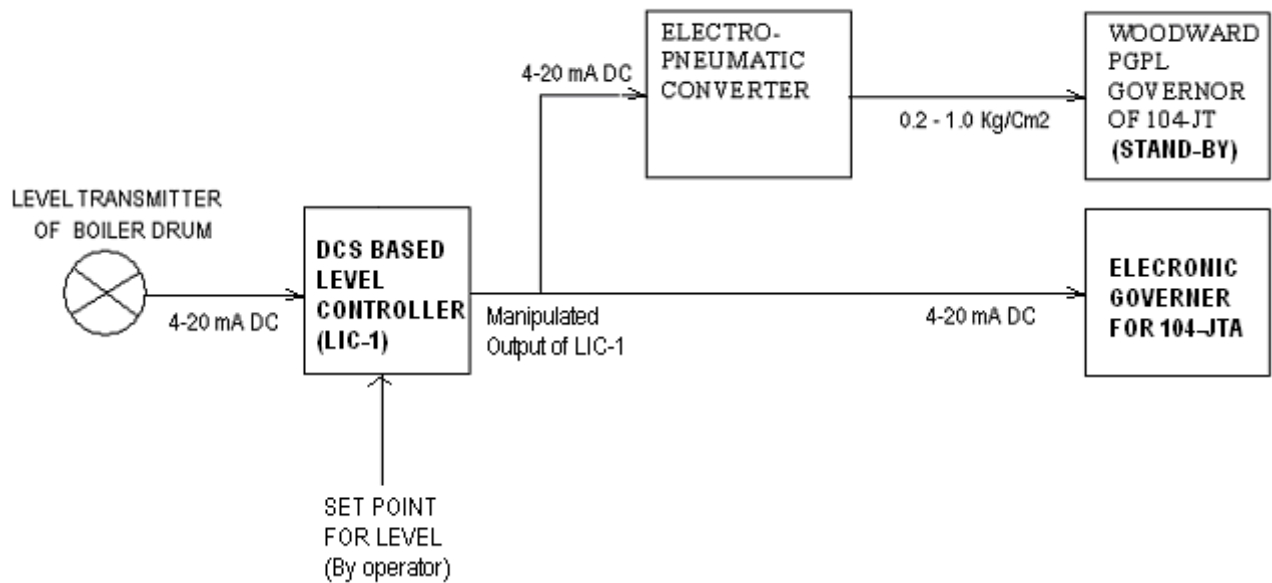
- Open steam valve slowly to get 600 rpm to developing governor oil pressure.
- Press reset button to clear all the alarm and trip I/O
- Issue run command from the 505 front panel
- The speed set point will ramp up to minimum governing rpm(1500 rpm) and the valve limiter set point also raise to 100% as per the programmed rate.
- The governing system will maintain 1500 rpm of turbine speed.
- Press F3 and then press YES to enable the remote speed set point.
- Now we can adjust the speed(1500 rpm – 3750 rpm) from DCS through 4-20mA.

OVERSPEED TRIP TESTING PROCEDURE

- Disable the remote speed set point by pressing F3 and then NO.
- Press & hold the F2 key and raise the speed set point (Max limit 4200 rpm) up to mechanical OST.
- While crossing the Electrical OST the trip message will be blink, but the turbine will not trip.
- The Electrical OST function is by passed during the F2 key is pressed.



Sketch showing the working of the Original hydro-mechanical governing system



Sketch showing the working of the New Hydro-electronic governing system

BOILER FEED WATER PUMP, TRAIN 104-J:

104-J Boiler Feed Water Pump major overhauling:

The Boiler Feed Water Pump 104-J shaft journal area diameter had reduced and the installed mechanical seal was of imported nature. This mechanical seal sleeve was threaded on the shaft while the indigenous seal sleeve was keyed type. Hence the complete rotor assembly was replaced by refurbished one.

The refurbished rotor assembly comprising of the following components were assembled at workshop and balanced new shaft.

104-J Rotor Assembly Replacement :

The pump was decoupled and the alignment readings were noted. The bearing clearance was noted.

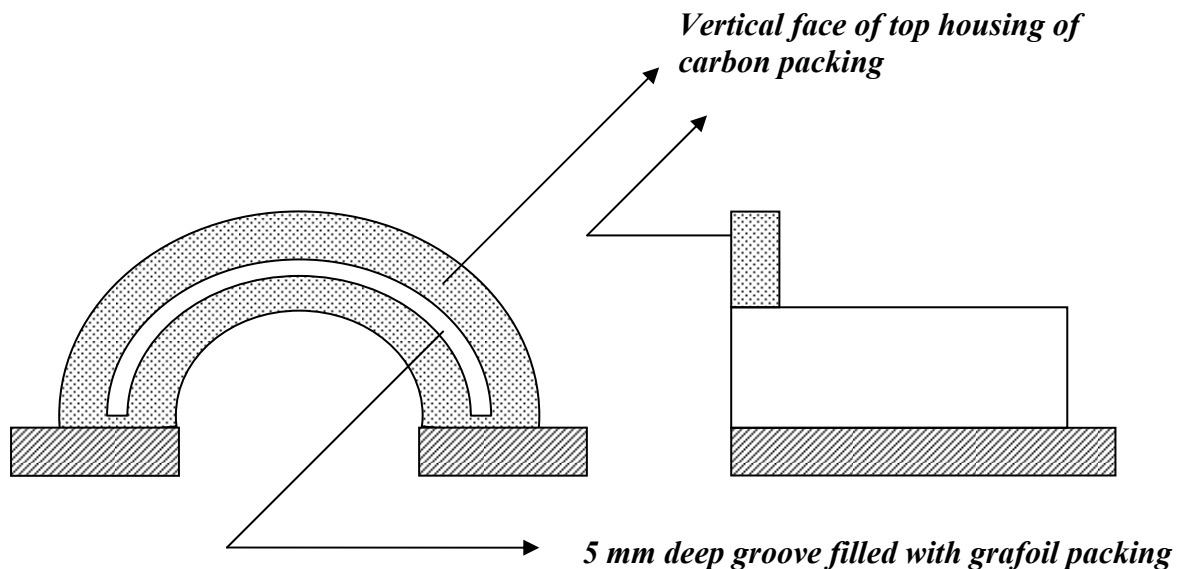
A systematic step by step procedure followed for complete dismantling, replacement of rotor and reassembling, has been elaborated below:

- The NDE lube and cooling water lines were removed. The main oil reservoir and the pumps were removed. Both end mechanical seals were locked and removed.
- The **Discharge Diffuser – Head assembly** constituting of Head, Discharge Diffuser, Inner Head Gasket & Pressure Reducing Bushing, was removed with the help of screw jack. A **1-1/4" x 12" long x UNF thread**. stud was used as the jack.
- The **Unitized internal assembly** was pulled out with the help of a Hydra. Wooden sleepers were kept below the assembly to guide the same. The assembly was taken to main workshop and placed horizontally on floor for dismantling.
- The Shaft Sleeve Compression Nut, Shaft Sleeve, Seal Ring & Inlet Spacer respectively came out with ease.
- The 1st Impeller Spacer Sleeve / Lock Nut and the 1st stage Impeller were removed.

- Then the 1st set of Intermediate Cover with, Bushing, Wearing ring & Diffuser was removed.
- The above two steps was repeated to dismantle the remaining stages i.e. from 2nd to 7th.
- Before removing each impeller, the following were measured and tabulated to calculate the clearances :
 - Impeller **Wear Ring** O.D.
 - Impeller **Spacer Sleeve** O.D.
 - Removed Suction Spacer /Intermediate Cover/ Discharge Spacer **Wear Ring** I.D.
 - Removed Suction Spacer / Intermediate Cover/ Discharge Spacer. **Bushing** I.D.
- The new rotor assembly was dismantled after proper marking so that the same sequence of installation can be carried out. The shaft was left with Pressure Reducing Sleeve, Pressure Reducing Sleeve Lock Nut, and Shaft Sleeve & Shaft Sleeve Compression Nut.
- Horizontal installation was started with 7th Impeller with Wear Ring and the same was locked with Spacer Sleeve.
- Then assembly of Discharge Spacer, Wearing ring, Bushing & Diffuser was installed.
- The above two steps were repeated until the 1st Impeller and the 1st Impeller Lock Nut was installed.
- After installing each impeller, the following were measured and tabulated to calculate the clearances. :
 - Impeller **Wear Ring** O.D & **Spacer Sleeve** O.D.
 - Next Suction Spacer/Intermediate Cover/Discharge Spacer **Wear Ring** I.D.
 - Next Suction Spacer / Intermediate Cover/ Discharge Spacer. **Bushing** I.D.
- Finally the Suction Spacer with Wear Ring was installed. This was followed by installation of seal Ring, Shaft Sleeve & Shaft Sleeve Compression Nut. The **Unitized internal assembly** was ready to be installed in the casing.
- The Unitized internal assembly was placed inside the casing and the **Discharge Diffuser – Head assembly** bolted to the casing.
- Both ends mechanical seals were installed. The stationary and rotating rings of both the mechanical seals were lapped and reassembled. All the ‘O’-Rings were replaced by new ones.
- To locate the impeller relative to the diffuser, the total rotor float was measured and recorded at 10.5 mm. The thrust bearing was placed and the shims at either end of the thrust bearing was maintained as it is to get 4.1 mm float on coupling side and 6.4 mm on free end.
- The journal bearing at the coupling end was replaced by new indegenised bearing manufactured at M/s Kanpur Metals. The clearances of both end bearings was noted and found within limit.
- The main oil pump assembly was installed.

104-JT Drive Turbine Preventive Maintenance:

Both ends journal bearing clearances were measured and found within limit. The non drive end carbon packing top cover was removed to check the cause of excessive steam leakage. It was observed that cover's vertical sealing face had a 5 mm deep groove that had no packing. Using manual's instruction, this groove was filled using grafoil packing. During running least leakage was observed.

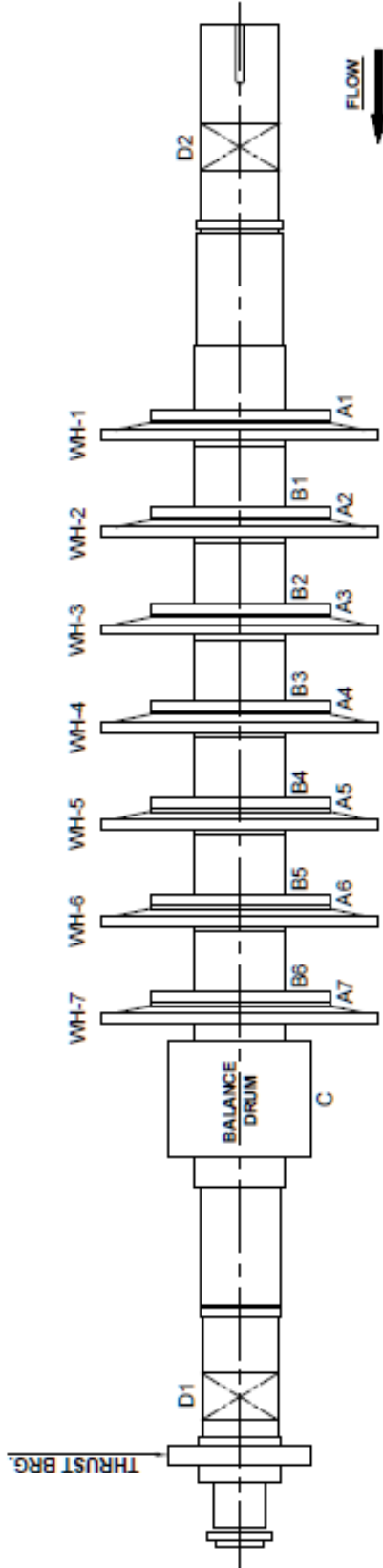


104-JT (ELLIOT) Carbon Packing Housing

Coupling inspection:

During removal of the coupling hub of the turbine, the hub moved out by 1.5 mm and got struck. This resulted in reduced DBSE. Since no spare coupling was available with us, the spacer length had to be reduced by 1.5 mm by taking cut on both ends. The turbine was coupled to the pump using this reduced length hub and during start-up the pump was run and no abnormality and vibrations were observed.

DATE : _____



IMPELLER NECK RING CLEARANCE (A)			INTERSTAGE BUSHING CLEARANCE (B)			POSITION			DESCRIPTION			DESIGN			ACTUAL							
POSITION	WEAR RING I.D. SUC. : 8.500" INT. : 7.375"	NECK RING O.D. SUC. : 8.485" INT. : 7.362"	CLEARANCE SUC. : 0.015" INT. : 0.013"	POSITION	BUSH I.D. 4.000"	SLEEVE O.D. 3.988"	CLEARANCE 0.012"	D1	JOURNAL BRG. CLEARANCE (COUPLING SIDE)	0.006" - 0.008"	0.12	D2	JOURNAL BRG. CLEARANCE (THRUST END SIDE)	0.006" - 0.008"	0.13	3	AXIAL THRUST	0.014"	0.35	4	TOTAL FLOAT	10.28
A1	216.02	215.46	0.56	B1	101.67	101.28	0.39	BALANCE DRUM CLEARANCE (C) POSITION BUSH I.D. (MM) 6.875" BALANCE DRUM O.D. (MM) 6.868" CLEARANCE (MM) 0.007"						174.70	174.38	0.32						
A2	187.45	186.96	0.51	B2	101.68	101.28	0.40															
A3	187.44	186.94	0.50	B3	101.68	101.28	0.40															
A4	187.44	186.94	0.50	B4	101.68	101.28	0.40															
A5	187.43	186.94	0.49	B5	101.76	101.30	0.46															
A6	187.43	186.94	0.49	B6	101.71	101.30	0.41															
A7	187.43	186.94	0.49																			

NOTE :-

R.P.M. :- 3500

ROTOR WEIGHT :- 223 Kg.

SIZE :- 6" LL BFIC

IFFCO - KALOL

CLEARANCE RECORD FOR BFW PUMP 104-J/JA

PLANT : AMMONIA

PREVENTIVE MAINTENANCE RECORDS: 104-J TRAIN

COUPLINGS

Description	Position	Design (Inch)	Before (mm)	After (mm)	
Coupling Float (For Gear Coupling Only)	---	---	0.36"	0.36"	
Distance between Hub Face (With Rotor at extreme ends)	---	---	123.30	121.90	
Coupling Hub / Shaft Overhang	JT	Hub	0.00	1.5	3
		Shaft	0.00	---	---
	J	Hub	0.00	0.00	0.00
		Shaft	0.00	0.00	0.00

PREVENTIVE MAINTENANCE RECORDS: 104 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (mm)	After (mm)
Coupling end					
Journal Bearing	Mandrel		0.007"-0.010"	---	---
	Filler / lead wire			0.17	0.17
Governor end					
Journal Bearing	Mandrel		0.007"-0.010"	---	---
	Filler / lead wire			0.24	0.24

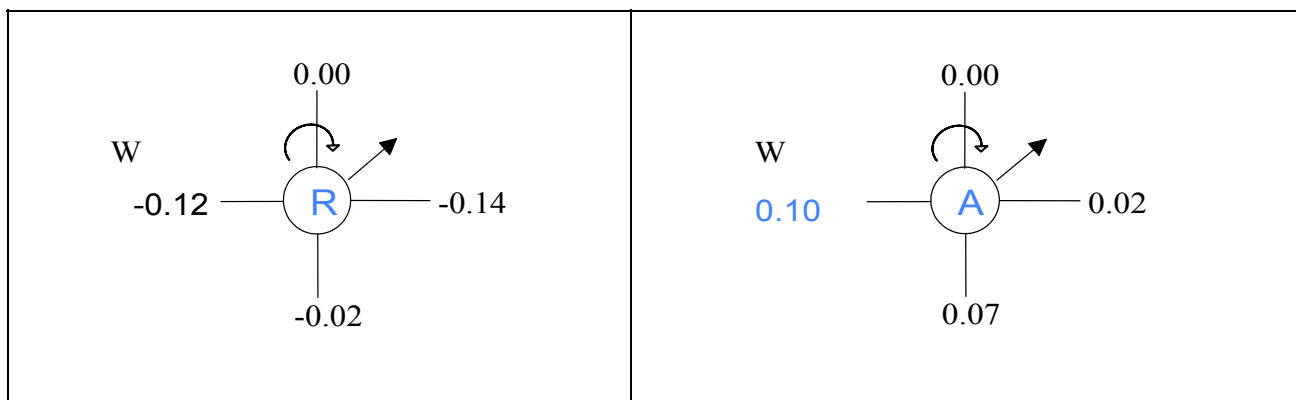
Thrust Bearing Pad Thickness,mm : 104-JT				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	15.94	15.94	25.41	25.41
No 2	15.91	15.91	15.38	15.38
No 3	15.94	15.94	25.39	25.39
No 4	15.95	15.95	15.40	15.40
No 5	15.93	15.93	25.40	25.40
No 6	15.93	15.93	25.40	25.40

CLEARANCE CHART: 104-J

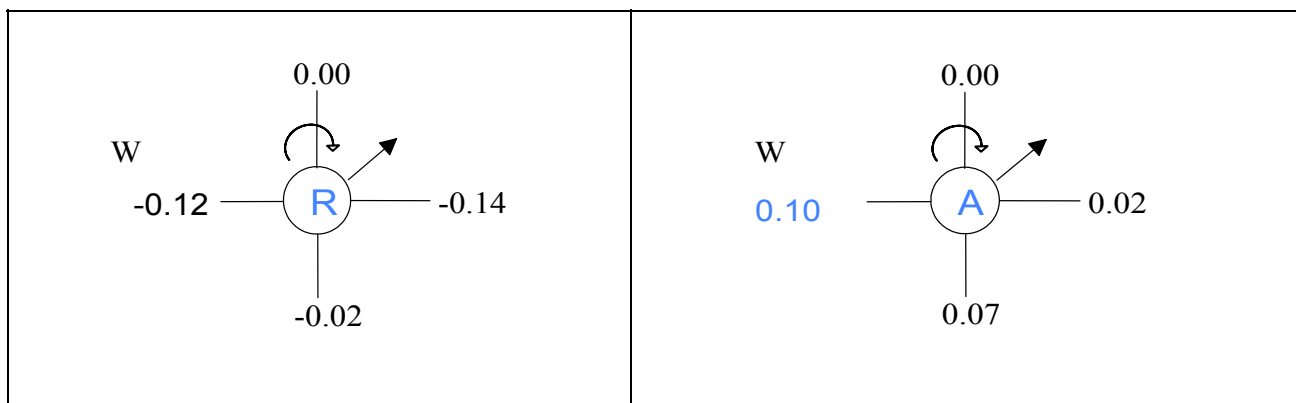
Description	Design Clearance (Inch)	Before PM (mm)	After PM (mm)
104 J			
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.13	0.13
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.12	0.12
Axial Thrust	0.014	0.35	0.35

Thrust Bearing Pad Thickness,mm : 104-J				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	25.37	25.37	25.37	25.37
No 2	25.38	25.38	25.37	25.37
No 3	25.38	25.38	25.37	25.37
No 4	25.38	25.38	25.37	25.37
No 5	25.37	25.37	25.37	25.37
No 6	25.38	25.38	25.37	25.37

ALIGNMENT READINGS : 104-JT to 104-JA (Before PM)



ALIGNMENT READINGS : 104-JT to 104-JA (After PM)



aMDEA PUMP 107-J Train:

107-JT Drive Turbine Preventive Maintenance:

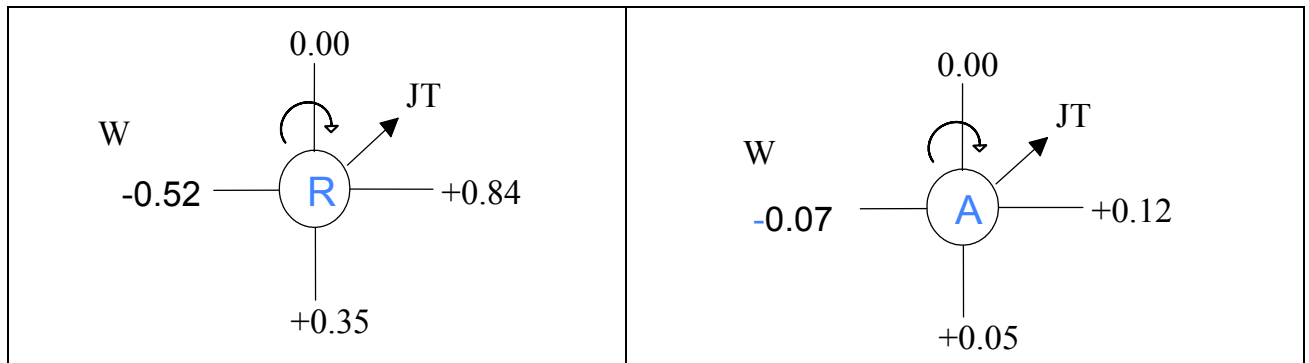
The turbine was decoupled and the coupling was inspected. The pump side flexible elements were found broken and was replaced by new assembly. Both end bearings was inspected and found in good condition. The suction strainers were cleaned. The lube oil coolers and console were cleaned. Gauss measurements was taken and found below maximum limit. The dimension of the MOP coupling was measured for indigenization.

CLEARANCE CHART: 107-JT (MURRY TURBINE)

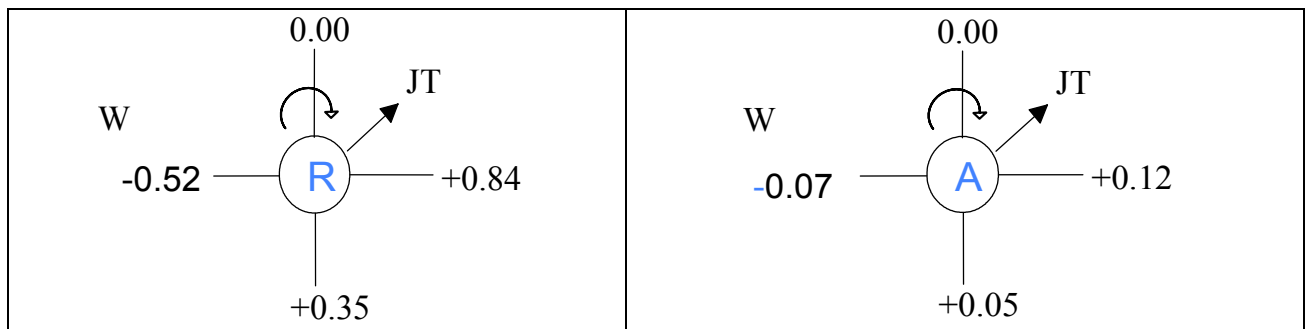
Description	Design Clearance (Inch)	Before PM (mm)	After PM (mm)
Journal bearing Thrust end	0.004 – 0.006	0.17	0.17
Oil Guard Thrust end - Inboard	0.011" – 0.017"	0.13	0.13
Oil Guard Thrust end - Outboard	0.011" – 0.017"	---	---
Journal bearing Opposite thrust end	0.004 – 0.006	0.17	0.17
Oil Guard Opposite thrust end - Inboard	0.011" – 0.017"	0.14	0.14
Axial Thrust	0.007 – 0.013	0.25	0.25

GAUSS			
LOCATION		BEFORE (Gauss)	AFTER (Gauss)
Journal bearing Governor end	Top half	1.1	1.1
	Bottom half	2.0	2.0
	Shaft	1.3	1.3
Journal bearing Coupling end	Top half	1.1	1.1
	Bottom half	2.0	2.0
	Shaft	1.3	1.3
Thrust bearing	Collar	2.2	2.2
	Pad	2.2	2.2

107-JT to 107-J (Before PM)



107-JT to 107-J (After PM)



SPLIT STREAM PUMP TRAIN

Drive Turbine, 116-JAT Preventive Maintenance :

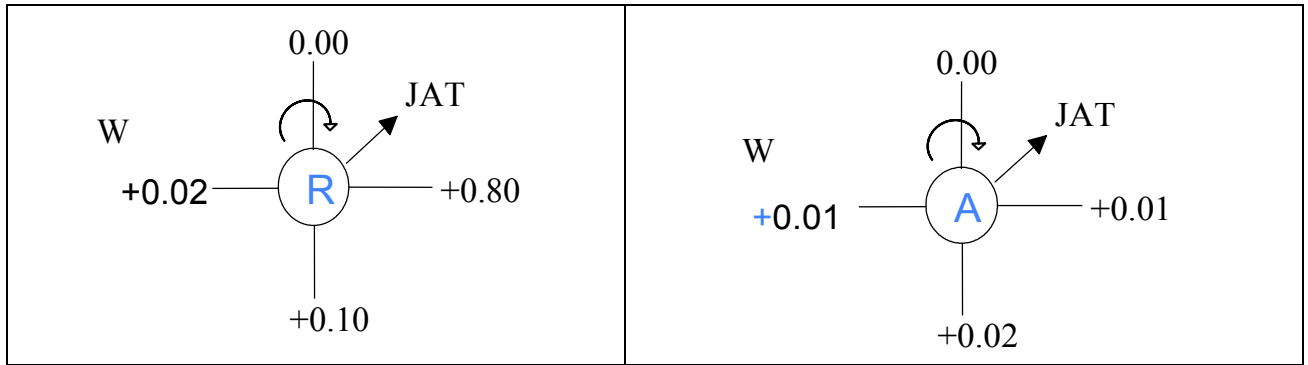
The turbine was taken for preventive maintenance. The journal bearing sleeves were visually inspected and dye penetration tested and found O.K. The bearing clearance of the coupling end journal bearing was on higher side and an even clearances were hence was replaced by a new bearing. The carbon ring clearance was measured and found to be OK.

The cooling water lines for the turbine's bearing was flushed. The pump's mechanical seal lines flushing lines were flushed and the strainers cleaned. The ARV/NRV of both the pumps were overhauled and reinstalled.

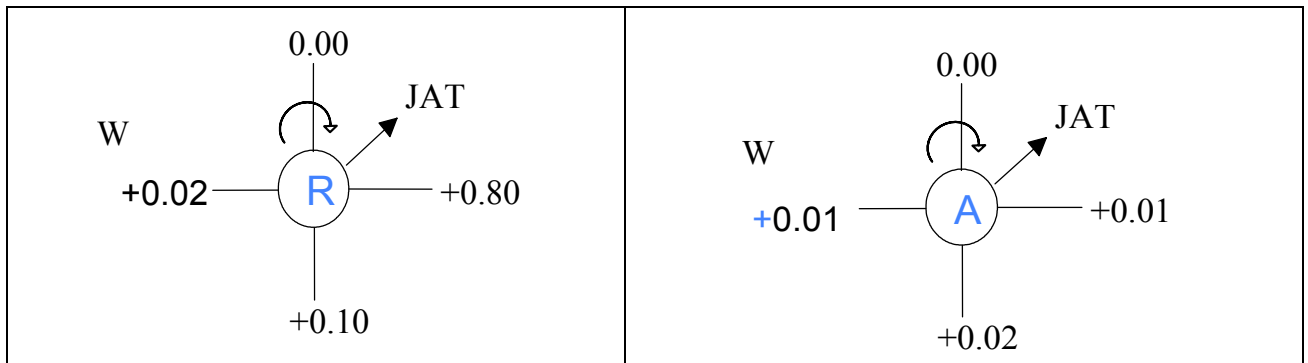
PREVENTIVE MAINTENANCE RECORDS: 116-JAT

Description	Position	Dwg. Ref	Design Clearances (mm)	Before (mm)	After (mm)
Coupling end					
Journal Bearing (Diometrical)	Mandrel	---	0.15 – 0.23	---	---
	Filler / lead wire	---		0.27 max	0.22
Oil Guard (For Jr. Brg Housing)	Kalol Side	---	0.25 – 0.37	0.32	0.32
	Ahmedabad Side	---	0.25 – 0.37	0.32	0.32
Shaft Diameter (Journal)	Jr. Brg.	---	49.07 – 49.08	49.07	49.07
Bearing Pinch	Jr. Brg.	---	---	---	----
Governor End					
Journal Bearing	Mandrel	---	0.15 – 0.23	---	---
	Filler / lead wire	---		0.23	0.23
Shaft Diameter (Journal)	Jr. Brg.	---	49.07 – 49.08	49.07	49.07
Bearing Pinch	Jr. Brg.	---	---	---	----
Oil Guard (For Brg. Housing)	Kalol Side	---	0.25 – 0.37	0.30	0.30
Axial Thrust.	With Top Housing	---	0.00	0.00	0.00
	Without top Housing	---		0.00	0.00

116-JAT to 116-JA (Before PM)



116-JAT to 116-JA (After PM)



COPPUS TURBINE :

101/105-JLOPT Preventive maintenance :

The turbine was removed from installation and taken for preventive maintenance. The radial as well as thrust bearings were inspected and found OK. The bearing housing end packings were damaged and hence were replaced by felt packing. The turbine trip valve assembly was replaced by new trip valve assembly which had been assembled from spare internals and spare body. The bearing cooling water lines were flushed. The gate cum check valve of both the MOP and AOP was overhauled by lapping the valve and the seat. The turbine was boxed up and installed at location. The bearing cooling water lines were modified as per production departments' requirement.

103-JLOPT Preventive maintenance :

The turbine was taken for preventive maintenance. The radial as well as thrust bearings were inspected and found OK. The bearing housing end packings were damaged and hence were replaced by felt packing. The turbine trip valve assembly was opened and cleaned. The turbine was boxed up.

DM WATER RECIPROCATING PUMP P1 AND P2

The pumps were taken for preventive maintenance. The liquid end of the pumps was opened and the valves were inspected and found in good condition. The crank case was opened and the bearing were inspected and found OK except for one connecting rod bearing of P1. The same was replaced by new one. The bearing clearances were measured and found in the range of 0.10-0.17 mm which was acceptable. The V belts were inspected and found in good condition. The pumps were aligned to the motor.

RECIPROCATING CO₂ GAS COMPRESSOR TRAIN (117-J)

LP Cylinders Overhauling:

The end clearance at TDC and BDC were measured and found OK. Opened the head of both cylinders. The cylinder liners were inspected and found OK. The runout of the piston rod was checked and found OK. Removed the piston for checking seals on piston head. The seal rings and bearing rings were found damaged and hence were replaced by new ones. The bearing ring were heated to a temperature of 200⁰C and inserted on to the piston assembly. All the valve assemblies were reconditioned. The seal rings of the gas packing were replaced by new ones.

HP Cylinders Overhauling:

The end clearance at TDC and BDC were measured and found OK. The cylinder liners were inspected and found OK. The runout of the piston rod was checked and found OK. Both the cylinders were disassembled. The seal rings and bearing rings on the piston head were found damaged and hence were replaced by new ones. The bearing ring were heated to a temperature of 200⁰C and inserted on to the disassembled piston assembly. All the valve assemblies were reconditioned. The seal rings of the gas packing were replaced by new ones.

Crank case assembly Overhauling:

Open the crank case cover for the inspection of the bearings and other internals. Clearances of all the big end bearings were found on higher side and the white metal lining had worn out. These bearings were replaced by new ones. All other components were visually inspected and found OK. All the clearances were measured and found within limit. All critical nuts were tightened at respective design torque. The AOP was run and oil flow inside the crank case was checked and found OK.

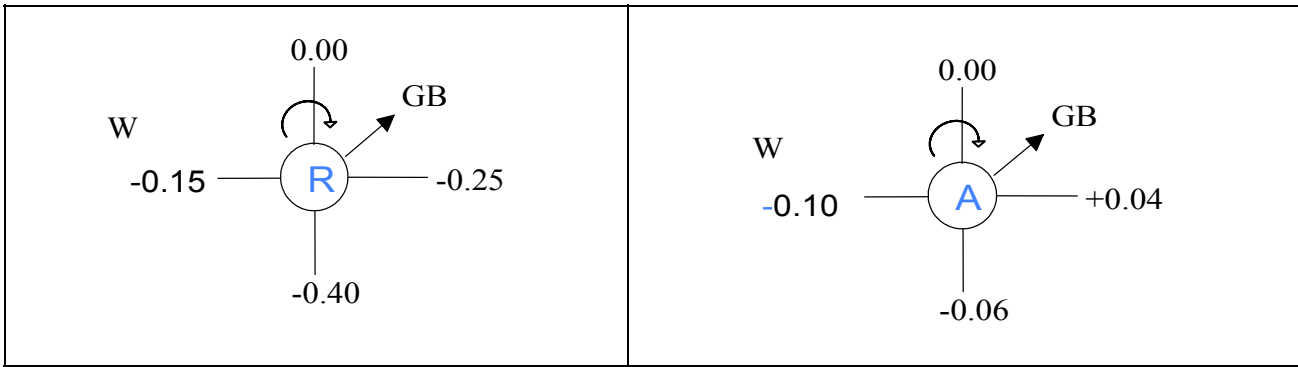
The tube bundle of the interstage cooler was pulled out and cleaned by hydro jetting. The LP and HP flow dampener were checked and found OK. The lube oil strainers were cleaned and reinstalled.

CLEARANCE CHART: 117-J TRAIN

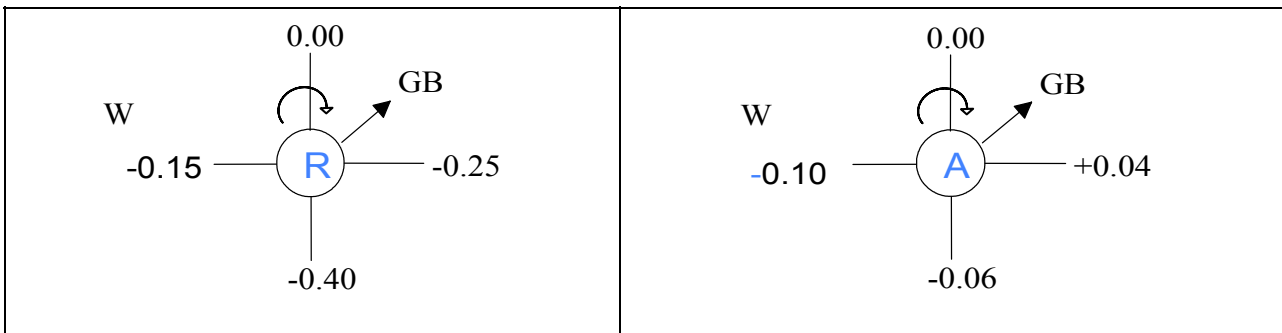
Description	Position		Design clearance (mm)	Before (mm)	After (mm)
Piston end clr. (Front /TDC)	LP	Urea side	2	3.02	3.02
		Ammonia side	-- do --	3.02	3.10
	HP	Urea side	-- do --	3.25	3.03
		Ammonia side	-- do --	3.15	2.74
Piston end clr. (Intermediate /BDC)	LP	Urea side	1.5	1.52	1.73
		Ammonia side	-- do --	1.7	1.62
	HP	Urea side	-- do --	1.44	1.42
		Ammonia side	-- do --	1.52	1.45
Main bearing	I	Urea side to Ammonia side	0.08-0.15 (0.3 MAX)	0.19	0.19
	II		-- do --	0.16	0.17
	III		-- do --	0.17	0.17
	IV		-- do --	0.17	0.17
	V		-- do --	0.15	0.15

Big end bearing	LP	Urea side	0.07-0.13 (0.3 MAX)	0.16	0.16
		Ammonia side	-- do --	0.15	0.15
	HP	Urea side	-- do --	0.16	0.15
		Ammonia side	-- do --	0.15	0.15
Small end bearing	LP	Urea side	0.05-0.10 (0.2 MAX)	0.12	0.11
		Ammonia side	-- do --	0.09	0.09
	HP	Urea side	-- do --	0.06	0.05
		Ammonia side	-- do --	0.06	0.06
Cross head guide	LP	Urea side	0.18-0.26 (0.6 MAX)	0.23	0.24
		Ammonia side	-- do --	0.23	0.23
	HP	Urea side	-- do --	0.23	0.23
		Ammonia side	-- do --	0.24	0.24
Side clearance (Crank shaft)	----	Crank shaft	0.45-0.60 (0.9 MAX)	0.9	0.9
Side clearance (Connecting rod big end)	LP	Urea side	0.33-0.42 (0.6 MAX)	0.38	0.38
		Ammonia side	-- do --	0.42	0.42
	HP	Urea side	-- do --	0.42	0.42
		Ammonia side	-- do --	0.43	0.42
End clearance piston rings	LP	Urea side	3.84	3.4	3.4
		Ammonia side	3.84	3.2	3.2
	HP	Urea side	2.52	3.4	3.4
		Ammonia side	2.52	3.3	3.3
Diametrical clr. (Piston – Cylinder)	LP	Urea side	3 - 4	3.53	3.53
		Ammonia side	3 - 4	3.51	3.51
	HP	Urea side	3 - 4	3.50	3.50
		Ammonia side	3 - 4	3.58	3.58
Piston rod OD	LP	Urea side	--	31.60	31.61
		Ammonia side	--	31.70	31.70
	HP	Urea side	--	31.78	31.78
		Ammonia side	--	31.70	31.70
Piston OD	LP	Urea side	--	156.56	156.56
		Ammonia side	--	156.53	156.53
	HP	Urea side	--	101.40	101.40
		Ammonia side	--	100.51	100.51
Cylinder ID	LP	Urea side		160.07	160.07
		Ammonia side		160.06	160.06
	HP	Urea side		105.01	105.01
		Ammonia side		105.01	105.01

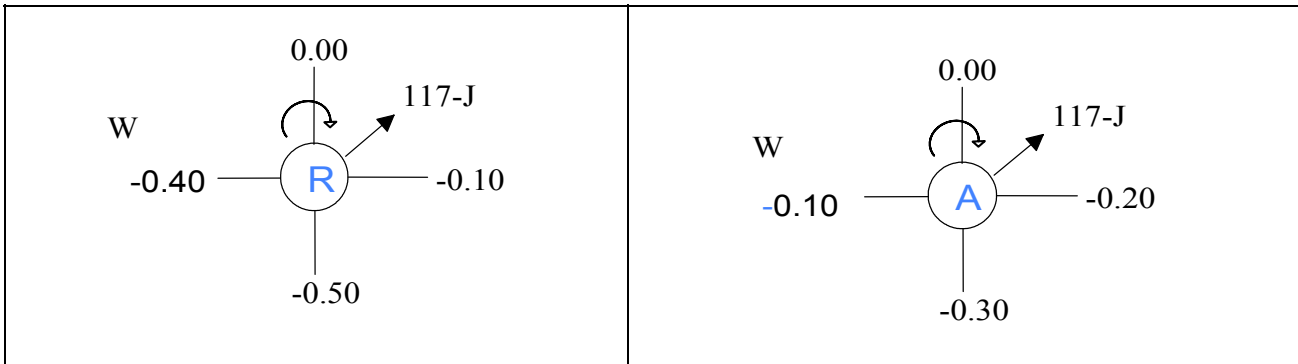
117-JM to Gear Box - (Before PM)



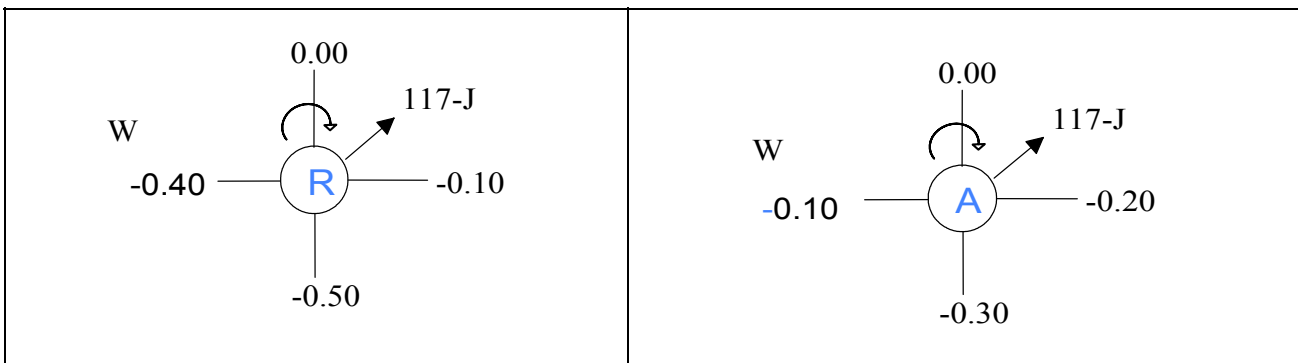
117-JM to Gear Box - (After PM)



Gear Box to 117-J - (Before PM)



Gear Box to 117-J - (After PM)

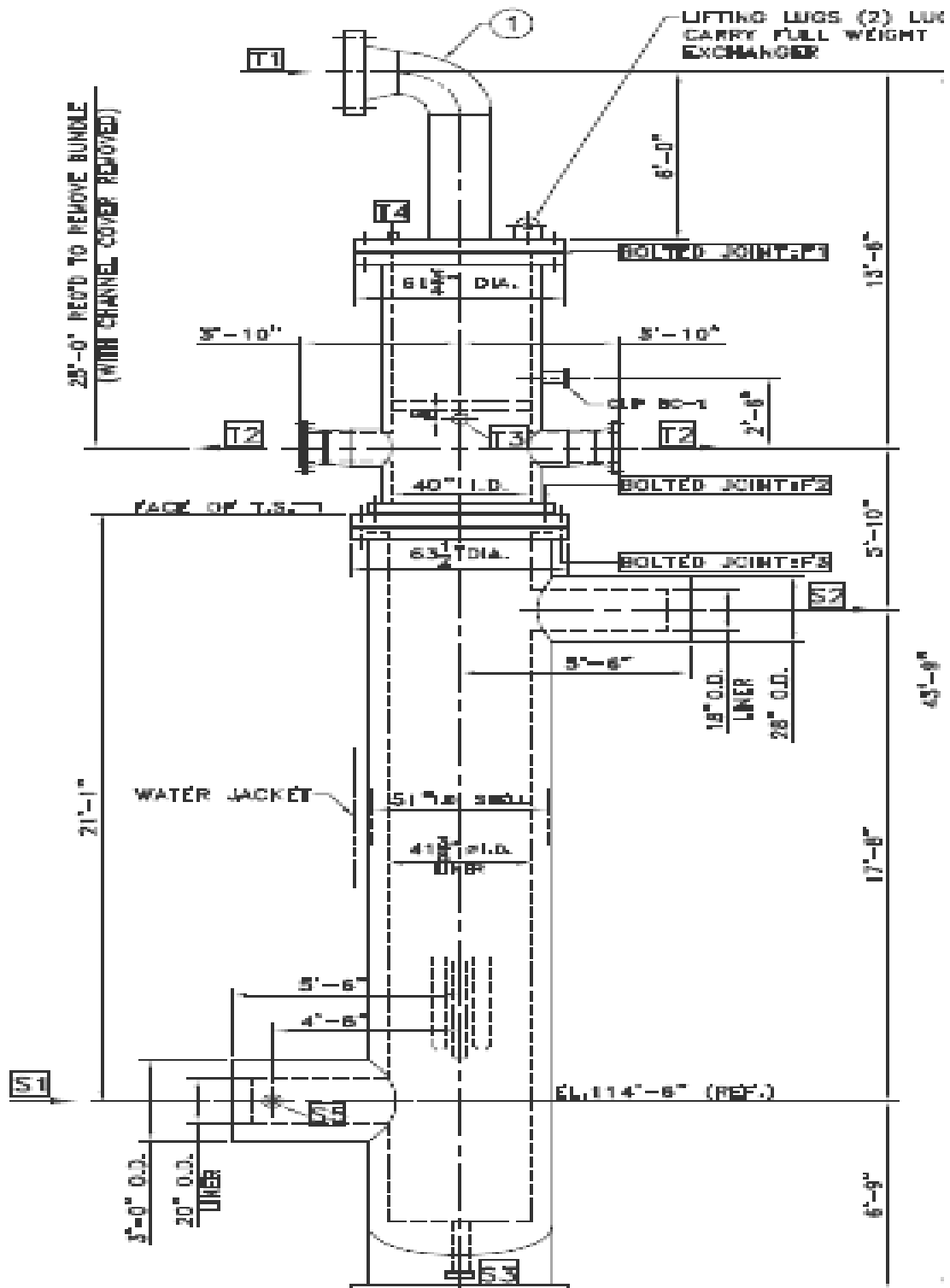


Waste Heat Boiler (101-CA & 101-CB) Jobs.

The Channel Cover Bottom to Outer Tube Sheet Flange Joint (Bolted Joint F-2)was furmanited since long for 101-CA Tube Bundle. Also the tube bundle was in service since 1996, hence replacement of 101-CA Tube bundle was planned with available spare Tube Bundle.

During December-2009, the F-2 joint of 101-CB was also found leaking, hence it was planned to replace the gasket of F-2 Joint and re-use the same bundle.

Service of M/s Shree Ganesh Engineering Services, A'bad was used for the job. Pre-shut-down activities:



101-CA/CB Dimensional sketch



Chain block being tested



Gasket seating face



Inner tube being inserted into outer bundle for 101-CA



Tube Bundle made ready for lifting



**Spare Tube bundle
being lifted for 101-
CB**

- a) Identification & Load testing of wire rope slings, D-shackle.
- b) 40- Ton chain block was installed at monorail.
- c) Removal of platform at Chain Block Level.
- d) Measurement of gap between Top of 102-C & minimum length Chain block with Wire rope & D-shackle. It was measured as 11,660 mm and minimum gap required to pull out 101-CA over 102-C Top is 10,750 mm.
- e) List of various required spanners prepared.
- f) Arrangement for Load Test of Chain Pulley block was made with 23.5 Tons Dead weight.
- g) The bolts of Structure to be opened were roused.

Shut-Down Activities:-

- a) The chain Block was tested with 23.5 Tons Dead weight and found o.k.
- b) The elbow bolts of 101-CB were opened and elbow was removed with RT-760 Crane.
- c) The Elbow of 101-CA was removed with Chain Block and Kobelco crane with the Two Slings.
- d) The gasket face of both elbows was attended with stone and high spots were removed.
- e) The Tube Bundle of 101-CB was lifted by Kobleco crane and shift on low bed trailer with RT-760 crane. The Bundle was dismantled on rack near Gail station.
- f) The grafoil tape on the Gasket of F-2 joint was found washed out at one location.
- g) The bottom face of channel cover and Top face of Outer Tube flange attended with stone. The gasket groove and snub was found o.k. The flange was re-assembled with Soft Iron Gasket without any grafoil tape/ Teflon tape. However one of the soft iron gasket rejected due to depression observed on welded joint. The other soft gasket was found o.k. and used.
- h) The 40 Ton chain block was used during assembly of inner tubes to outer tubes.
- i) Blinds for Steam riser flange and hydrotest cover was assembled and bundle was tested at 130 kg/cm² pressure. Afterwards, the bundle was placed in dummy shell and transported to Reformer site for erection.
- j) The liner of 101-CB furnace was found cracked at four locations, which was repaired by incoweld-A Electrode.
- k) Soft iron gasket without Telfon / grafoil tape was used for Outer Tube to furnace Joint F-3.
- l) While placing the tube Bundle in the Furnace, the gasket has to be placed in the groove available in Tube Bundle Flange and Male Tongue is available in Bottom flange. Hence AUDCO grease 735 was used as adhesive to fix the gasket in top flange groove and gasket was monitored till 1" gap by small torch while lowering of Tube bundle.

- m) The Tube bundle of 101-CA was lifted by Chain block with provision of Two Slings Hand for shifting the bundle on Crane. The bundle was lifted to clear the 102-C top in approximately 7 hrs by team of 20 persons.
- n) The spare tube bundle, which was repaired departmentally and hydro tested on 02.01.2010, was shifted from Pipe Rack to Reformer site in Dummy shell and lifted by Kobelco crane and spare sling loop to shift the load on chain pulley block.
- o) The Tube bundle was assembled back in the furnace with soft iron gasket, in line with, 101-CB assembly procedure.
- p) The Water inlet elbows of both exchangers were assembled with soft iron gaskets, without Teflon/ grafoil tape. The tightening sequence of Studs was followed very stringently. First the Nuts were hand tightened. The positioned of nuts in stud was checked for full thread engagement on both the ends. Then numbers were marked on each stud and opposite Nuts were tightened by Hydraulic Torque wrench in steps of 50 PSI, 1500 PSI, 3000 PSI , 4000 PSI and 4500 PSI.

PRIMARY REFORMER 101-B Jobs

- Ten nos damaged burner blocks were replaced by new one.
- Cerafelt insulation on bottom header was replaced.
- All Primary air registers were made free.
- Tunnel burners were overhauled.
- Lever for Foot valve of all burners were fixed properly for easy operation.
- Ceramic fiber module insulation on roof was replaced wherever, the module were opened. "Supermax" End Modules were used to roof insulation.
- On roof insulation, gap was filled, wherever required.
- As before shut-down, the high temperatures was observed near Peep Holes. Hence the area around all Peep Hole was covered with 2 layers of 1425 Deg Centigrade Ceramic Fibre Blanket fixed with SS 304 "U" Pins and Rigidizer was applied. Total 18 nos peep holes were attended.



Damaged Roof Insulation of HT Convection zone

- The roof insulation of HT Convection zone was found damaged at two locations. Also the MS plate was burnt out. Hence new MS plate was welded and "Y" type inconel anchors were welded to support the refractory insulation and fresh Refractory was applied.
- The LT & HT panels were dismantled and Coils were cleaned.

AUXILIARY BOILER, ITS BURNERS JOBS:

All the five Nos burners were cleaned at the location. The lube oil was replaced. The AG and Naphtha filters of all the burners were cleaned. External cleaning of tubes was done.

Boiler Inspection

All three following Boilers of ammonia Plant was offered for Annual statutory inspection by IBR Authority:-

GT-1631 (112-C),

GT-1632 (101-F),

GT 5217 (107-C)

The inspection was carried out by CIB Gujarat and permitted for further service. Open inspection was carried out on 25.03.2010 and hydrotest was witnessed by CIB on 31.03.2010.

Bench test of following Safety valves carried out on 25-03-2009

Boiler No.GT-1631 (112-C)

RV No.1 (Front)		RV No.2 (Rear)	
Pop.Pressure	Reset Pressure	Pop.Pressure	Reset Pressure
10.5 Kg/cm ² g	9.4 Kg/cm ² g	10.3 Kg/cm ² g	9.4 Kg/cm ² g

Boiler No.GT-1632 (101-F)

Bench test of following Safety valves of GT-1632 was done on 30.03.2010 and the readings are as under.

	RV (North)	RV (Middle)	RV (South)	RV (Super Heater)
Popping Pressure	117.00 Kg/cm ² g	118.80 Kg/cm ² g	115.00 Kg/cm ² g	111.80 Kg/cm ² g
Reset Pressure	105.50 Kg/cm ² g	107.00 Kg/cm ² g	103.50 Kg/cm ² g	105.00 Kg/cm ² g
Locking washer thickness	06.70mm	15.00mm	05.70mm	20.00mm

BENCH TEST FOR BOILER NO.GT-5217 (107-C) :

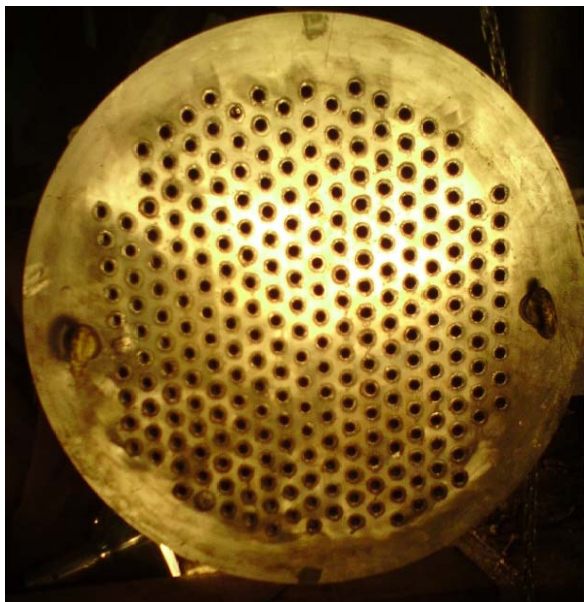
Bench test of following Safety valves of GT-5217 was done on 30-03-2010 and the readings are as under.

RV No.1 (Front)		RV No.2 (Rear)	
Pop.Pressure	Reset Pressure	Pop.Pressure	Reset Pressure
45.0 Kg/cm ² g	43.65 Kg/cm ² g	46.3 Kg/cm ² g	42.0 Kg/cm ² g
Locking washer thickness	14.70mm	14.20mm	

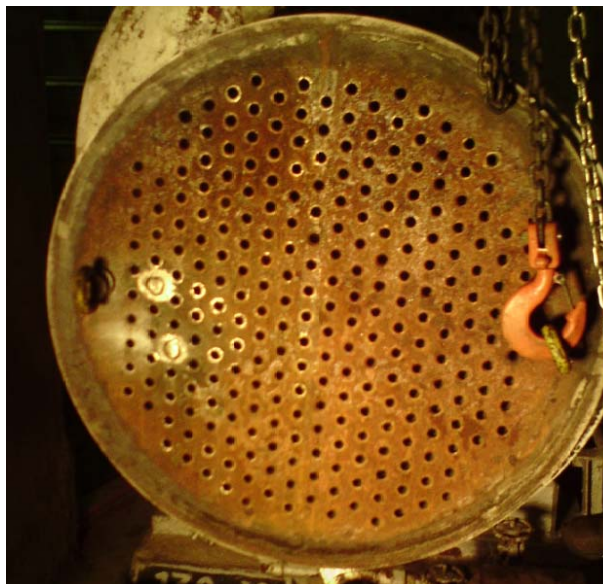
HEAT EXCHANGERS

Air Compressor Interstage Cooler (129-JC) & 130-JC

The tube Bundles of 129-JC & 130-JC was pulled out and Hydrojet Cleaning was carried out. During Plant Start-up activities, when cooling water was charged, water leakage was observed from shell side of 129-JC and 130-JC. After lowering the water level, both the Intercoolers were isolated and Tube Bundle was pulled out. The tube bundles of 129-JC and 130-JC were assembled in Hydrotest shell and Hydrotest was carried out.



Details of Tube Plugged on 129-JC



Details of Tube Plugged on 130-JC

Air Compressor 3rd stage Cooler 131-JC

The existing tube bundle was replaced by new tube bundle assembly procured from M/s Patel Airtemp, vide PO No 20090134 dtd 29.05.2009 @Rs 23.34 Lacs. The Tube Bundle was upgraded to Duplex Steel Tube. .

The following heat exchanger tube bundles were cleaned by hydrojetting.

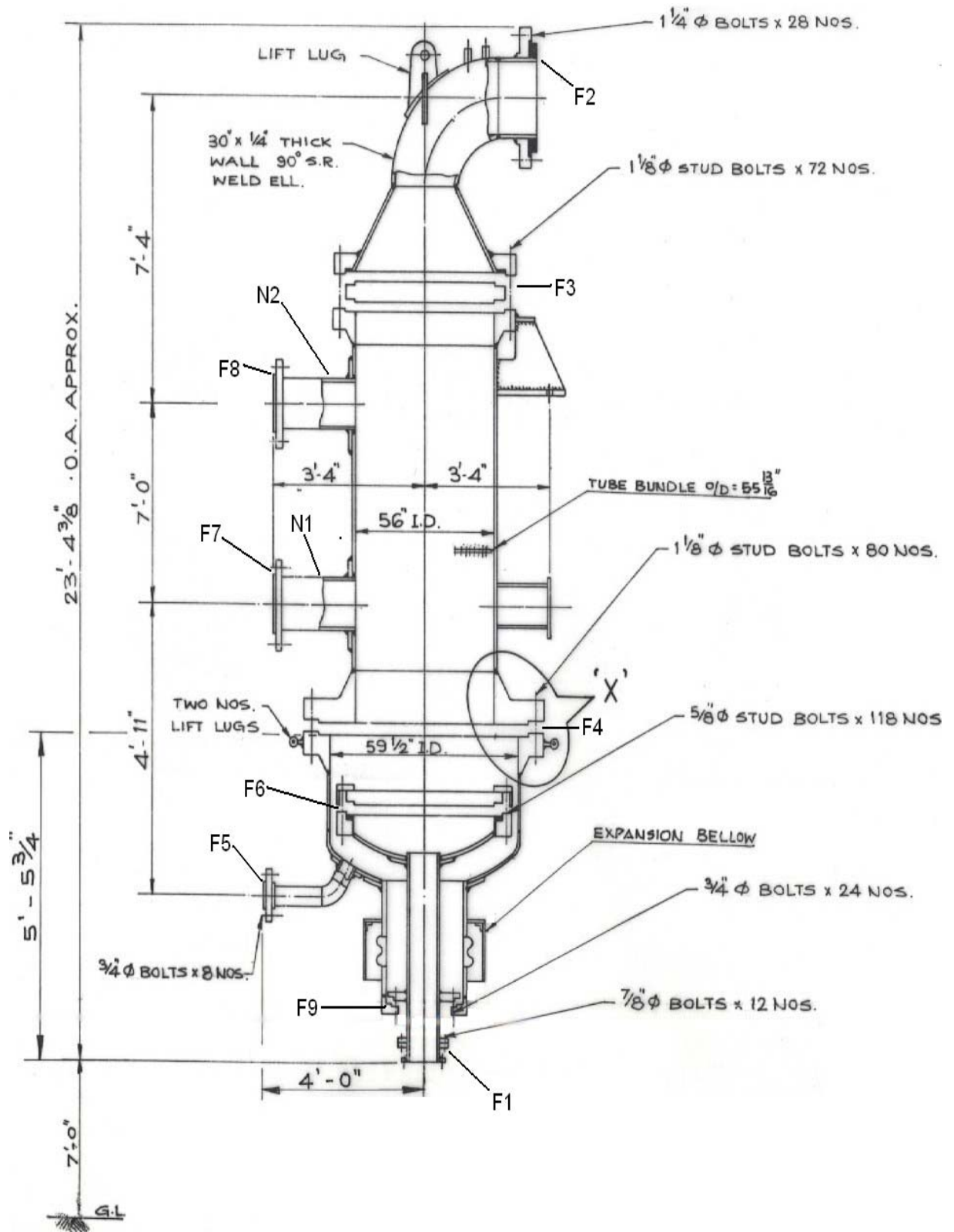
EQUIPT. NO.	OPENING START	OPENING COMP.	HYDROJETTING		HYDRO-TEST		BOX-UP DATE	REMARK
			START	COMP.	SHELL SIDE	TUBE SIDE		
105-CA	23.03.2010		26.03.10	27.03.10	46.4 Kg/Cm2 28.03.10			
						Head Press 30.03.10		
							04.04.10	
105-CB			27.03.10	28.03.10	34.0 Kg/Cm2 03.04.10			
						Head Press. 04.04.10		
							05.04.10	

110-CA	22.03.10	22.03.10	23.03.10	24.03.10			02.04.10	
110-CB	22.03.10	22.03.100	24.03.10	24.03.10			02.04.10	
127-CA	22.03.10	22.03.10	23.03.10	24.03.10	31.05 Kg.Cm2 26.03.10		02.04.10	Temporary CW Line for 131-JC was removed
127-CB	22.03.10	22.03.10	22.03.10	24.03.10	31.05 Kg.Cm2 26.03.10	02.04.10		
128-C	24.03.10	24.03.10	26.03.10	27.03.10			27.03.10	
129-JC	22.03.10	23.03.10	24.03.10	25.03.10			01.04.10	Two Nos Tube Plugged
130-JC	22.03.10	23.03.10	25.03.10	25.03.10			01.04.10	Two Nos Tube Plugged
131-JC	22.03.10	22.03.10					01.04.10	New Tube Bundle
173-C	24.03.10	24.03.10	30.03.10	31.03.10			31.03.10	
105-JT G.C.	24.03.10	24.03.10	27.03.10	27.03.10			01.04.10	
101-JLC/1			26.03.10	26.03.10			31.03.10	
101-JLC/2			26.03.10	27.03.10			31.03.10	
103-JLC/1	23.03.10	23.03.10	26.03.10	26.03.10			29.03.10	
103-JLC/2	23.03.10	23.03.10	26.03.10	26.03.10			29.03.10	
101-JCA I/A	24.03.10	24.03.10	27.03.10	27.03.10			03.04.10	
101-JCA S.C.	22.03.10	22.03.10	24.03.10	26.03.10			03.04.10	
101-JCB I/A	24.03.10	24.03.10	27.03.10	27.03.10			03.04.10	
101-JCB S.C.	22.03.10	22.03.10	28.03.10	29.03.10			03.04.10	
103-JBT GC	24.03.10	24.03.10	27.03.10	27.03.10			03.04.10	
101JT G.C.	24.03.10	24.03.10	27.03.10	27.03.10			03.04.10	
115-C	24.03.10		26.03.10	26.03.10	15.8 Kg/cm2 27.03.10		02.04.10	
116-C	23.03.10	25.03.10	26.03.10	26.03.10	15.8 Kg/cm2 27.03.10		31.03.10	
124-C	23.03.10	23.03.10	26.03.10	26.03.10	26.5 Kg/cm2 27.03.10		31.03.10	
HE-2	22.03.10	23.03.10	29.03.10	30.03.10			03.04.10	
172-C	25.03.10	26.03.10	30.03.10	31.03.10			31.03.10	
115-JA	31.03.10	31.03.10	01.04.10	01.04.10			03.04.10	
115-JB	31.03.10	31.03.10	01.04.10	01.04.10			03.04.10	

The following tube bundles were taken for tube bundle pulling for hydro jetting.

EQUIPT. No.	OPENING START	OPENING COMP.	HYDROJETTING		HYDRO-TEST		BOX-UP DATE	REMARK
			START	COMP.	SHELL SIDE	TUBE SIDE		
108-C1A	23.03.10	24.03.10	28.03.10	29.03.10	8.1 Kg/Cm2 30.03.10		02.04.10	
						8.1 Kg/Cm2 31.03.10		
					8.1 Kg/Cm2 31.03.10			
108-C2A	23.03.10	24.03.10	27.03.10	28.03.10	8.1 Kg/Cm2 30.03.10		02.04.10	
						8.1 Kg/Cm2 30.03.10		
					8.1 Kg/Cm2 31.03.10			
109-C1A	23.03.10	24.03.10	26.03.10	27.03.10	8.1 Kg/cm2 29.03.10		04.04.10	
						8.10 Kg/cm2 29.03.10		
					8.1 kg/cm2 30/03/10			
109-C2 A	23.03.10	24.03.10	25.03.10	26.03.10	8.1 Kg/cm2 29.03.10		04.04.10	
						8.1 Kg/cm2 29/03/10		
					8.1 Kg/cm2 29.03.10			

Hydro-Jet Cleaning & Hydro Testing of 105-CA/CB



Dimensional Sketch of 105-CA/CB

During On site Discussions, while cleaning of 105-CA, It was decided that now onwards, The Floating Head and Bottom dome cover i.e Bolted Joint No F4 & F6 shall not be dismantled. A butter fly valve shall be installed after Bolted Joint F1 and Hydro jet cleaning of Tubes shall be carried out from Top Tube sheet and debris shall be removed from Butterfly valve.

SAFETY RELIEF VALVES & RELIEF VALVES OVERHAULING & TESTING

Pilot Operated RVs: The following were overhauled and serviced and tested on test bench.

Sr. No.	RV Tag No	Valve Size	Set Pressure (kg/cm²)	Reset pressure (kg/cm²)
1	RV – 102 F (Anderson Green)	6" x 8"	29.50	26.50
2	RV-105-D (Anderson Green)	3"x 4"	153.00	138.0
3	RV – 103- J (Anderson Green)	3" x 4"	158.93	143.0
4	RV – 106-F (Anderson Green)	1.5' x 2"	158.00	142.50

Critical RV's :

RV 123-CA

1. Make: TYCO
2. Sr.No: 21-2964
3. Model: JOS-66-D-STL-IBR
4. Size: 3 J 6
5. Service: Syn gas
6. Design set pressure: 122.0 kg/cm²
7. Cold differential set pressure : 122 kg/cm²
8. Seat tightness test pressure : 111.0 kg/cm²

RV 123-CB

1. Make: TYCO
2. Sr.No: 95-3280
3. Model: JOS-66-D-STL-IBR
4. Size: 3 J 6
5. Service: Syn gas
6. Design set pressure: 122.09 kg/cm²
7. Cold differential set pressure : 122 kg/cm²
8. Seat tightness test pressure : 111.0 kg/cm²

RV 104-D1

1. Make: TYCO
2. Sr.No : -----
3. Model :
4. Size: 4 L 6
5. Service: Steam
6. Design set pressure: 46.3 kg/cm²
7. Cold differential set pressure : 46.3 kg/cm²
8. Seat tightness test pressure : 42 kg/cm²

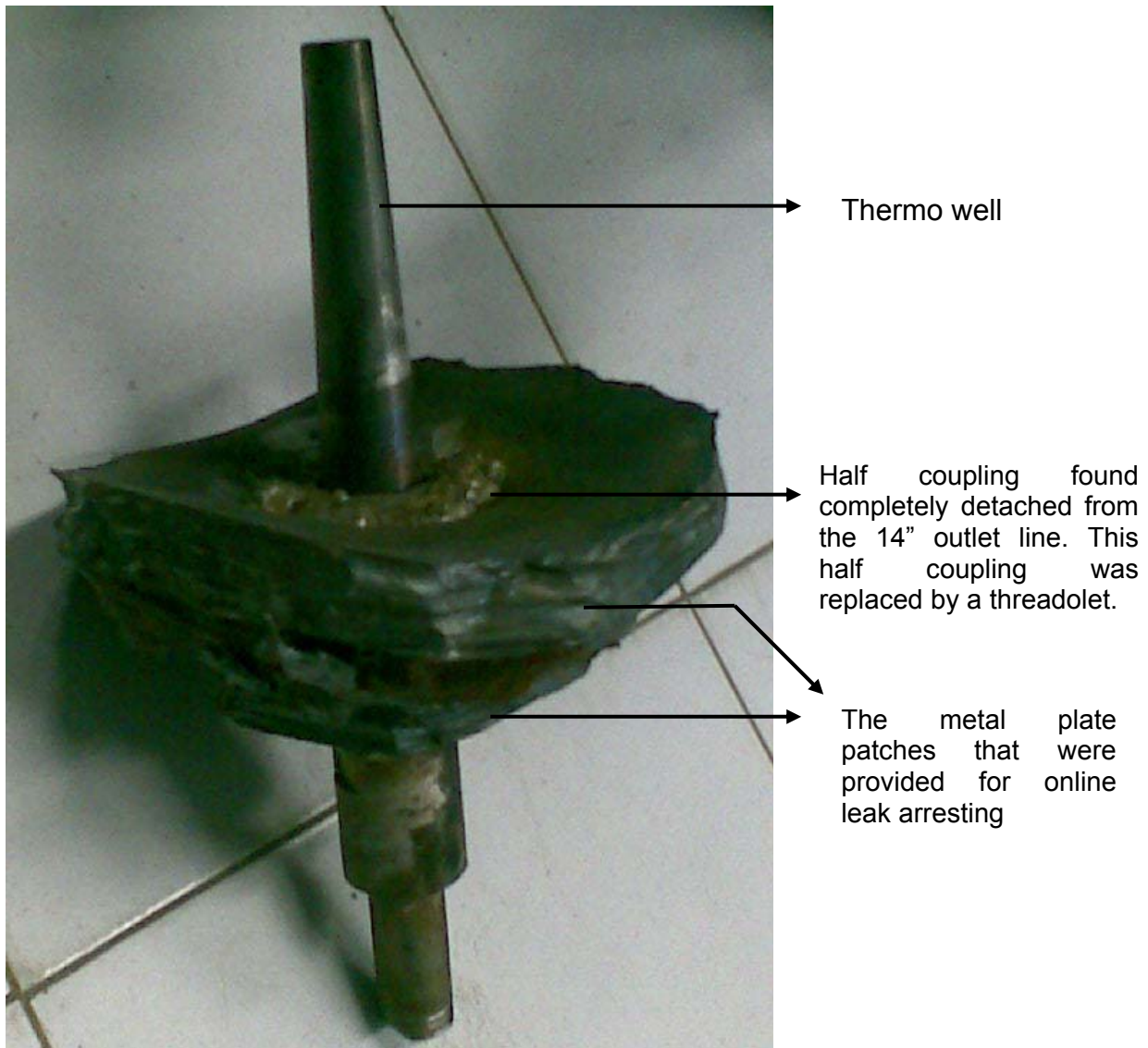
General service RV's : The following RVs were overhauled and serviced and tested on test bench:

Sr. No.	RV Tag NO	Valve Size	Set Pressure (Kg/cm2)
1	RV – MS 9	4" x 6"	42.2
2	RV – S 7	4" x 6"	14.8
3	RV – LS 1	4" x 6"	12.7
4	RV – BFW 1	1.5" x 2.5"	92.0
5	RV – S 26	2.5" x 4"	14.06
6	RV – 103 JAT (2 Nos)	4" x 6"	660
7	RV – 103 JAT	¾" x 1"	660
8	RV – 104 JAT	6" x 8"	0.37
9	RV – 112 CA	1.5" x 3"	10.50
10	RV – 112 CB	1.5" x 3"	10.50
11	RV – 109 F	6" x 8"	19.0
12	RV – 110 F N & S (2 Nos)	3" x 4"	7.0
13	RV – 111 F	4" x 6"	6.3
14	RV – 112 F	4" x 6"	6.3
15	RV-175-J	1 ½ x 2	40
16	RV – 101 D	3" x 4"	43.9
17	RV – 102 D	3" x 4"	43.9
18	RV 101-	4" x 6"	36.9
19	RV – 105 JLO	2" x 3"	5.3
20	RV – 129 C	1" x 2"	8.4
21	RV – 104 D 2	1.5" x 2"	34.10
22	RV – 101 E	1" x 2"	30.6
23	RV – PG 39	4" x 6"	5.3
24	PSV- 111	0.5" x 1"	4.01
25	PSV-177	15" x 20"	57.08
26	PSV-1201	1 ½" x 3"	7
27	PSV-1202	1 ½" x 3"	7
28	PSV-1203	1" x 2"	48
29	PSV-1204	1 ½" x 2"	48
30	PSV-1205	3" x 4"	7
31	PSV-1206	1 ½" x 2 ½"	48
32	PSV-1209 A	1" x 2"	42
33	PSV-1210	1 ½" x 2 ½"	48
34	PSV-1212	¾" x 4"	7.0
35	PSV-301	1 ½" x 3"	10.0
36	RV 116-JAT	3 x 4	6.1
37	RV – 117 J-1	1 ½" x 3"	5.8
38	RV – 117 J-2	1 ½" x 3"	15.8
39	RV – 117 J-3	1" x 2"	30.2
40	RV – 115 JA- AOP-1	1" x 2"	11.0
41	RV – 115 JB- AOP-2	1" x 2"	11.0
42	RV – 115 JB AOP-1	1" x 2"	11.0
43	RV – 115 JB AOP-2	1" x 2"	11.0

CRITICAL FABRICATION JOBS :

1. **108-D outlet to 107-C, thermo well, TI-496, tapping leakage:** This leakage was from the half coupling's root joint around which, metal plate patches had already been provided to arrest the leakage.

The complete converter was purged with nitrogen and handed over to the maintenance by the production department. The metal plate patches along with the half coupling and the thermowell were removed by grinding. As per standard practice, a threadolet was provided in place of the half coupling. Over this threadolet the threaded thermowell was tightened followed by welding. Dye penetration test of the root and the final joint was carried out while radiography of the final joint was carried for all the weld joints. Dehydrogenation before welding and post weld heat treatment of these joints was also carried out.

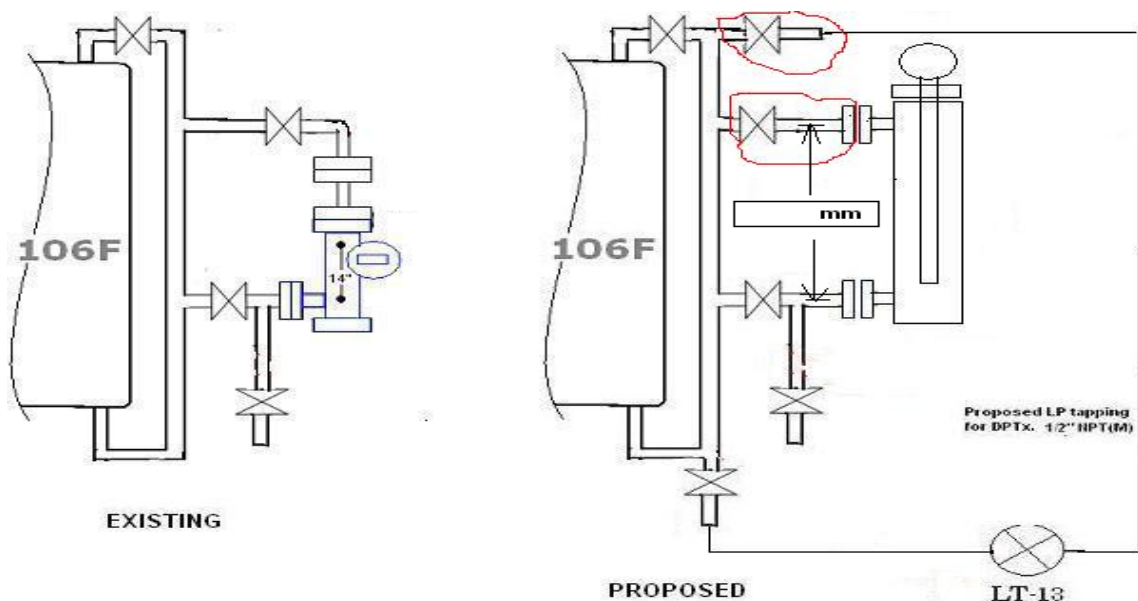


Detached TI-496 Thermo well Root Tapping

2. **108-D inlet line bypass control valve, HIC-487, down stream flange weld joint leakage:** A metal plate patch with vent valve had already been provided on this weld joint crack to arrest the leakage. This patch was removed by grinding. The weld joint was removed by grinding over a length of two inches thus removing the crack. New welding was carried out. Dye penetration test of the root and the final

joint was carried out while radiography of the final joint was carried for all the weld joints. Dehydrogenation before welding and post weld heat treatment of these joints was also carried out.

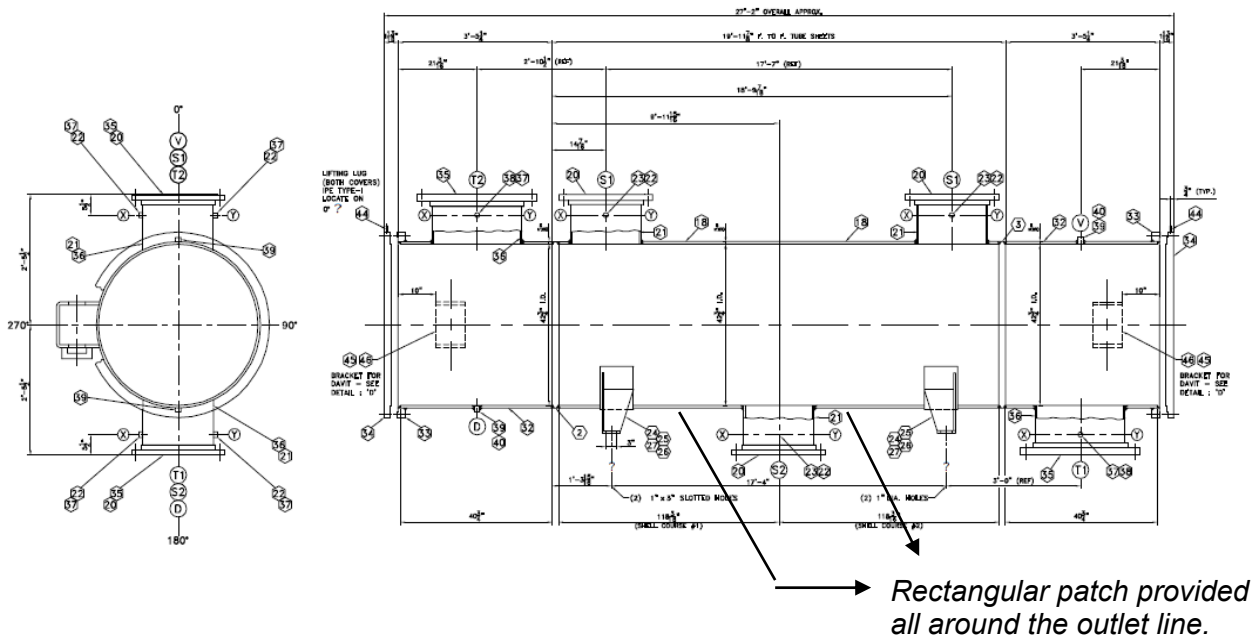
3. **105-D outlet line, 1st thermo well tapping leakage** : The damaged weld joint all around the thermowell was removed by grinding. New welding was carried out. Dye penetration test of the root and the final joint was carried out while radiography of the final joint was carried for all the weld joints. Dehydrogenation before welding and post weld heat treatment of these joints was also carried out.
4. **106-F level transmitter, LIC-13, modifications as per instrumentation requirement** : The instrumentation had planning to replace this level troll by a new radar based level transmitter and hence required some modifications in the piping. All necessary fabrications were carried out and low temperature carbon steel materials were used for the same.



Existing & Proposed level Transmitter arrangement of 106-F

5. Gas Metering Station jobs : Various jobs as per technical department requirement like , isolation of NG/NGBC, certain modification, jacket work & removal of unwanted, were carried out.
6. 110-CA/CB CW inlet line and its by pass line fabrication. : Heavy thickness reduction was observed in these lines. A 30" box of length 1.5 mm approximately had already been provided for online arresting of a leakage. Hence the lines were replaced by new ones.
7. During the shut down all aMDEA lines prior to the ESP 2005-2006 were inspected for reduced thickness. It was observed that , 108-C outlet line to 107-J/JA train inlet pipeline thickness had reduced at a couple of locations. Metal plate patch work was done in these areas.
8. 110-CA/CB gas outlet line pad leakage was observed during the running plant. A new pad was made at workshop and taken for welding. The damaged pad was removed and it was observed that a 1.0 m X 1.0m portion of the shell has been completely corroded thus making a opening. Through this opening the visible baffles and other internals were found in highly corroded condition. To close the opening, a new pad was made from a 36" pipe and the same was welded over this damaged shell area.

9. 131-JC piping modification: During the shutdown 2009, since more than 50% of the tubes had been plugged due to leakage, the exchanger was converted from two pass (CW) to one pass by making all necessary modification in the channel covers and the inlet and outlet cooling water lines. The same jobs were reverted back to re-convert it into two pass (CW). This was done because the damaged tube bundle was replaced by new tube bundle.



Sketch of 110-CA/CB Showing position of shell damage

10. For 101-D/ 102-D gas line steam jacket was provided to help in maintaining the temperature of the gas.
11. Convection zone panel plate replacement : The damaged panel plate located at the top of the passage connecting the radiant zone and the convection zone was replaced.
12. PRC-23 Damper was repaired wherever damage was observed. The distance between the flappers had increased to as high as 135 mm. This gap was reduced by inserting 20 mm SS 310 flats. The final gap obtained was around 40 mm.

NON CRITICAL FABRICATION JOBS:

1. Reoriented instrument cables and tubing on 101-CA / CB platform to create space for safe working in the area.
2. 101-U LG top 1st isolation valve stem was broken and hence it was replaced.
3. 103-D railing towards control room side was fixed.
4. D.M. water conductivity sampling isolation valve was hard to operate and hence replaced.
5. TICV-60 both isolation valve were passing and hence replaced.
6. Provided platform at 117-J discharge line 2nd isolation valve to 101-E gas inlet line.
14. Provided approach platform for 101-EA gas inlet line flange.
15. Removed the angle of monkey ladder of 3rd & 4th platform with safety movable bar.

16. Provided support at M.S. header R.V. down stream drain line near MS-9 .R.V.
19. Pin hole leak on Auxiliary Boiler Coil 1st blow down intermediate line was attended.
20. Pipe connected with 101-JCA before strainer of 112 J/JA/JB.
21. 101-JCA R.V. Seal water isolation valve wheel was free and hence replaced.
22. New water flow indicator installed on 101-JLOT cooling water outlet line.
23. FRCV -2 down stream trap was not working and hence replaced.
24. Drain valve wheel of PC-2B was found free and hence replaced.
25. MS steam line to Pre Reformer above naphtha filter, welding joint leak was repaired.
26. 103-D Jacket damaged portion were repaired.
27. Monkey ladder & approach platform with hand railing was fabricated for 101-F silencer.
28. V-25 Platform modified for making the area safe for working.
29. 112-F Silo side cover railing fouling.
30. 101-F RV exhaust pipe platform to be make for safe working.
31. 112-J priming line re-routed
32. Beam provided at 101-F bottom structure to facilitate for inspection of riser & down comer weld joints.
33. Permanent blinding provided at 102-JT exhaust line to 101-JCB, surface condenser.
34. 103-D Top platform ladder support plate was corroded and hence replaced.
35. PIC-5 vent snuffing steam both isolation valves were passing and hence replaced.
36. PCV-502 down stream line trap bypass valve upstream line pin hole leak repaired.
37. 502 upstream drain isolation valve gland was leaking and hence was replaced.
38. 38 kg. Steam to ARU block Valve down stream vent valve gland was leaking and hence was replaced.
39. PIC-13 B jump over isolation valve gland was leaking and hence was replaced.
40. 105 Kg. steam sample line root isolation valve gland was leaking and hence was replaced.
41. MIC-61 upstream drain both isolation valve wheel was free and hence the valves were replaced.
42. 108J/JA discharge to FICV 14(102-EB)top line 'T' joint crack was repaired.
53. 115-JAT steam trap and outlet line replaced as the same was corroded.
54. AG and NG line from gas metering station for isolating from 800-J
43. A pin hole leak at absorber sample line upstream isolation valve near semi lean solution inlet nozzle was attended.

VALVE GLAND LEAK AND REPACKING JOBS:

1. TRC-10 both side gland leakage was attended and one broken bolt was replaced.
2. SP-39 gland leakage was attended.
3. 112-C steam outlet by pass drain valve gland leak was attended.
4. 101-F, 112-C & 107-C connected all 1st & 2nd isolation valve gland were replaced.
5. All rotary equipment inlet and outlet 1st Isolation valve gland were replaced.
6. MICV-61 upstream isolation valve gland was replaced.
7. LTS outlet vent gear valve gland leak was attended.
8. Steam outlet line from 107-C(under 110-F platform) vent valve gland leak was attended.
9. MIC-61 H P Tapping root Isolation valve gland leak was attended.
10. MIC-61 Bypass valve gland leak was attended.
11. C1 Drain 2nd Isolation valve gland leak was attended.
12. 2004 JAT Steam inlet and exhaust isolation valve gland leak was attended.
13. 104JT Steam inlet isolation valve gland leak was attended.
14. F-1 Filter D/S block valve gland leak was attended.
15. 101-F Steam drum vent 1st Isolation valve gland leak was attended.
16. FRC-505 D/S trap upstream gland leak was attended.
17. HE-3 B Shell side inlet isolation valve gland leak was attended.
18. PRCV-12 TX root isolation gland leak was attended.
19. 115-JAT steam inlet block valve gland leak was attended.
14. 104-J/JA inlet & outlet valve gland repacking was done.
15. aMDEA pump 107JA/JC inlet & outlet valve gland repacking was done.
16. 103 JLP suction valve gland leak was attended.
17. MS to ARU isolation valve gland leak was attended.
18. MS line to pre-reformer block valve gland leak was attended.
19. 101-F high level switch top isolation valve gland leak was attended.
20. PIC-16 chain valve gland leak was attended.

FLANGE LEAK & VALVE PASSING JOBS:

1. 101-F Steam drum middle RV upstream flange leak was attended.
2. Steam drum BBD sample root valve were passing and hence repaired.
3. 105-CA condensate drain line flange leak was attended.
4. 105-CB Condensate drain line flange leak was attended.
5. C-1 ARU 1st flange leak from bottom was attended.
6. C-1 steam inlet line flange leak was attended.
7. 107-C South side LG top flange leak was attended.
8. 107-C High level switch top isolation valve upstream flange leak was attended.
9. 107-C North side LG top isolation valve up stream flange leak was attended.
10. 151-C Condensate trap down stream isolation valve upstream flange leak was attended.
11. 101-L Flow Orifice flange leak was attended.
12. LTS Inlet RV upstream flange is leak was attended.
13. PC - 2A suction valve is passing was attended.

14. FI - 104 - E both isolation valve are passing was attended.
15. Check valve of Instrument Air line from utility is passing was attended
16. V-25 upstream plug valve bottom flange leak was attended.
17. V-25 upstream flange leak was attended.
18. FIC-505 upstream isolation valve downstream flange leak was attended.
19. Raw water Isolation valve wheel broken was repaired.
20. LIC-503 up stream flange leak was attended.
21. C-2 Vacuum breaker top cover leak was attended.
22. 3.5 kg steam header isolation valve to ESP-1 above 118-J upstream fig-8 flange leak was attended.
24. 101-U LG top Fist isolation valve steam was broken and hence replaced
25. LG isolation valve was made free by grousing.
26. PIC-16 steam 3/4" drain valve steam was broken and hence replaced
27. 106-C DMW outlet to dearator elbow flange gasket changed.
28. 101-D outlet block valve was passing and hence repaired.

VALVE REFURBISHING JOBS:

The following valves were refurbished departmentally.

- 38 kg/cm² battery limit valve near reformer which was passing.
- 104-JT Elliot turbine inlet valve which was passing.
- 101-JT steam inlet valve which was passing & bonnet was leaking.
- 11.00 kg/cm² chain valve above PIC - 13 A/B for DS Regeneration steam which was hard to operate.

VALVE BONNET LEAKAGE :

- The following valves bonnet leakage was attended
- 106-F 2nd tricoock isolation valve.
- 106-F tricoock middle isolation valve.
- LTS Inlet line RV isolation valve.
- Offsite BFW Coil inlet line drain valve.
- 120-C shell bypass valve.

MISCELENAOUS JOBS :

Motor operated valve SP – 70 gear box replacement:

The existing valve's gear box cover had broken and hence a new complete gear box assembly with improved design was procured for installation. This new design gear box had already been working successfully for "SP-1". Extra reinforcement clamp for the gear box made at workshop was also provided for additional safety. The necessary coupling to couple the gear box shaft to the valve shaft was made at the workshop. The gear box was installed and necessary cabling and calibration was done by the electrical section.

UREA PLANT

ROTATING EQUIPMENTS

MINOR OVERHAULING OF CO₂ COMPRESSOR DRIVE TURBINE (Q-1801)

Turbine was taken up for minor overhauling. Following activities were carried out:

- Decoupled the Turbine from LP case.
- Alignment of Turbine and LP case was checked.
- Journal bearing pads on free end were opened for inspection. Found clearance values within acceptable limit. (Ref Table-1).
- Journal bearing pads on LP case side were opened for inspection. Clearance values found marginally above design clearance however it was not replaced. (Ref Table-1).
- Thrust bearing was opened for inspection. Thickness of the thrust pad was checked and clearances value found within acceptable limits. (Ref Table-1)
- Gauss measurement of Thrust collar, journal shaft & bearing housing was carried out by Inspection section and found within acceptable limit.
- DP testing of pads, thrust collar and journal shaft was done and the same were found acceptable.
- Final alignment readings were taken and recorded. Alignment correction was not required to be done.
- LP case and Turbine was coupled at the required tightening torque 53.2 kgf.m (521.36 N. m). The Coupling spacer between LP casing & Turbine was assembled.
- Gland re packing of both 60 ata steam control valve was done. Condition of spindle was checked and found satisfactory.

Table 1-Bearing clearance for Turbine:

Description	Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on free end	0.25	0.18 to 0.31	0.25
Journal bearing clearance on LP side	0.36	0.24 to 0.35	0.36
Thrust bearing clearance	0.23	0.25 to 0.35	0.25

Table 1(a): Spares Consumed:

Sr. No.	Item code	Description	Qty.
1	122023326410	"Flojet-7" Gland Packing, Expanded Flexible Mineral Die Molded Ring, Size : 19.95mm ID X 32mm OD X 4mm Thick, stem packing for 60 ata and 23 ata steam control Valve of Q-1801	5
2	122023326420	"Flojet-7" Gland Packing, Expanded Flexible Mineral Die Molded Ring, Size : 19.95mm ID X 32mm OD X 6mm Thick , stem packing for 60 ata and 23 ata steam control Valve of Q-1801	25

MINOR OVERHAULING OF CO₂ COMPRESSOR LP CASE (K-1801-1):

LP compressor was taken up for minor overhauling. Following activities were carried out:

- Decoupled the LP case from Gear box.
- Alignment of LP case and gear box was checked and found disturbed.
- Journal bearing pads on GB side were opened for inspection. Clearance values found marginally above the design value however it was not replaced. (Ref Table-2)
- Journal bearing pads on Turbine side were opened for inspection. Clearance values found marginally above the design value however it was not replaced. (Ref Table-2).
- Thrust bearing was opened for inspection. Clearances value found within acceptable limits. (Ref Table-2).
- Gauss measurement of pads, Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.
- Alignment between LP Case & Gear box was corrected as per OEM reference values. Details are given in this report.
- LP case and Gear box was coupled at required tightening torque 20 kgf.m (196 Nm). Finally spacers between LP case & gearbox were assembled after alignment correction.

Table 2- Bearing Clearances Data Sheet of K-1801-1:

Bearing Description	Before O/H (mm)	Design value (mm)	After O/H (mm)
Journal bearing clearance on Turbine side	0.16	0.11 ~ 0.15	0.16
Journal bearing clearance on Gear Box side	0.16	0.11 ~ 0.15	0.16
Axial Thrust	0.34	0.28 ~ 0.38	0.34
Observations	Brownish deposits observed on active thrust pads.(Fig 1)		



FIG 1, LP Case active side thrust pads



FIG 2, LP Case inactive side thrust pads

MINOR OVERHAULING OF CO₂ COMPRESSOR HP CASE (K-1801-2):

HP compressor was taken up for minor overhauling. Following activities were carried out:

- Decoupled the HP case from Gear box
- Alignment readings were checked and found disturbed.
- Journal bearing pads on Gear box side were opened for inspection. Clearance values found marginally above design clearance however it was not replaced. (Clearance values measured are given in Table-3)
- Journal bearing pads on free end side were opened for inspection. Clearance values found marginally above design clearance however it was not replaced. (Clearance values measured are given in Table-3)
- Thrust bearing was opened for inspection. Thickness of the thrust pads was checked and clearances values found within acceptable limits. (Clearance values measured are given in Table-3).
- Gauss measurement of pads, thrust collar, journal shaft & bearing housing were carried out by Inspection section. Gauss value on top and bottom of journal bearing base ring for free end side was 14.0 & 16.0 respectively. On Gear Box side, gauss value on top and bottom of journal bearing base ring was 9.3 & 9.1 respectively. Gauss value was reduced to acceptable limit by demagnetization.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.
- Alignment between HP-Gearbox was corrected as per OEM reference values. Details are given in this report.
- HP case and Gear Box was coupled at the required tightening torque 9.7 kgf.m (95.06 Nm).
- High temperature rise of Thrust bearing of LP case was reported during June-2009. This has occurred earlier also for Gear box and HP case bearings. The photographs of damaged bearings are shown at Fig 3 and Fig 4 for reference. Hence it was decided to check the possibility of providing additional earthing brush on coupling spacer between Gear box and HP case. After opening the coupling guards, the dimensions were taken and observed that there is sufficient space for installation. Earthing brush is proposed to be installed after procuring the same during next Annual Shut down.

Table 3- Bearing Clearance (Diametrical Clearance) Details for HP case:

Description	Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on Free end	0.15	0.11 to 0.14	0.15
Journal bearing clearance on Gear Box side	0.15	0.11 to 0.14	0.15
Thrust bearing clearance	0.30	0.25 to 0.35	0.31
Observations	<ul style="list-style-type: none">• Gauss value of top & bottom journal bearing base ring of both ends were above limit.• Minor brownish deposition observed on journal bearings and thrust pads		

MAJOR OVERHAULING OF GEAR BOX M-1801:

Gear Box was taken up for major overhauling. Following activities were carried out:

Low-speed Gear Shaft and Bearings:

- Both Low speed shaft bearings (Elliptical Type) were inspected and clearances values found within acceptable limit. (Clearance values measured are given in Table-4).
- Gauss measurement of pads, journal shaft, thrust collar and bearing was carried out by Inspection section and found within acceptable limit.
- DP checking of thrust bearing pads, thrust collar, journal shaft and bearing was done and found satisfactory.

High-speed Pinion Shaft and Bearings:

- Both Pinion shaft bearings (Offset Halves Type) were opened for inspection. Clearance values found marginally above design clearance however it was not replaced. (Clearance values were measured as given in Table-4)
- Gauss measurement of shaft journal and bearing was carried out by Inspection section and found within acceptable limit.
- DP testing of shaft journal & bearing was done and the same was found acceptable.
- Assembly was done using the same bearings.

Table 4- Bearing clearance for Gear Box:

Description		Before O/H (mm)	Design Value (mm)	After O/H (mm)
Low speed shaft	Journal bearing clearance on LP side	0.17	0.125 to 0.185	0.17
	Journal bearing clearance on HP side	0.18	0.125 to 0.185	0.18
	Thrust bearing clearance	0.40	0.38 to 0.61	0.40
High speed shaft	Journal bearing clearance on LP side	0.24	0.15 to 0.21	0.24
	Journal bearing clearance on HP side	0.24	0.15 to 0.21	0.24
Gear backlash		0.48	0.383 to 0.608	0.48
Observations	Minor brownish deposition observed on bearings. (Ref Fig 3 & 4)			



FIG 3, GB High speed shaft Free end top and bottom half

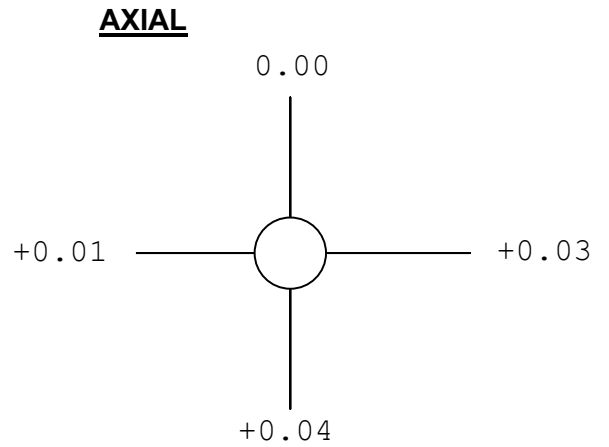
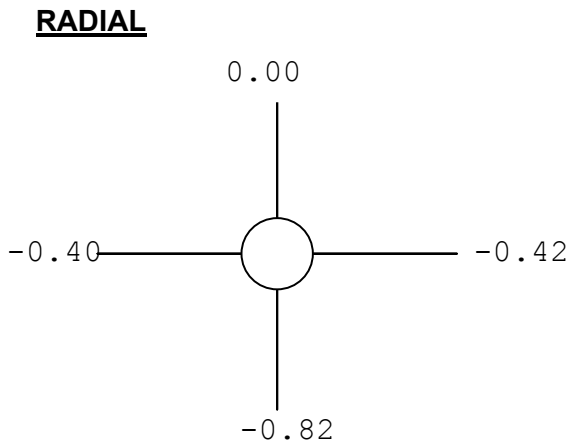


FIG 4, GB High speed shaft HP end bottom half

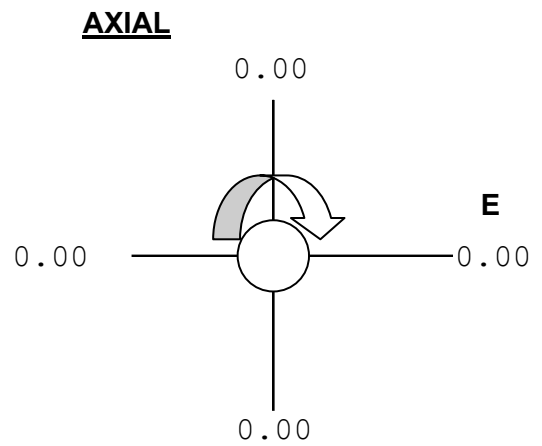
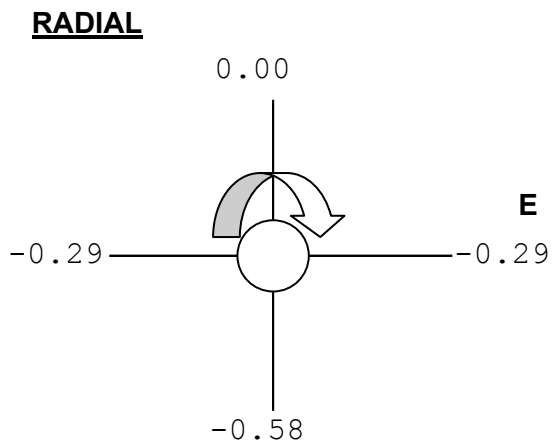
ALIGNMENT READINGS: TURBINE TO LP COMPRESSOR:

**Dial on LP Compressor Coupling
All values are in mm**

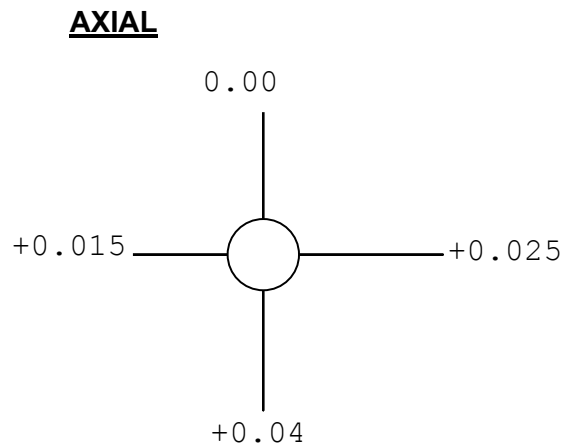
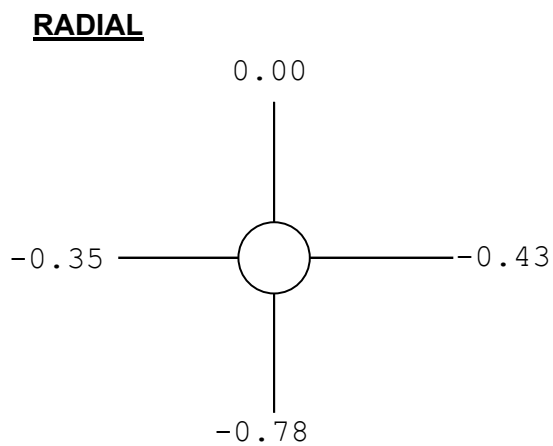
Before PM



Protocol Values



After PM

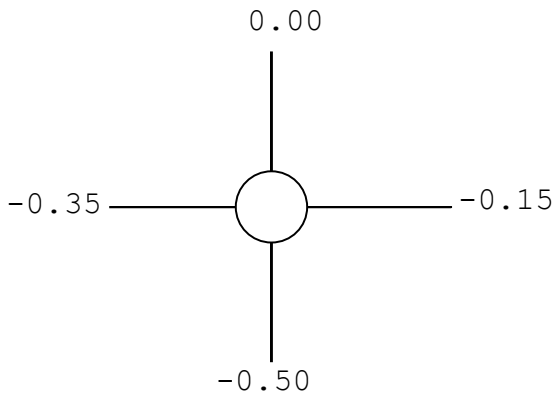


ALIGNMENT READINGS: GEAR BOX TO LP COMPRESSOR:

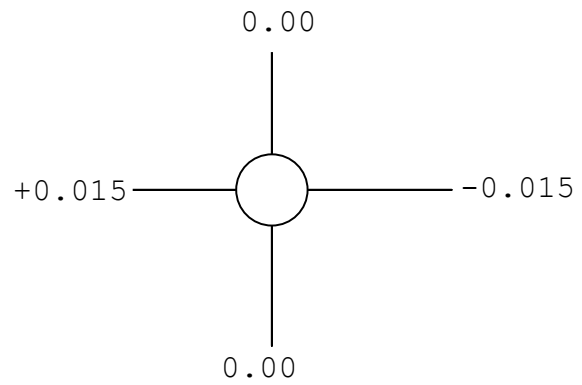
Dial on LP Compressor Coupling
All values are in mm

Before PM:

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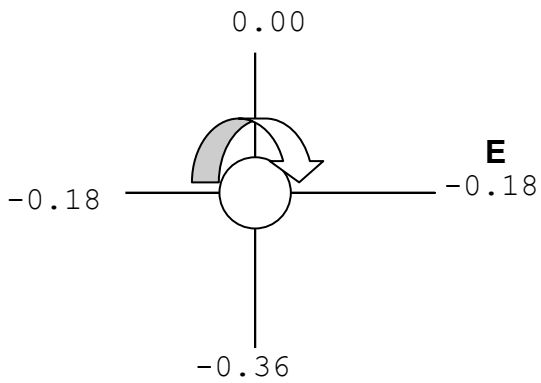


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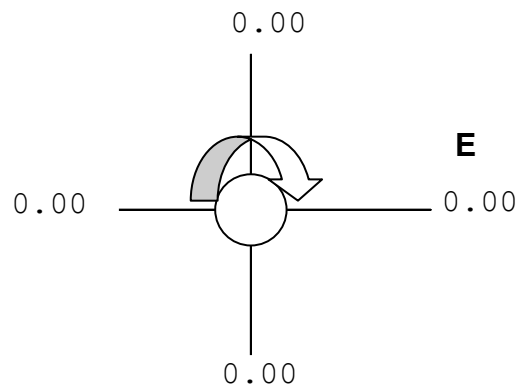


Protocol Value

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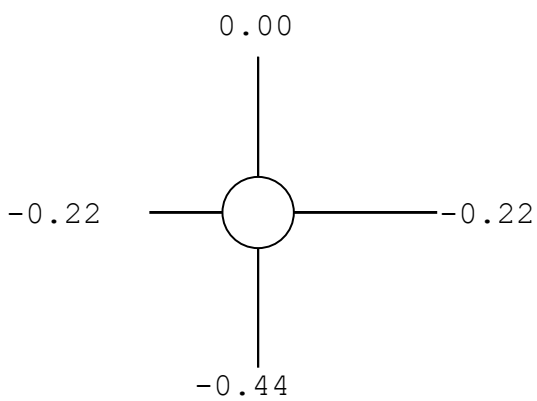


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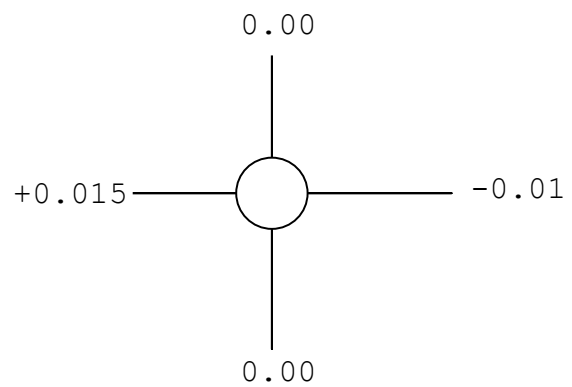


After PM

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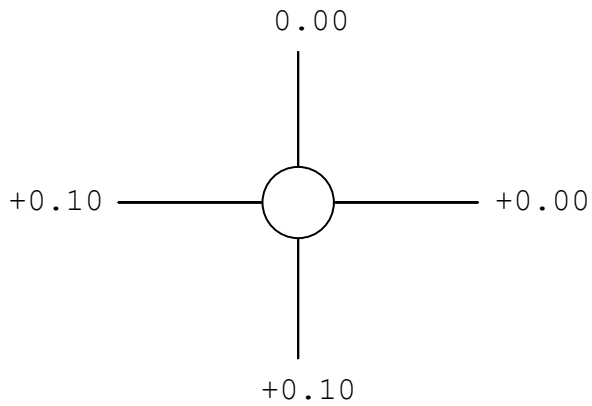


ALIGNMENT READINGS: GEAR BOX TO HP COMPRESSOR:

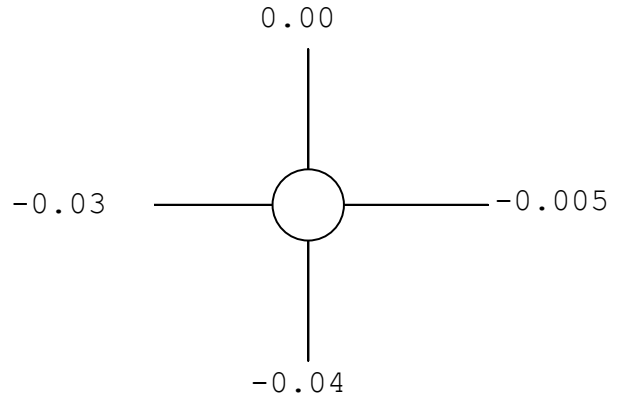
**Dial on HP Compressor Coupling
All values are in mm**

Before PM

RADIAL

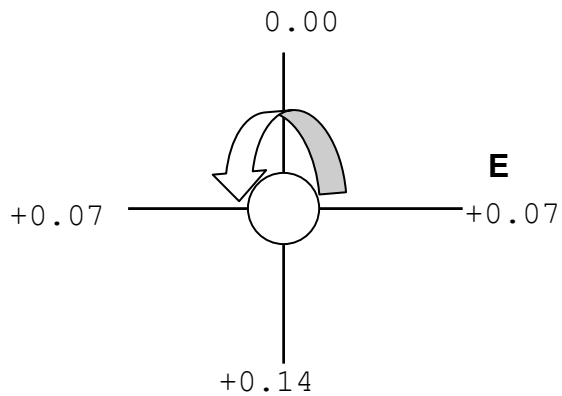


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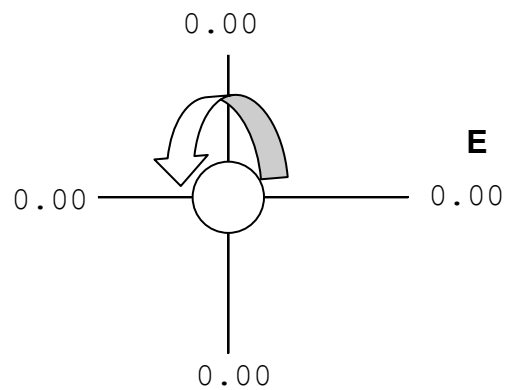


Protocol Value

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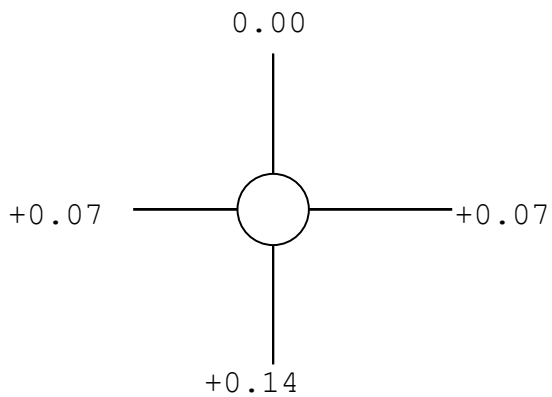


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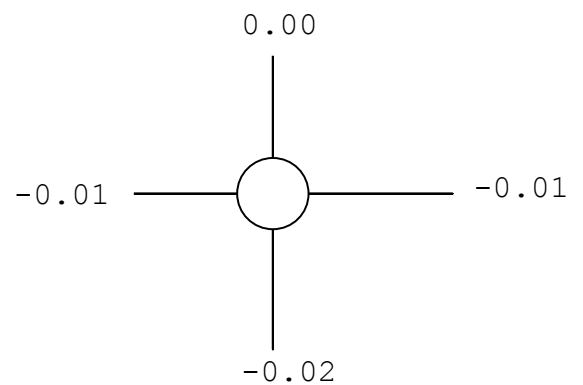


After PM

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CLEANING OF LUBE OIL CONSOLE OF HITACHI COMPRESSOR:

Due to problem of temperature rise in bearings of compressor, It was decided to check the Lube oil console for any wax deposits. Lube oil was replaced during SD-2007. Hence it was decided to reuse the same oil if the condition is OK. 50 nos. of old oil drum were cleaned and kept ready for keeping the oil. Oil was removed using centrifuge which was removed from Ammonia Plant NG compressor.

Scattered Black deposits were observed on the side and partition walls of console and at console bottom. There were removed and console was cleaned. Please refer Fig 5 and Fig 6.

The oil sample was drawn from LO console and after centrifuge and given to IOC for testing before removal. The test report of IOC is given in Table -5. The oil sample met the required specifications and was fit for further use in the system. Hence the removed oil was filled in console through centrifuge. 1890 litres (9 drums) of new oil was also added.

Table-5

SAMPLE DRAWN FROM	CO2 CENTRIFUGALCOMP.	
PRODUCT	S.PRIME 46 T	
Location	T 1814 Console	After Centrifuge
Running Hrs.	41040 Hrs/Three Years	
Date of Sampling	27/2/2010	
TESTS, METHOD		
Appearance, Visual	Clear	Clear & Bright
Water content % Wt.	Nil	Nil
Colour Visual/ASTM D1500	Yellow	Yellow
Kin. Viscosity @ 40 0C, cSt,ASTM D445	45.89	46.59
Kin. Viscosity @ 100 0C,cSt,ASTM D 445	6.9	6.98
Viscosity Index, D2270	106	106
Total Acid No.mg KOH/gm, D-974	0.14	0.11
Total Base No.mg KOH/gm, D -2896	--	--
Flash Point COC, 0C, D-92	224	220
Sediments %	Nil	Nil
Emulsion Characteristics @ 54 0C as Water -oil-emulsion layer -(min.)	40-37-03-(30')	40-38-02-(30')



FIG 1, LP Case active side thrust pads



FIG 2, LP Case inactive side thrust pads



FIG 5, Deposits on side wall of LO Console



FIG 6, Black deposits removed from Console

MAJOR OVERHAULING OF LUBE OIL TURBINE (Q-1814):

Lube oil turbine was in service for the last 14 years after installation in 1997. Hence it was taken up for major overhauling. Details of turbine are given below:

Make	:	Coppus
Model No.	:	RLA 16E,
Sr. No.	:	96T2398
Power	:	75 KW,
Speed	:	2960 rpm
OST	:	3582 rpm

Following activities were carried out:

Dismantling of Turbine

- Decoupled the turbine with pump. Measured the distance between coupling halves and it was 137.88mm (DBSE: 141.7mm).
- Alignment of turbine with lube oil pump was checked in cold condition and found disturbed with reference to protocol values.
- Disassembled the Governor & Stop valve assembly and removed the OST assembly.
- Bearing and Gland housing of governor end were removed. Carbon rings were hard and hence broken while removal.
- Opened the casing and measured the position of sector from casing face & recorded the readings. (Ref. Table 5).
- Removed the bearing and gland housing of coupling end. Carbon rings were hard and hence it was broken while removal.
- Removed the rotor and sector.
- Shot blasting of old rotor was carried out.
- Diameter at bearing portion of rotor at both sides of wheel was observed reduced due to the normal wear. Pitting marks were also observed on the blades and shrouds. Hence it was decided to replace rotor with new one. Please refer Fig 7 shroud with pinholes.



FIG 7, – View of wheel of removed rotor of turbine

Assembly of Turbine:

- As a pre shut down activity, dynamic balancing of spare rotor was checked and found within acceptable limit. Radial and axial run-out was also checked & found ok.
- Sector was placed between the two rows of blades on the wheels of rotor and rotor alongwith sector was slide into casing.
- New sealing washers were placed under sector cap screw heads and engaged sector cap screws in the sector. Sector cap screws were tightened after ensuring that sector was solidly seated against the casing shoulder.
- Reassembled the gland assembly at coupling end with new carbon ring (Ref. Table 6). Grafoil was provided between gland housing and casing.
- Reinstalled the coupling end bearing, yoke and associated components.
- Reassembled Casing cover with grafoil and bolts of casing were tightened.
- Reinstalled the governor end gland assembly with new carbon rings. (Ref. Table 6). Grafoil was provided between gland housing and casing cover.
- Reinstalled the governor end bearing, yoke and associated components. Reinstalled mounting housing. Connected the connecting rod to the trip latch. Reinstalled the over speed trip collar assembly and governor.
- 2 nos. of hard to operate manually operate nozzle valves (north side) which were fully open, were made free to operate.
- After final assembly of turbine checked the alignment between turbine and pump and corrected as per protocol value.
- Coupled the turbine with pump. OST was done at 3600 rpm (protocol value – 3582 rpm).

Table 6- Clearance Data Sheet of Q-1814

(Ref Table-B1, Page- B-5 of Instruction Manual, Rev B)

Sr. No.	Description	Required Value	Actual value (Before O/H)	Actual value (after O/H)
1	Carbon Ring to shaft clearance – governor end	0.0025" - 0.005"	Not taken	0.003" 0.003" 0.0025" 0.0025"
2	Carbon Ring to shaft clearance – coupling end	0.0005" - 0.003"	Not taken	0.0015" 0.0015" 0.001" 0.001"
3	Position of sector from the face of casing	-	7.90 mm	7.90 mm

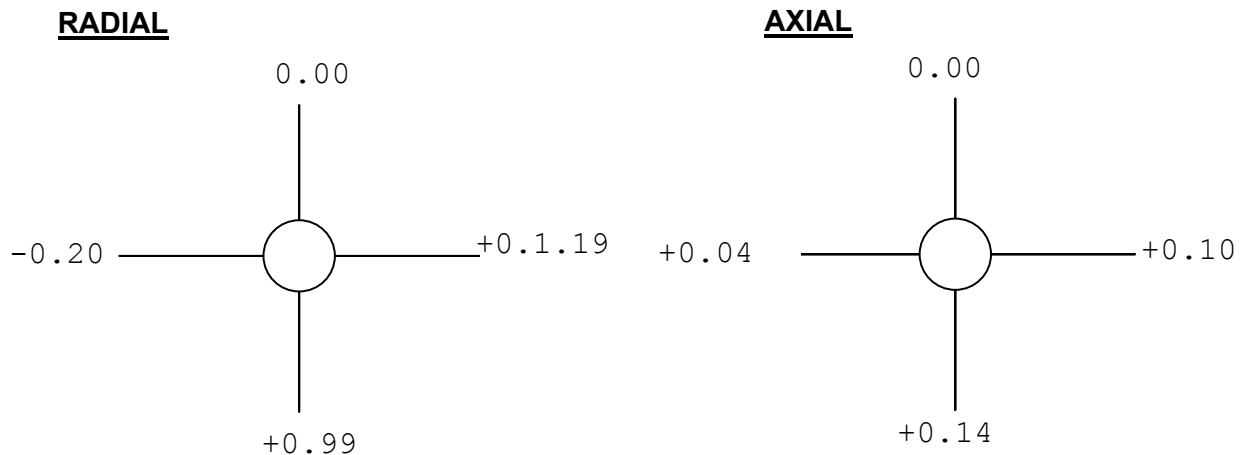
Table 7- Stocks consumed:

Sr. No.		Description	Qty consumed
1	122012409400	Coupling end Carbon ring, # 207	4 set
2	122012409410	Governor end Carbon ring, # 215	4 set
3	122012424720	Throttle valve body gasket, # 110	1
4	122012446100	Rotor assembly	1
5	122012448400	Seal ring at both ends, Teflon, # 40	2
6	122012448410	Seal ring at Governor end, Teflon, # 41	1
7	996010909080	Governor end Bearing, 6309 C3, #34	1
8	996010909080	Coupling end Bearing, 6309 C3, #33	1

ALIGNMENT READINGS: TURBINE TO PUMP:

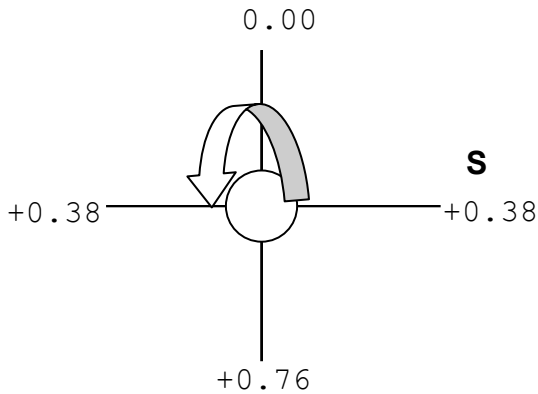
**Dial on Turbine Coupling
All values are in mm**

Before O/H

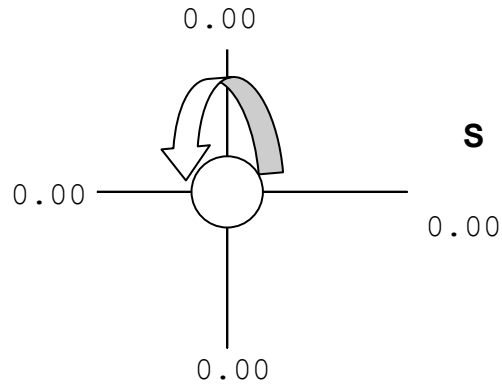


Protocol Value

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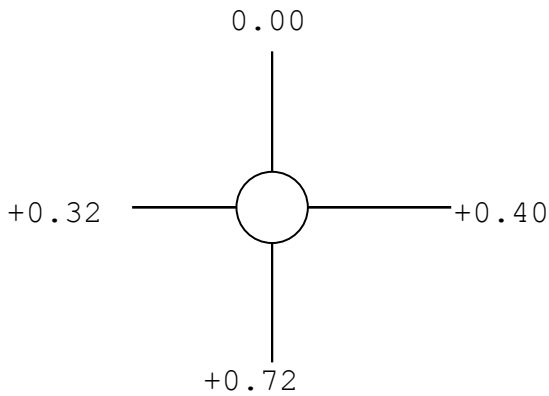


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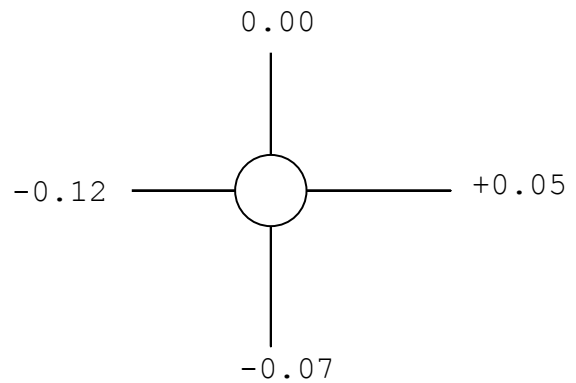


After O/H

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HP VESSELS:

HP Stripper (H-1201):

Bottom Dome:

- Bottom cover was removed using bolt tensioner at 900 kg/cm².
- The bottom cover was lowered onto the wooden sleepers.
- After inspection, the bottom cover was boxed up.
- No repairs /rectifications were required to be carried out.

Top Dome:

- Top cover was removed using bolt tensioner at 900 kg/cm².
- The top cover was shifted below the platform using monorail hoist and chain blocks.
- Ferrules were removed from position. Ferrules were thoroughly cleaned by Production department.
- Eddy current testing was carried out by Inspection Department. No repair work was required to be carried out.
- The ferrules were fixed in position with new PTFE gaskets (2700 nos).

- After the bottom cover was boxed up, pressure drop measurement was carried out by production department for each tube and the same was found within limit.
- Exchanger was thoroughly cleaned with compressed air and then with DM water.
- Top and bottom cover were boxed up with reconditioned “Kempchen” gasket (839 mm OD x 800 mm ID x 4 mm thick) with new 0.5 mm thick Teflon envelope.
- Tightening pressure for top and bottom cover.

1 st tightening round	300 kg/cm ²
2 nd tightening round	600 kg/cm ²
3 rd tightening round	900 kg/cm ²
Final tightening round /checking round	900 kg/cm ²

HP Condenser (H-1202):

- Top flange of off gas lines was opened.
- Bottom flange (H-1202 to V-1201 pipe line) was opened.
- Top cover and bottom cover was opened using bolt tensioner at 700 kg/cm².
- Internals from the top dome were removed.
- Eddy current testing of tubes was carried out. No repair work was required to be carried out.
- After inspection, internals were placed on top dome. Top and bottom cover Boxed up with reconditioned “Kempchen” gasket (839 mm OD x 800 mm ID x 4 mm thick) with new 0.5 mm thick Teflon envelop.
- Tightening pressure for top and bottom cover

1 st tightening round	300 kg/cm ²
2 nd tightening round	500 kg/cm ²
3 rd tightening round	700 kg/cm ²
Final tightening round /checking round	700 kg/cm ²

Autoclave V-1201:

Repair of Liner weld joints of Autoclave:

During Annual Turnaround- April 2009, liner welds of 1st and 3rd compartment were repaired which was most affected by corrosion. It was decided to carry out repair and rewelding of four circumferential and six longitudinal weld joints of liner during the Annual Turnaround 2010.

WO was Placed on M/s Ganesh Engineering, Ahmedabad (WO No.: 20091026 dtd. 28/12/2009) for execution of the welding job.

- Top cover was removed using bolt tensioner at 700 kg/cm²
- It was decided to carry out repair job on liner welds & rewelding job of 2nd and 4th compartment which was most affected by corrosion.

The following repair procedure was followed:

- Weld area was cleaned by SS wire brush.
- Welding joint was ground and flushed. Visible pitting / pores were removed with Grinder and surface was made smooth. It was ensured that grinding was not done deeper than 2 mm below the surface of liner.
- Corroded area of Heat Affected Zone of joints was also grinded and removed.
- DP of grinded portion was carried out. Porosity observed was removed. However if the porosity extends deeper than 2 mm below the surface of liner, it was fused while performing welding.
- Welding was done by TIG using 25-22-2LMn filler wire size -2.4 mm dia with low heat input.
- Inter pass temperature kept below 150 deg. C.
- Minimum three layer of weld was required. At some portions where the width was increased due to removal of corroded portion, an additional layer of welding was applied.
- It was ensured that no area was left ground without welding
- Final DP was carried out.
- Ferrite content was checked. It was found within acceptable limit (Max 0.6 %)
- Finally weld was cleaned and passivated by washing with 10 % HNO₃ and rinsing with DM water.

Repairing jobs as per Inspection Report:

Compartment No.1 (Top Compartment):

2 nos. of missing fasteners of tray segment were provided.

Compartment No.3:

Welding of 1 no. corroded tray holding clip was repaired. 1 no. of missing tray holding bolt was provided.

Compartment No.4:

Welding of 1 no. of corroded tray holding clip was repaired.

Compartment No.8:

1 no. of crevice corrosion cavity on upper C seam of Insert liner and 1 no. on west side T joint were repaired.

Compartment No.9:

Crevice observed in East side long seam 80mm above tray was repaired.

Compartment No.12 (Bottom Compartment.):

- 8" NB Carbamate inlet nozzle (from East) was found having 1 no. corrosion cavity. Downcomer Fillet weld was found to have 3 nos. crevice cavities/undercut. These spots were repaired.
- 3" Ammonia inlet nozzle sleeve was found to have cracks at its face, OD & ID in Dye penetrant test (Ref Fig 8). Repairing was done at face and OD of nozzle sleeve by welding (Ref Fig 9). No repairing was done at ID due to improper access for welding. The nozzle will have to be replaced during forthcoming shutdown-2011.

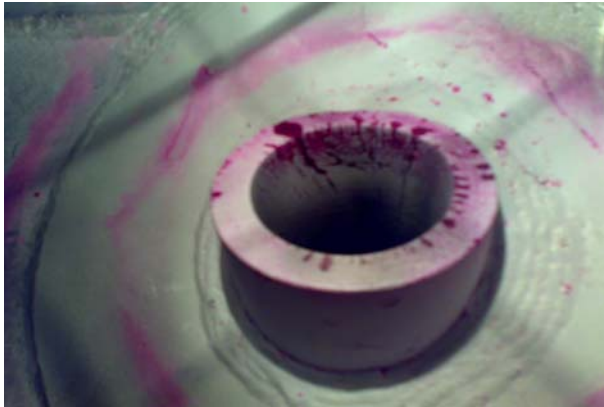


FIG 8, C3 Nozzle DPT of cracks

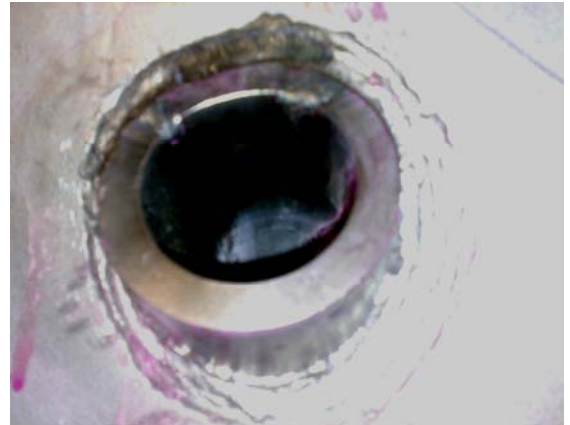


FIG 9, C3 Nozzle after repairing of face and OD

No repair work was required in other remaining compartments. All repairing jobs were done using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated by 10% HNO₃ and washed DM water.

After taking clearance from Production, top cover was boxed up with reconditioned "Kempchen" gasket (839 mm OD x 800 mm ID x 4 mm thick) with new 0.5 mm thick Teflon envelop.

- Tightening pressure for top cover.

1 st tightening round	300 kg/cm ²
2 nd tightening round	500 kg/cm ²
3 rd tightening round	700 kg/cm ²
Final tightening round /checking round	700 kg/cm ²

REPLACEMENT OF SHELL OF FLASH TANK CONDENSER (H-1421):

There was leakage from weep hole through reinforcement pad of inlet nozzle (14" x 150#) of H-1421 during normal operation before Shutdown 2008. During Shutdown 2008, repairing was done on shell surface and new reinforcement pad was welded. However it could not be repaired successfully as stress corrosion cracks were getting developed further and further. The weldability of shell was very poor since it was in service for a long period. It was ultimately decided to procure new shell of H-1421. Since tube bundle was in good condition, it was planned to use the same tube bundle with new shell.

Shell of H-1421 was procured against Capital Budget from M/s Hindustan Dorr-Oliver Limited, Ahmadabad against PO 20090555 dtd 03/06/2009.

Contract for removal and installation of tube bundle, shell & ejector was awarded to M/s General Engineering Works, Bharuch against WO No. 20091248 dtd. 19/02/2010. (WO for Opening & Box-up of Heat Exchangers)

Activities for Replacement of existing Shell:

This involved removal of tube bundle & shell of Flash Tank Condenser H-1421, Second stage Evaporator Booster Ejector(P-1423), piping and structural platforms connected to H-1421 for creating space to facilitate the removal of Shell.

Following activities were carried out:

Disconnected the following flanges connected to H-1421:

- 14" x 150# (RF) - CO₂, NH₃, H₂O Vapor Inlet
 - 4" x 150# (RF) - Inerts Outlet
 - 3" x 150# (RF) - Liquid Outlet
 - 1/2" x 150# (RF) - Vent
- Removed the top cover of H-1421 along with CW pipe by Kobelco Crane.
 - Disconnected the following flanges of P-1423 ejector.
 - 44" x 150# (RF) - Ejector suction
 - 36" x 150# (RF) - Ejector discharge
 - 10" x 150# (RF) - 9 ata Steam Injection
 - 1/2" x 150# (RF) - 4 nos. – Spray Nozzle
 - P-1423 Ejector unit (11.10 mtr long and weight 2.313 ton) was lifted and kept at ground floor by Kobelco Crane.
 - Grills of both platforms of H-1421 were cut and removed.
 - It was initially tried to remove the tube bundle of exchanger with the help of crane. After lifting by about 1 mtr. , it was observed that the 1st baffle of bundle was getting obstructed with the shell due to the inward bulging of shell near 14" NB gas inlet nozzle.
 - Hence, the tube bundle (filled with water) along with the shell (Appx. Wt- 8.5 ton) was required to be lifted with the help of Kobelco crane. The exchanger was horizontally placed on the ground with the help of Hydra and Kobelco crane. Thereafter , for ease in removal of the bundle from the shell by pulling with the chain pulley blocks, shifted the same to the old PB compressor area.
 - Rigging arrangement was provided for pulling out tube bundle from the old shell. The bulged portion of shell, which was fouling the baffle near 14 " NB gas inlet nozzle was grinded and removed. The bulging of the nozzle was caused due to repeated repair welding done in the past on the reinforcement pad and shell.
 - Tube bundle was easily pulled out from the shell.
 - ID of new procured shell was checked with OD of Buffer plate/ runner plate of the old tube bundle. It was found to have 3mm clearance.

Erection of New Shell:

- New studs were welded with foundation bolts, which were cut for removal of shell.
- New shell was placed in existing position with the help of Kobelco crane. Packing plates were provided and orientation of shell was confirmed. Leveling of shell was done by spirit level. Tightened the foundation bolts and grouting was done by civil department. Connected all flanges of the shell.

- Tube bundle was placed in new shell by Kobelco crane
- For checking the leakage between girth flange of new shell with old tube bundle, hydrotest was done at 1.2 kg/cm² g and found ok.
- Tightened all connected piping flanges of shell.
- Steam inlet pipe for injection (10" x 150#) was cut for easy installation of ejector, P-1423
- Ejector P-1423 was lifted by Kobelco crane and it was installed in position.
- The steam inlet pipe line was welded.
- All connected flanges for P-1423 were tightened.
- Placed the top cover and piping connected to H-1421 by Kobelco crane.



FIG 10, Tube bundle with old shell lifted by Kobelco Crane



FIG 11, Bulged portion of old shell near 14" Gas Inlet nozzle was cut and removed to facilitate tube bundle removal



FIG 12, Foundation of new shell



FIG 13 Tube bundle being inserted in new Shell

LP Vessels and Tanks:

LP Vessels and Tanks were opened for internal inspection during Shutdown. No repair was required in following LP vessels and tanks:

- H-1104
- V-1102
- V-1103
- V-1206
- V-1502
- V-1811
- V-1812
- T-1301 A
- T-1401
- T-1401 A
- T-1501

Repair work was done in following LP vessels and tank on the basis of inspection report.

V-1101:

3 nos. of demister pads which were lifted upwards were fixed.

V-1202:

Damaged nuts of tray support rings were replaced. Spray breaker which was installed during last Annual shutdown was having cracks. Hence it was replaced with reconditioned Spray breaker available with us. 4 nos. nuts which were missing were provided in grating support ring.

V-1203:

Bulging of appx. 30-35 mm deep was observed just opposite to gas inlet nozzle on in west side of shell above Cir. Seam near nozzle of LIC-1203. This may be due to the impingement of the gas from gas inlet C1 nozzle on shell which was extended during last annual shutdown. Hence it was decided to cut and remove the extended portion. Also a reinforcement pad (500 mm wide, 8 mm thk SS 304 L plate) was provided inside the vessel in this area around the circumference. It may be noted that similar bulging with slightly less concavity was also observed during previous Turnaround 2009.

Bottom grid was found intact. The additional clamping which was provided during last annual shutdown was checked. 1 no nut was missing and 3 nuts were found loose. New nut was provided and all the nuts were tightened.

Box was fabricated on the internal surface of bottom manhole cover to cover the nozzle length extended portion. Plain manhole cover was provided during last annual shutdown.

Cracks of 3 to 4 mm were observed above circumferential seam near nozzle of LICV-1203 and the same was repaired by welding from inside surface of vessel.

Steam tracing line is provided in the gas inlet line of V-1203. To improve the heat transfer, steam jacket was fabricated in the spool piece flanged expander just before gas inlet C1 nozzle.

V-1301:

One loose clamp of the tray was tightened.

V-1351:

Steam inlet flange gaskets were replaced.

V-1352:

Inlet flange gasket of 1½" reflux line was replaced.

V-1423:

Loose demister pad was refixed. Bolts of sieve tray which were missing were provided and loose bolts were tightened.

V-1501:

Open inspection of Steam drum (GT-1664) was carried out by Boiler inspector. Steam drum loop was hydraulically tested at 11 kg/cm² on 31/03/2010 and the same was witnessed by IBR Inspector. Also, IBR Inspector witnessed testing of Safety Relief Valves at test bench. The set pressure was kept 7.12 kg/cm² g as per IBR guide line.

V-1503:

Missing fasteners were provided on U-clamp of south side inlet steam header support.

V-1813:

Demister drain pipe (1" NB) was found lying freely inside the vessel. This line has got detached from its weld joint. However no repairing was done, as the pipe was inaccessible for repair.

T-1301:

Tack weld of 2" line in East with bottom plate was repaired.

CLEANING AND HYDROJETTING OF HEAT EXCHANGERS:

The Hydrojetting job was awarded to M/s Deluxe Hydroblasting services, Mumbai vide W.O. No. 9921620 dated 29-02-2008. Following heat exchangers were opened for cleaning by hydrojetting. After cleaning, exchangers were boxed up with new gaskets.

- Surface condenser (H-1815)
- Main lube oil coolers (H-1814-A/B)
- Condenser Pre-evaporator (H-1419)
- First Evaporator (H-1422) with DM water.
- First Evaporator condenser (H-1423)
- **Second Evaporator (H-1424)** with D.M. water

After opening, it was observed that urea has got solidified and deposited inside the top dome. Since it was unable to remove the deposits, it was decided to remove the vapour outlet elbow to P-1423, Ejector to have proper access. Elbow was removed using Kobelco crane and kept at ground floor.

After removal of elbow, the urea hard deposits were removed by Civil and Production department. It was observed that the sparger provided for cleaning, was deformed and its support were got bent. Repairing of sparger and support was done.

It was observed that the weld joints of vapour outlet elbow (44" NB) were corroded. Hence repairing of the weld joints was carried out using ER 316 L (mod) filler wire. An additional sparger was provided through the elbow near vapour outlet nozzle (N3) of H-1424. This was provided to improve the circulation of condensate during cleaning of H-1424. The elbow was installed after necessary repairs using Kobelco crane.

During last annual shut down, a box was welded to the manhole cover of H-1424 to prevent the urea deposition in the opening. Since there was difficulty in removal of manhole cover, the box was cut and removed.

- Second Evaporator I condenser (H-1425)
- Second Evaporator II condenser (H-1426)
- First Evaporator Final condenser (H-1420)
- Recirculation heater (H-1204) with D.M. Water
- L.O. coolers of P-1102-A/B/C
- L.O. coolers of P-1201-A/B
- Reflux condensé (H-1352)
- Pre-evaporator condenser (H-1419)
- CCS - II cooler (H-1207)
- Tube bundle of following heat exchanger was pulled out. Tube bundle was cleaned by hydrojetting. After cleaning, the exchanger was boxed up with new gaskets.
- 1st Stage Cooler of Hitachi Compressor Train (H-1811)

RELIEF VALVE OVERHAULING AND TESTING:

Overhauling and testing of RV was done by M/s Flotec Engineering Services, Surat against W. O. No. 20090973 dated 21-12-2009. The testing was done on new RV test bench.

Final stage discharge RV of Hitachi Compressor (RV-1181) was replaced with new RV procured against PO No.- 20090384 dtd 01/08/2009 from M/s Tyco Sanmar, Vadodara.

Following RV's were removed, overhauled and tested on valve test bench:

Sr. No.	RV No.	Description	Test Medium	Set Pressure Kg/cm² g	Reset Pressure Kg/cm² g
1	RV-1201 A	V-1201 off gas line	Nitrogen	165	150
2	RV-1201 B	V-1201 off gas line	Nitrogen	65	150
3	RV-1201 C	V-1201 off gas line	Nitrogen	165	148
4	RV-1205	P-1201 A discharge	Water	165	148
5	RV-1206	P-1201 B discharge	Water	165	148
6	RV-1208	P-1201 C discharge	Water	165	148
7	RV-1103 A	P-1102 A discharge	Water	150	140
8	RV-1103 B	P-1102 B discharge	Water	150	135
9	RV-1103 C	P-1102 C discharge	Water	150	135
10	RV-1181	K-1801 final discharge	Nitrogen	177	159
11	RV-1903	K-1801 3 rd stage discharge	Nitrogen	111	100
12	RV-1202A	V-1202 off gas line LP System	Nitrogen	6	5.5

13	RV-1202B	V-1202 off gas line LP System	Nitrogen	5.7	5.2
14	RV-1202C	V-1202 off gas line LP System	Nitrogen	6	5.5
15	RV-1203	P-1201 A Suction line	Water	8.5	7.5
16	RV-1204	P-1201 B Suction line	Water	8.5	7.5
17	RV-1207	P-1201 C Suction line	Water	8.5	7.5
18	RV-1101A	Liquid ammonia line from H-1102 to V-1102	Water	31	29
19	RV-1101B	Liquid ammonia line from H-1102 to V-1102	Water	31	29
20	RV-1102 A	Ammonia Suc. Vessel (V-1103)	Water	31	29
21	RV-1102 B	Ammonia Suc. Vessel (V-1103)	Water	31	29
22	RV-1108 A	Cold ammonia line from Amm storage tank to H-1102	Water	31	29
23	RV-1108 B	Cold ammonia line from Amm storage tank to H-1102	Water	31	29
24	RV-1106 A	Liquid amm, line from amm. Plant to amm. filter.	Water	31	29
25	RV-1106 B	Liquid amm, line from amm. Plant to amm. filter.	Water	31	29
26	RV-1107 A	Liquid ammonia line(hot) before ammonia filter	Water	31	29
27	RV-1107 B	Liquid ammonia line(hot) before ammonia filter	Water	31	29
28	RV-1110 A	Liquid ammonia line from atm. Amm.storage tank to H-1102	Water	31	28
29	RV-1110 B	Liquid ammonia line from atm. Amm. storage tank to H-1102	Water	31	28
30	RV-1901	1 st stage discharge of K-1801.	Nitrogen	7	6.7
31	RV-1902	2 nd stage discharge of K-1801	Nitrogen	27	25.1
32	RV-1503	23 ata Steam	Nitrogen	25	23.8
33	RV-1504	9 ata Steam Drum	Nitrogen	12	11
34	RV-1129 A	4 ata Steam Header	Nitrogen	6	5.4
35	RV-1129 B	4 ata Steam Header	Nitrogen	6	5.4
36	RV-1501	4 ata Steam Drum	Nitrogen	7.5	6.8
37	RV-1502	4 ata Steam Drum	Nitrogen	7.5	6.6
38	RV-1506	4 ata Steam Main	Nitrogen	6	5.4
39	RV-1209	V-1203 Vessel	Nitrogen	10	9
40	RV-1351	RV of V-1351	Nitrogen	24	23
41	RV-1352	RV of V-1352	Water	6	5.4
42	RV-1301	RV of V-1301	Nitrogen	6	5.9
43	RV-1184 (CCS-I)	H-1102 outlet NH3 outlet	Water	6	5.5

44	RV-1221 (CCS-II)	P-1204 disch. To H-1203	Water	16.5	15
45	RV-1913	Ejector system of Q-1801	Nitrogen	0.20	0.20
46	RV-1914	Ejector system of Q-1801	Nitrogen	0.20	0.2
47	RV-1916	23 ata Steam extraction	Nitrogen	28	26
48	RV-1917	4 ata Steam exhaust	Nitrogen	4	3.6
49	RV-1351 A	RV of P-1351 A	Water	10	9
50	RV-1351 B	RV of P-1351 B	Water	10	9
51	RV-1130	24 ata steam header	Nitrogen	26	22.5
52	RV-1904	H-1811 1 st stage gas cooler	Water	7	6
53	RV-1905	H-1812 2 nd stage gas cooler	Water	7	6
54	RV-1906	H-1813 3 rd stage gas cooler	Water	7	6
55	RV-1224	C.W from utilities	Water	6	5.4
56	RV-NH3	RV To NH3 Ammonia Plant	Water	85	77

NRV Inspection:

Following NRVs in Urea Plant were opened, inspected and boxed up.

- CO₂ to H-1201
 - NH₃ to H-1202
 - NH₃ to V-1201
 - Carbamate to H-1202
 - Carbamate to H-1203
 - CO₂ to H-1203
 - 4 ata steam to V-1352
 - 23 ata steam to V-1351
 - 4 ata steam to V-1301
 - Condensate to melt return line
 - P-1201 A/B steam injection to discharge RV
 - 9 ata steam injection to offgas line of V-1203/V-1207
 - 9 ata steam injection to off gas line of V-1205
 - NH₃ water to V-1352
 - CO₂ to 1st Desorber V-1352
 - P-1351 A/B discharge
 - Final discharge of K-1801 to H-1201
- Internals of NRV were replaced with new one. The same were procured from M/s Hoerbiger India Ltd., Pune against PO No. 20090479 dtd. 07/09/2009.
- NH₃ water to V-1203 top
 - NH₃ water to V-1207
 - CO₂ to Hydrolyser

Urea Melt Pump P-1408:

Coupling pads of pump were replaced and alignment was done.

Prill Cooling System:

Inlet Air Fan (K-1701):

Bearings of K-1701 were opened and inspected. Bearing condition was found satisfactory and hence boxed up.

Exhaust Air Fan (K-1702):

Bearings of K-1702 were opened and inspected. Bearing condition was found satisfactory and hence boxed up. All 8 nos. of V-belts (SPC-6300) were replaced with new ones. Finally alignment was checked and corrected.

Fluidized Bed Cooler, Dust Silos & Cyclone Separator:

Fluidized bed cooler, dust Silos and cyclone separators were opened for inspection. 3 nos. of manhole for cyclone separator were fabricated. Some locking nuts of fluidized bed cooler were found missing. New locking nuts were provided and loose locking nuts were tightened. After inspection and cleaning of fluidized bed cooler, dust silos and cyclone separators the same were boxed up.

Conveyor System:

Prill Tower Conveyors (M-1403-1/2/3):

Joint of conveyor belt of M-1403-1 was opened slightly during operation. Hence belt was replaced with new one ("Nirlon" make, 850 mm wide, N/N Rating 630/4, 4 ply, grade HRT2, 3mm top and 1.5mm bottom cover - 37.4 mtr. total length). Damaged carrying rollers and return rollers were replaced with reconditioned one.

M-1403-1 drive Geared Motor (control room side) of M/s PBL make was replaced with M/s Ingeco make Gear Box (PO No. 20090051, dtd 22/04/2009). Before shutdown, base plate of the gear box was fabricated & trial run was carried out at Urea workshop. GB was run in both directions. During running, the Gear Box was found to have abnormal sound. Gear box was sent to M/s Ingeco's workshop & the problem was attended. The gear box was re-installed & alignment was done. Platform was made for proper access of gear box for maintenance. During running minor abnormal sound is observed. However oil temperature & vibration was normal.

In order to improve the reliability, Conveyor belt of M-1403-2 ("Nirlon" make, 850 mm wide, N/N Rating 630/4, 4 ply, grade HRT2, 3mm top and 1.5mm bottom cover - 16.6 mtr. total length) was replaced with new one. Both NTN make bearing of head pulley were replaced with new one. The existing old conveyor belt was having damaged joint which was revulcanised during normal plant prilling shutdown. Gear box was filled with new oil (Servo system-460). New coupling bush were provided. Damaged carrying rollers and return rollers were replaced with reconditioned one. A window was provided at the bottom of discharge chute to fluidized bed cooler. This is for the easy removal urea lumps & dust from scrapper floor during prilling shutdown.

Belt condition was found satisfactory in M-1403-3. New coupling bush were provided. Gear box was filled with new oil (Servo system-460).

Link Conveyor (M-1419):

Belt condition was found satisfactory. New coupling bush were provided. Gear box was filled with new oil (Servo system-150). Damaged carrying rollers and return rollers were replaced with reconditioned one. Alignment was checked and corrected.

Prill Cooling System Link Conveyor (M-1421):

Belt condition was found satisfactory. Gear box was filled with new oil (Servo system-150). New coupling bush were provided. Damaged carrying rollers and return rollers were replaced with reconditioned one. Alignment was checked and corrected.

Dust Conveyor System (M-1702):

Conveyor belt was replaced with new one (600 mm width, 4 ply, store code - 154010104600). New coupling bush were provided. Gear box was filled with new oil (Servo system-150). Damaged carrying rollers and return rollers were replaced with reconditioned one. Alignment was checked and corrected.

Prill Tower Scraper (M-1402-1/2):

Fluid Coupling:

The existing fluid coupling of scraper is M/s Hansen, Belgium make Hydroflow coupling. For spare fluid coupling the party was contacted. The party informed that model is obsolete & they have stopped manufacturing of this model. For similar fluid coupling, various indigenous, vendors were contacted and finally 2 nos. fluid coupling (Model – DFP 290, Prembril , Oil – Servo Prime 46 T) were procured from M/s Premium Energy Transmission Ltd., Ahmedabad against PO. No. 20081036 dated 17/12/2008. For checking the performance of these fluid couplings both the existing fluid couplings were replaced with new Prembril fluid coupling immediately after Shutdown of Urea Plant. The scraper was run for about 8 hr and performance was found satisfactory.

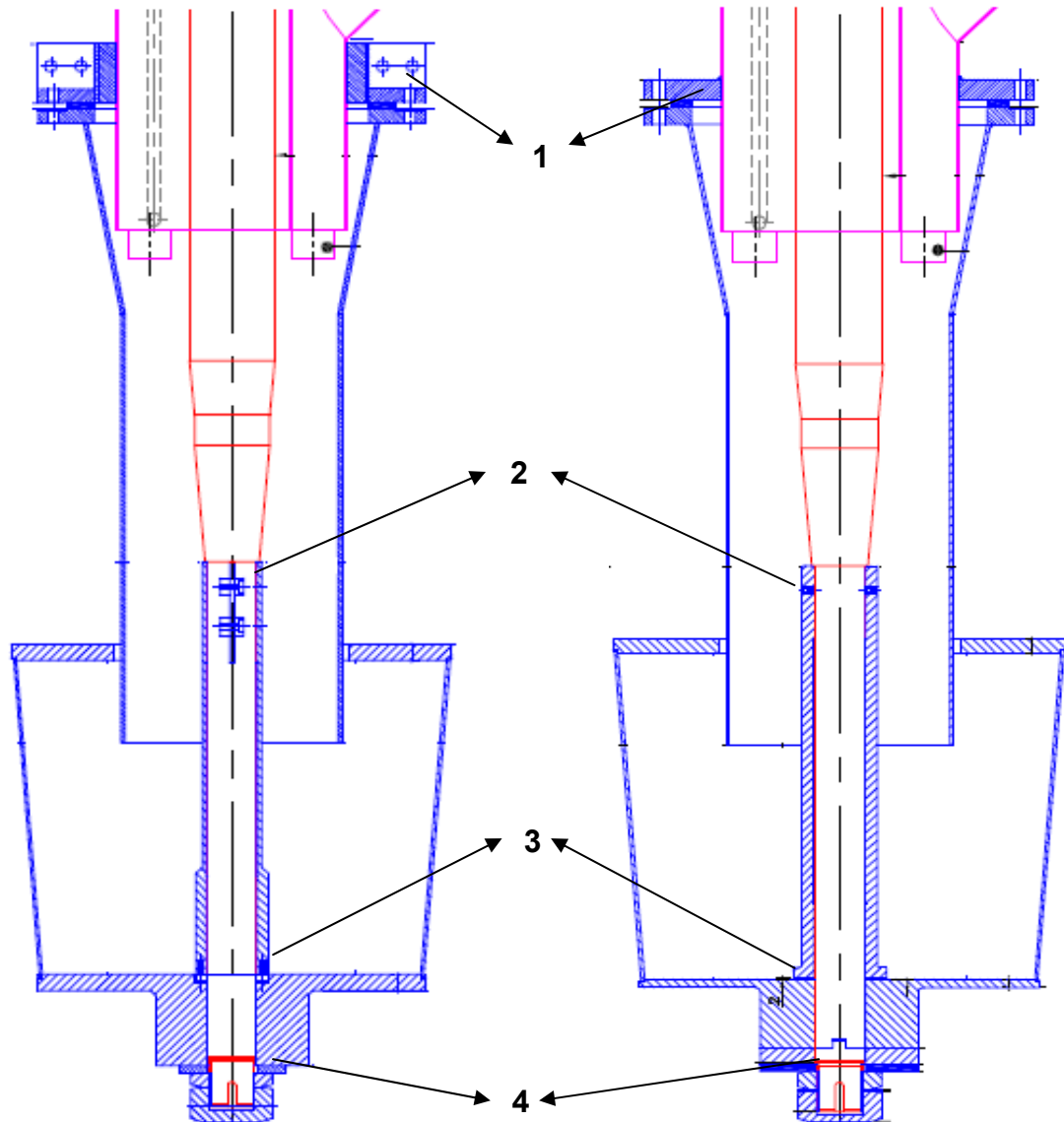
Gear Box (M-1402-1/2):

Abnormal noise was observed in Gear box M-1402-1 (Bagging side) during normal plant operation. It was decided to replace the Gearbox with reconditioned Gear Box during Shutdown. Gear box was removed by providing rigging arrangements from bottom. Pinion of existing gear box was found in satisfactory condition. Same pinion with reconditioned gear box was installed. Pulleys of both gear boxes were replaced with new ones. All 4 nos. of V-belts (B-69) of M-1402-1 (control room side) were replaced with new ones

Prill Bucket Mechanism (M-1401 A/B):

Trial Run of New M/s Simco Make Modified Bucket in M-1401 A

New Simco make modified bucket along with shaft, sleeve & distributor flange were procured against PO No. 20090458 dtd. 19/08/2009.



Existing Simco Make Bucket

New Modified Simco make Bucket

FIG 9 Comparison of existing and modified SIMCO bucket

The new prill bucket was procured incorporating some modifications, since the Prill bucket which was installed earlier was on trial basis to evaluate its performance. Hence earlier installation of bucket was done on temporary fixtures. Now as the performance is found satisfactory, the installation was to be made Permanent. Also modification was done for easy removal and installation of bucket.

Following modifications were done on new simco make bucket as compared with existing simco make bucket. (Ref Fig 9)

- Distributor extension flange is welded with distributor in the modified bucket whereas in the existing bucket, distributor extension flange was provided by clamping arrangement. (Note- However this modification was not carried out. The existing distributor extension & flange with clamping arrangement were used)
- In the existing bucket, sleeve at top end was cut axially and it was clamped on the shaft by providing 4 nos. allen screws (M6 X 20 mm long). In the new Bucket instead of this arrangement, 3 nos. of Allen screws (M6 X 12 mm long) were provided at 120° and counter sunk was made on the shaft to lock the sleeve from rotation with the shaft.
- The existing bucket was having 2 nos. allen screws (M6 X 15 mm long) at bottom end of sleeve which was to be inserted in the slots provided in bucket hub during installation. This provision was removed. In the new bucket, diameter of bottom end of new sleeve was made bigger for proper seating of sleeve and Teflon washer was provided between bucket hub and sleeve.
- In the new bucket, a key way was provided at bottom of bucket in which key provided on the lock washer will be fixed. ID of lock washer was made A/F and cross section of corresponding portion of shaft was also made A/F.

Before shutdown, existing Simco make bucket along with shaft was removed. Modified simco make bucket along with new shaft (Procured from M/s Mehul Industries, Ahmedabad) and sleeve was installed. Both bearings were replaced with new one. Timing belt (Optibelt) was replaced with new one. New simco make bucket was installed and trial run was taken successfully before shut-down.

Trial Run of Vibro Priller Bucket by M/s Urea Casale and M/s Tuttel in M-1401 B:

M/s Urea Casale, Italy & M/s Tuttle, USA approached IFFCO for trial run of vibro priller in place of prilling bucket. It was decided to replace the existing prill bucket of M-1401 B with vibro priller.

Vibro Priller consists of a prilling bucket, rotating on its vertical axis, with the particular feature (patented) that the external conical wall vibrates in vertical direction. The vibration is achieved through a pneumatically driven vibrating box, installed at the bottom to increase production while improving the uniformity (size and shape) of the urea prills and reducing the fine content in the product combined with reduction of duct emission from the top of prilling tower. It consists of vibrating bucket, shaft & vibrating box.

New shaft, impeller & bucket, vibrating box, pressure regulator and other parts required for modification were sent by M/s Urea Casale, Italy & M/s Tuttle, USA. The installation & trial runs were taken in presence of the representative of M/s Urea Casale, Italy & M/s Tuttle, USA.

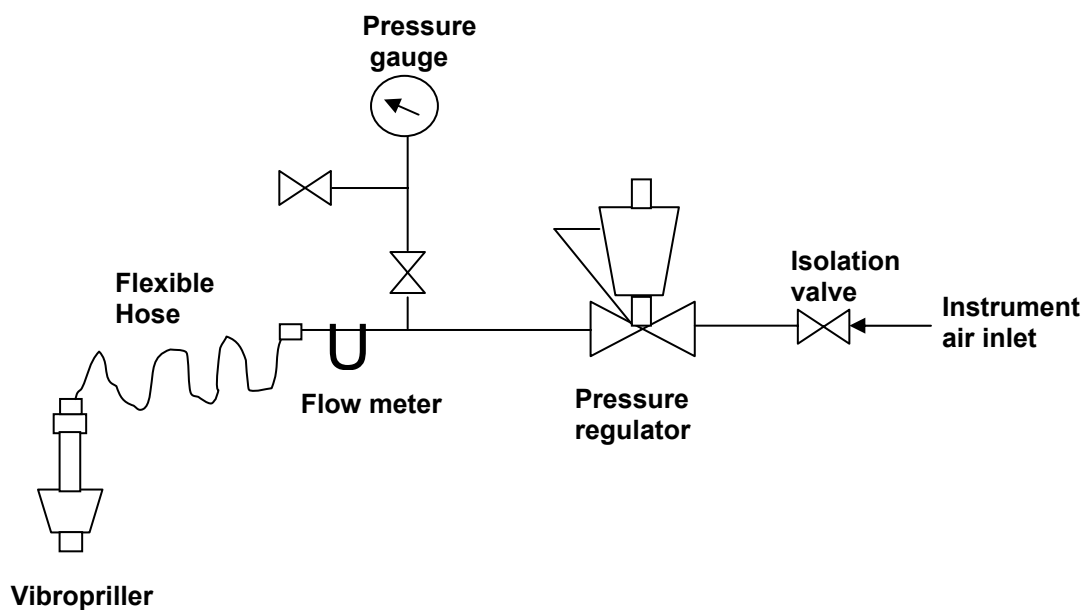


FIG 10, Schematic Diagram of Vibropriller Mechanism

Following activities were carried out for installation of vibro priller assembly.

- Removed the existing M/s Kreber make bucket assembly along with shaft.
- Bucket shaft supplied by Casale was assembled with new bearings. Shaft diameter at top bearing area was built-up & machined to the required dimension, since the shaft dia. of this portion was smaller than required for installation of bearing.
- Flange was positioned & welded on existing distributor and bucket was assembled.
- Existing top cover was removed & spacer was made from Workshop and provided at top for fitting instrument air connection.
- For 6 kg/cm^2 g compressed air required for producing the vibration in bucket, Instrument air line was fabricated from 2nd floor to the bucket room. The tapping was taken from instrument air line, AR-1201-2"-B1. Pressure regulator with gauge and flow meter was provided in air line near bucket. Air line was connected with top of the shaft through SS flexible hose.
- Gear fixture for drive of bucket was manufactured from Ahmedabad as this component was not available in consignment.

During start up of plant, trial run of vibro priller bucket was taken at different Prill load condition. Trial was done by varying the flow of air & also by changing the internals of Vibropriller. However trial was not successful, since the prill quality was bad and even at 60% load, temperature of urea prills remained very high. (approx. 115 – 120 C).

Vibro priller assembly was completely removed. SIMCO prilling bucket which was removed from M-1401 A and new distributor extension were installed in M-1401 B. Modified sleeve, lock washer, Aluminum washer, SS washer etc were made from Work shop. The bucket hub face was machined and key way was made in bucket hub to suit the modified assembly requirement as per new bucket supplied by Simco. This ensured interchangeability of Simco bucket

For fixing the distributor extension, the distributor extension flange was placed above the flange which was welded for vibro priller bucket assembly and it was bolted with the distributor extension. The distributor extension was cut 200mm from the bottom for adjusting the length. Finally simco make bucket assembly (M-1401A) was installed and commissioned.

Fabrication Jobs:

Following fabrication jobs were carried out by M/s J & J Engineers, Kalol & M/s Smitha Engineers, Kalol.

Compressor area:

- 23 ata steam header 2nd i/v from DM plant was replaced by new one. MWR No. - 0905202410 (Gate valve, CS, ½" x 800#, 2 nos.)
- 60 ata to 40 ata drain 1st and 2nd i/v g/l near FT-1101 were replaced (which were fermanited)
- Control valve at inlet of Q-1814 was not normally operated by production. Hence the control valve was removed and spool piece was provided as per requirement of production.

Ground floor:

- 23 ata header drain i/v FR-1101 was repaired by fermaniting. The same i/v was replaced with new one. MWR No. – 0905200638
- Condensate valve of T-1301 was not operatable. Same was replaced by new one. MWR No. - 0905201625 (Gate valve, CS, ½" x 800#, SW)
- Welding leak of condensate inlet line for packing of P-1102A/B/C was repaired
- P-1201 A/B/C discharge line loop steam tracing line with header heavily corroded ,hence it was replaced was fabricated.
- P-1102 A/B/C discharge and suction line drain i/v (3/4" x 800#) was replaced by 3/4" x 1500#
- New supports, which were fabricated before shutdown for Ammonia suction and discharge line was provided.
- 40 ata drain line 2nd i/v (with missing wheel) was replaced with new one.(Gate valve , ¾" x 1500#).
- Patch was provided in suction line of P-1102 B due to the thickness reduction.

1st floor:

- 3 nos. of instrument air header i/v were not operatable. The same valves were replaced with new one. MWR No. – 0905201041
- Gland leak of 23 ata steam tracing i/v was repaired by fermaniting during normal plant operation. This valve was replaced. MWR No. – 0905200685
- Steam trap – BPT21, ½" SW, near H-1204, which was having bonnet leak was repaired by fermaniting. The same was replaced. MWR No. – 0905202689
- Corroded condensate header line (3" x 40 Sch , CS) above P-1304 C/D was replaced
- New steam tracing line (½" x 40 Sch CS) near F-1206 was fabricated from ground floor to 1st floor

2nd floor:

- Steam tracing line Pin hole leak was observed near H-1205, new Header 2" with stem tracing line ½" was fabricated and 3 nos. of gate valve ½" x 800# were provided. MWR No. – 0905202216
- H-1424 condensate pot vent i/v gland leak was repaired by fermaniting during normal plant operation. The same valve was replaced with new one. MWR No. – 0905200302
- Valve of plant air line was replaced by new one. (Globe valve , 1" x 800# , CS)
- Equal Tee (SS 304, 1-1/2" x 3000#) of common discharge line of P-1211 A/B was found cracked . The same was replaced.
- Pin hole leakage of Condensate line (CS, 6" X 40 Sch & 4" x 40 Sch) near V-1423 was provided with patch plate during normal plant operation. This line was replaced with new one.

3rd floor:

- steam tracing i/v near 2nd evaporator, 1st ejector which was having Gland leakage was replaced with new one (gate valve, ½" x 800# , CS).
- Steam trap near P-1422 ejector was having bonnet leakage. This was replaced with new steam trap MWR No. – 0905201469 (TD, ¾" x 800#, CS)
- Steam tracing lines with header near V-1201, which was heavily corroded, was replaced.
- 1 no. of circumferential steam tracing line was fabricated for V-1418.
- H-1425 condensate flushing u/s union was replaced due to the leakage

3.5th floor:

- Steam trap tracing line below NRV (NH3 to H-1202 and Carbamate to H-1202) was rerouted & traps were provided.

4th floor:

- Bush of i/v of steam tracing line at top of H-1202 was found broken. Valve was replaced by new one MWR No. – 0905200873 (Gate valve, ½" x 800# , CS)

PT Top:

- Steam trap of H-1203 steam tracing line (½", BPT-21) was replaced & V-1203 RV o/l steam tracing line was repaired MWR No. – 0905201134.
- Steam tracing i/v, g/l, near CO2 to H-1203 was repaired by fermanite during normal plant operation. This was replaced by new one. MWR No. - 0905202454 (gate valve , ½" x 800#, CS, SW)
- Wheel of i/v for steam hose of PT fan was free, it was welded. MWR No. – 0905202725

PCS:

- 4 ata steam i/v above transformer was repaired by fermanite during normal plant operation. Same was replaced with new one MWR No. - 0905201806 (Gate Valve , ½" x 800# ,CS)
- Pin hole leak was observed in condensate outlet line of TICV -1701 A/B. pipe line replaced with new one MWR No. - 0905201714 (2" x 40 sch, CS)
- Patch plate was provided at damaged portion of V-1703-3. MWR No. – 0905201581
- FICV-1351 root i/v gland leak was repaired by fermanite during normal plant operation. The same was replaced by new one. MWR No. - 0905201806 (Gate valve, ½" x 800#, CS)

Following fabrication jobs were done by departmentally:

- During start up of Urea Plant, ammonia gas leaked from the vent stack 1-1/2" threaded non metallic PTFE plug sample point located at 5th floor. In order to provide isolation to this sample point, new 1-1/2" SS 304 threaded plug with ½" hole was made in workshop and installed at sample point on vent stack. A ball valve (½" x 800#) with nipple was welded with threaded plug to facilitate isolation as and when required.
- NC ratio meter sample line from V-1201 outlet pipe line was having crack during normal plant operation. Box with i/v was fabricated to prevent the leakage. During shutdown this line was replaced. Equal tee (1" x Sch 80, SS 316L) and concentric reducer (ASTM A403 WP316L Urea grade, conforming to Stamicarbon specification 18005 BC 01 MS 26, 991683903L20) were provided. 3 nos. BEL valves (1" x 1500# - 1 no. & ½" x 1500# - 2nos.) were also replaced.
- Replacement of HICV-1201 control valve was done by Instrumentation Section. Existing control valve was having RTJ type flange on upstream and lens type flange on downstream (threaded). Newly procured HICV-1201 was having lens type flange (threaded) in upstream and downstream. Upstream flange was cut and spare threaded nozzle which was available with Instrument section was welded for installation of lens type threaded flange.
- As per radiography report, thermowell pipe of Autoclave line to Stripper (1.5TR1201) was having thinning of pipe. Since material was not available, patch plate in two pieces were provided and welding was done.
- As per radiography report, weldolet joint of thermowell at stripper outlet (1.5TR1210) at ground floor was having cavities. Additional weld layer was provided in the joint.
- As per radiography report, thermowell pipe of Autoclave to scrubber (1.5TR1206) at 5th floor was having thinning. Since material was not available, patch plate in two pieces were provided and welding was done.
- Both i/v for H-1201 sample line at Ground floor, which were passing were replaced with new one.
- Rupture disc flange (6" x 150#, CS) of HP Stripper (H-1201) at 1st floor was having leakage during normal plant operation. Box was provided on the flanges with Gate valve to prevent the leakage. During shutdown shell side flange was cut and new flange was fabricated.

- Ammonia line vent i/v (SW Gate valve, 1" x 2500#, CS - 3.5th floor) was having leakage during normal plant operation. Box with gate valve was fabricated to prevent the leakage. During shut-down i/v was replaced with new one.
- 4th stage suction line CO2 compressor, PI tapping i/v (Gate valve, ¾" x 1500#, SS304) was leaking. Same was repaired by fermenting during normal plant operation. Replaced it with new one.
- CO2 to H-1203 i/v (Gate valve, 1" x 2500#) gland leak was repaired by fermenting during normal plant operation. This valve was replaced with new one.
- Shell side vent flange leak (H-1201) at 1st floor was repaired by fermenting. Same was replaced by new one.

Process Jobs:

Compressor area:

- 23 ata MOV by pass line i/v bonnet leak. Bonnet gasket was replaced. MWR No. - 0905200638
- Gland repacking of 60 ata bypass valve of Q-1801 main i/v was done.
- Oil to journal bearing (LP case - out board) up stream joint was having leakage. Gasket was replaced with new one. (1" x 150#).
- Gear Box oil outlet slight glass flange was having flange leakage. Gasket was replaced with new one. (8" x 150#) MWR No. – 0905201588.

Ground Floor:

- Minimum flow line i/v of P-1302 C was having bonnet and flange leakage. Gaskets were replaced by new one MWR No. – 0905200800 (1-1/2" x 150#)
- 23 Ata steam header flange was having leakage. Gasket was replaced by new one. MWR No. – 0905202486
- H-1301A plate side inlet valve flange leak was repaired by fermenting. Gasket (6" x 300#) was replaced. MWR No. – 0905202426
- 23 ata steam inlet to V-1502 (23ata steam drum) gasket was replaced due to flange leak. MWR No. – 0905202032
- Suction i/v flange gasket of P-1305 B was replaced due to the leakage. MWR No. – 0905202415. (3" x 150#)
- P-1201 A/B/C packing flushing i/v was replaced with new one (Gate valve, 1" x 150#).

1st Floor:

- H-1206 PHE was having gasket leakage while Plant was taking Shutdown. However after start up of Plant no leakage was observed.
- Bonnet leak of P-1201 A suction I/V was repaired by fermenting during normal plant operation. Replaced it with new one. MWR No. - 0905200292 (Gate valve, 4" x 150 #, SS 316L)
- P-1201 B suction i/v bonnet gasket was replaced with new one.
- H-1207A dome inlet I/v of was having flange leakage. Gasket was replaced with new one.

3rd floor:

- 9 ata steam drum steam inlet flange gasket was replaced with new one. MWR No. – 0905202032.

PT Top:

- V-1203 LT i/v was not operatable. This valve was replaced with new one. MWR No. - 0905202575 (Gate valve , 2" x 150#)
- Steam tracing i/v above FICV-1202 was having gland leakage. Replaced it with new one. (Threaded Gate valve, ½" x 800#)

Hydrolyser Section:

- V-1352 off gas line steam tracing i/v flange gasket was replaced with new one. MWR No. - 0905202051 (1/2" x 150#).
- 23 ata steam to LIC-1351 orifice was flange gasket (¾" x 300#) was replaced with new one.

Gland repacking job was carried out by M/s Amrutha Engineering, Mumbai against PO. 20090923 dtd. 05/12/2009. Repacking of following valves was done.

- 23 ata tapping i/v at ejector floor
- PICV-1181 u/s, i/v
- PICV-1129 u/s, i/v, (control room side)
- Steam trap i/v behind P-1408.
- 23 ata steam to hydrolyser main i/v g/l near V-1409
- H-1422 condensate POT to boiler i/v
- 9 ata steam drum inlet main i/v g
- 23 to 9 ata condensate i/v

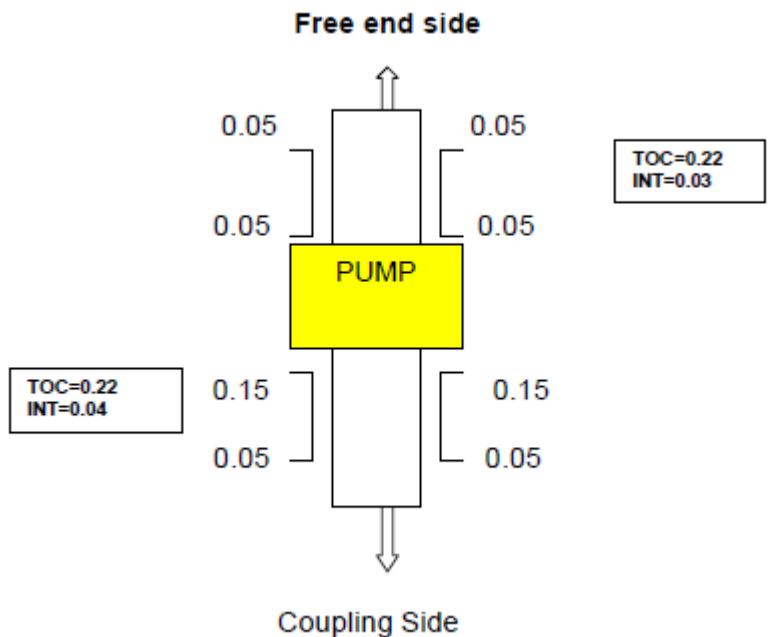
OFFSITE & UTILITY PLANT

PREVENTIVE MAINTENANCE OF ROTARY EQUIPMENTS:

COOLING WATER PUMP (P-4401/A):

Following activities were carried out:

- Coupling between the Pump and G.B. was decoupled.
- Before Preventive maintenance Pump to gearbox Alignment readings were checked.
- Both the Journal Bearings were checked and found OK.
- Bearing clearances of the pump was checked and recorded as(mm)



TOC: Top Oil Clearance (Bearing Diametrical Clearance)

INT: Interference between bearing and housing

- Pump total float is measured and found **0.77 mm**
- Both side glands of pump were repacked with 25 mm PTFE packing up to lantern ring.
- Coupling of pump with gear box was cleaned, checked and found O.K.
- After preventive maint. Alignment between pump to GB was checked
- Finally pump was coupled to GB with grease packed geared coupling.
- Final Clearance Chart is as under:

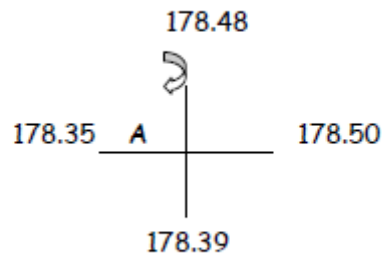
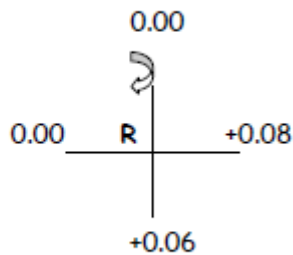
Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Total Float	-	-	0.77
2	Coupling end Journal Bearing Clearance	0.20	-	0.22
3	Front End Journal Bearing Clearance	0.20	-	0.22
4	Coupling end Journal Bearing side Clearance	-	-	0.05
5	Front end Journal Bearing side Clearance	-	-	0.05-0.15
6	Coupling end Journal Bearing Interference	-	-	0.04
7	Front end Journal Bearing Interference	-	-	0.03

Alignment Readings are as under

Before Preventive Maint.

{Dial on gear box}

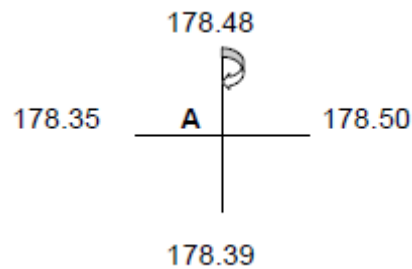
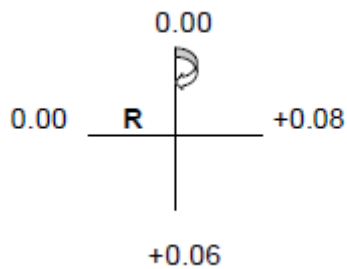
With Inside micrometer



After Preventive Maint.

{Dial on gear box}

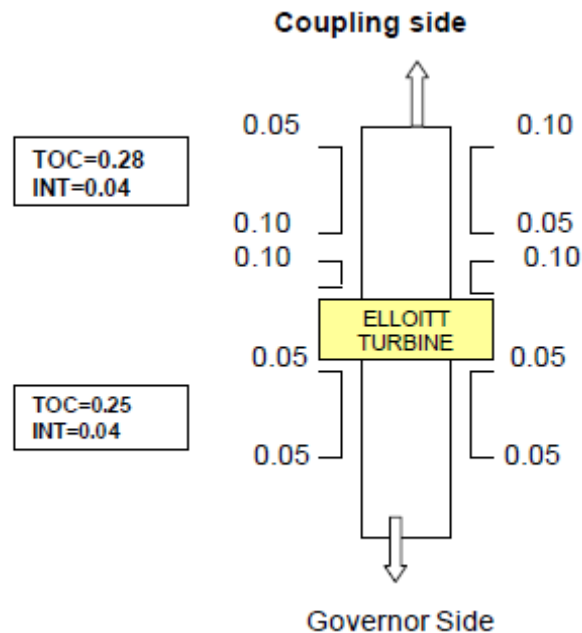
With inside Micrometer



ELLIOTT TURBINE (Q-4411):

Following activities were carried out during PM

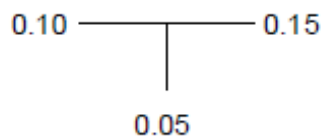
- Coupling between the Turbine and G.B. was decoupled.
- Turbine Bearings were opened, cleaned, checked found OK and boxed up.
- Turbine Bearing Clearances were checked and recorded(mm):-



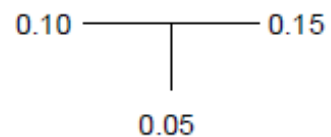
TOC: Top Oil Clearance (Bearing Diametrical Clearance)

INT: Interference between bearing and housing

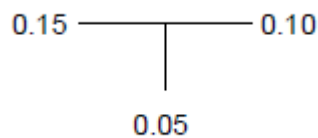
- Oil gland clearances were measured and recorded:



Front Bearing Front Side



Rear Bearing Front Side



Rear Bearing Rear Side

- Free float of the Turbine was measured as **1.70 mm**
- Thrust float of the Turbine was maintained 0.33/0.34 mm by providing shims of 0.5 mm.

- Thrust pads thickness were also measured and recorded as under:

S.No	Active Side (MM)	Non-Active Side (MM)
1	17.42	17.45
2	17.44	17.45
3	17.42	17.46
4	17.44	17.46
5	17.44	17.44
6	17.42	17.46

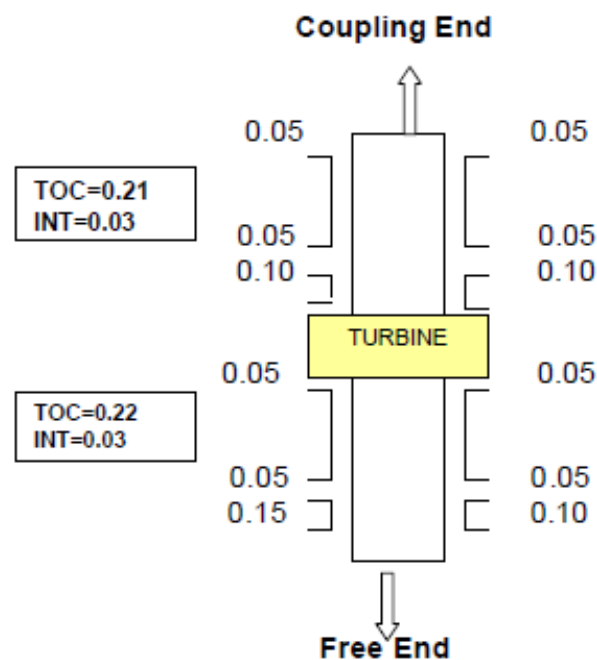
- Governor was removed from its position, overhauled & fresh oil was charged (SERVO-PRIME 32).
- Oil console was drained; cleaned and fresh oil charged (SERVO-PRIME 32)
- Main oil pump & Auxiliary oil pump suction strainers were cleaned & boxed up.
- The surface condenser was opened. Hydro jetting was carried out & then boxed up.
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Thrust Float	0.25-0.30	0.82	0.33-0.34 (After add. Of shims)
2	Free Float	-	-	1.70
3	Coupling end Journal Bearing Clearance	0.127-0.18	-	0.28
4	Front End Journal Bearing Clearance	0.127-0.18	-	0.25
5	Coupling end Journal Bearing side Clearance	-	-	0.05-0.10
6	Front end Journal Bearing side Clearance	-	-	0.05
7	Coupling end Journal Bearing Interference	-	-	0.04
8	Front end Journal Bearing Interference	-	-	0.04
9	Front Bearing Front side oil gland clearance	-	-	Side- 0.10-0.15 Bott – 0.05
10	Rear Bearing Front side oil gland clearance	-	-	Side- 0.10-0.15 Bott – 0.05
11	Rear Bearing Rear side oil gland clearance	-	-	Side- 0.10-0.15 Bott – 0.05

TURBINE FOR COOLING WATER PUMP P- 4401/B (Q-4401/B):

Following activities were carried out during PM

- Coupling between the Turbine and G.B. was decoupled.
- Before preventive maintenance Turbine to gear box alignment readings were checked and recorded.
- Both sides of the turbine bearings were opened, cleaned, checked, found OK and boxed up.
- Turbine Bearing Clearances were checked.



TOC: Top Oil Clearance (Bearing Diametrical Clearance)
INT: Interference between bearing and housing

- Free float of the Turbine was measured as **1.97mm**
- Thrust float of the Turbine was measured as **0.31mm**
- Governor was removed from its position, overhauled and boxed up.
- Fresh oil SERVO PRIME 32 was filled in the governor.
- Oil console was properly cleaned and charged with fresh oil.
- All connected oil pipe lines were also cleaned.
- Oil cooler was opened, cleaned and boxed up.
- Oil strainer was cleaned & replaced the oil filter.
- Final Clearance chart is as under:

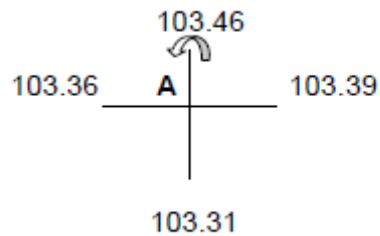
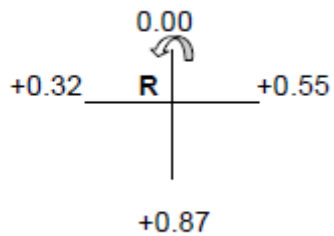
Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Thrust Float	0.25-0.30	-	0.31
2	Free Float	-	-	1.97
	Coupling end Journal Bearing Clearance	-	-	0.21
	Front End Journal Bearing Clearance	-	-	0.22
	Coupling end Journal Bearing side Clearance	-	-	0.05-0.10
	Coupling end Journal Bearing side Clearance	-	-	0.05-0.10
	Coupling end Journal Bearing Interference	-	-	0.03
	Front end Journal Bearing Interference	-	-	0.03

- Alignment Readings are as under:

Before PM Maint:

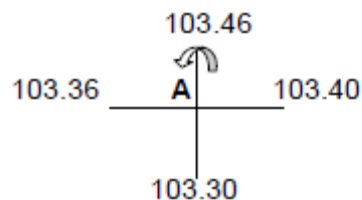
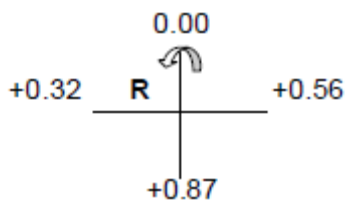
{Dial on gear box}

With Feeler gauge



After PM Maint:

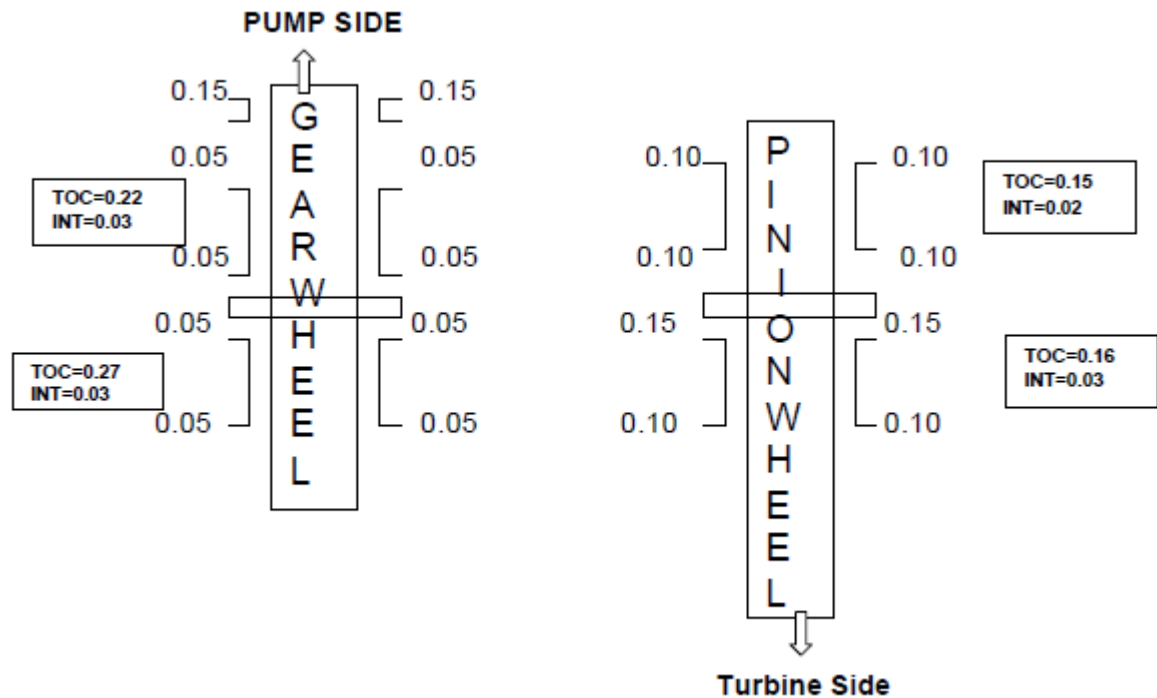
{Dial on gear box}



GEAR BOX FOR COOLING WATER PUMP P- 4401/B:

Following activities were carried out during PM

- Bearings of gear box was opened, cleaned, checked and found ok.
- Bearing clearances of Gear Box were checked.



TOC: Top Oil Clearance (Bearing Diametrical Clearance)

INT: Interference between bearing and housing

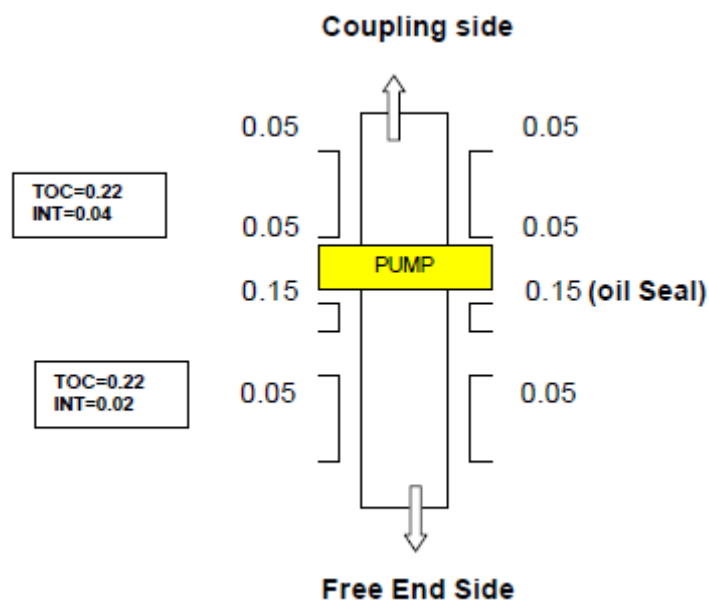
- Gear wheel Float was measured as **0.18mm**
- Pinion wheel float was measured as **0.27mm**
- Backlash was also measured as **0.57mm**
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint (mm)
1	Gear Wheel Thrust Float	-	-	0.18
2	Pinion Wheel Thrust Float	-	-	0.27
3	Gear wheel pump end Journal Bearing Clearance	-	-	0.22
4	Gear wheel free end Journal Bearing Clearance	-	-	0.27
5	Gear wheel pump End Journal Bearing side Clearance	-	-	0.05-0.05
6	Gear wheel free end Journal Bearing side Clearance	-	-	0.05-0.05
7	Gear wheel pump end Journal Bearing Interference	-	-	0.03
8	Gear wheel free end Journal Bearing Interference	-	-	0.03
9	Pinion wheel free end Journal bearing clearance	-	-	0.15
10	Pinion wheel turbine end Journal bearing clearance	-	-	0.16
11	Pinion wheel free end Journal bearing side clearance	-	-	0.10
12	Pinion wheel turbine end Journal bearing side clearance	-	-	0.10-0.15
13	Pinion wheel free end journal bearing interference	-	-	0.02
14	Pinion wheel turbine end journal bearing interference	-	-	0.03

COOLING WATER PUMP (P- 4401/B):

Following activities were carried out during PM

- Coupling between the pump and motor was decoupled.
- Before Preventive maintenance PUMP to gearbox Alignment readings were checked.
- The journal bearings were opened & cleaned.
- Bearing clearances of the pump was measured and recorded as:(mm)



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

- Total Pump float observed was **0.80mm**
- Both side glands of pump were repacked with 25 mm PTFE packing up to lantern ring.
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint (mm)
1	Total Float	-	-	0.80
2	Coupling end Journal Bearing Clearance	0.2	-	0.22
3	Free End Journal Bearing Clearance	0.2	-	0.22
4	Coupling end Journal Bearing side Clearance	-	-	0.05
5	Free end Journal Bearing side Clearance	-	-	0.05
6	Coupling end Journal Bearing Interference	-	-	0.04
7	Free end Journal Bearing Interference	-	-	0.02

- Alignment readings are as under:

Before Preventive Maint.

{Dial on gear box}

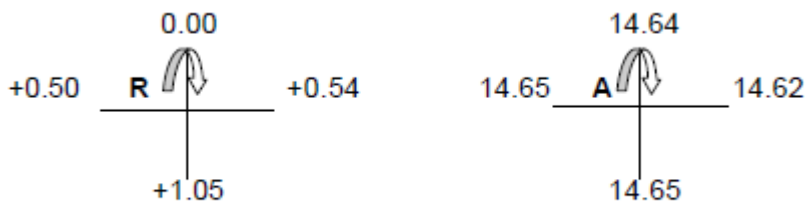


COOLING WATER PUMP (P-4402):

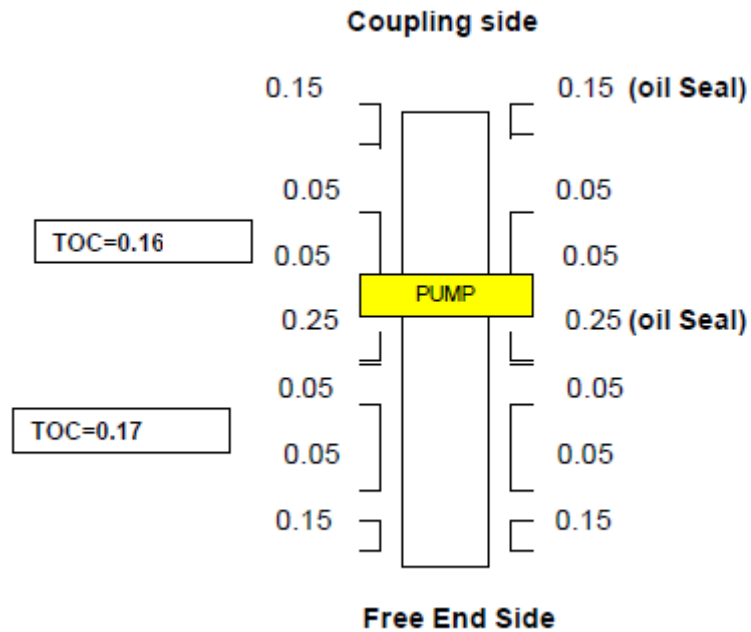
Following activities were carried out during PM

- Coupling between the pump and motor was decoupled.
- Before Preventive maintenance Motor to Pump Alignment reading are checked.

{Dial on Motor shaft}



- Both the journal bearings were opened, cleaned, checked & found OK.
- Bearing clearances were checked & following are the readings: (mm)



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

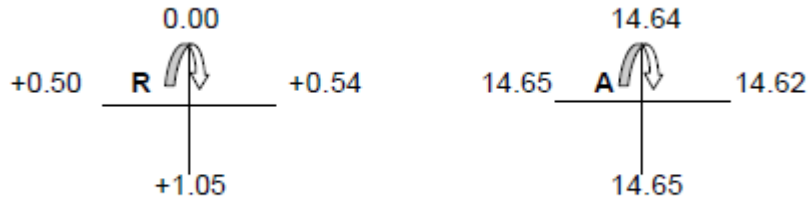
INT : Interference between bearing and housing

- Total float of the pump was measured as = **0.72mm**
- After filling oil in the bearing housing oil leakage was observed from both side oil guards, so Aluminum spacer was provided to stop the oil leakage.
- Final Clearance chart is as under:

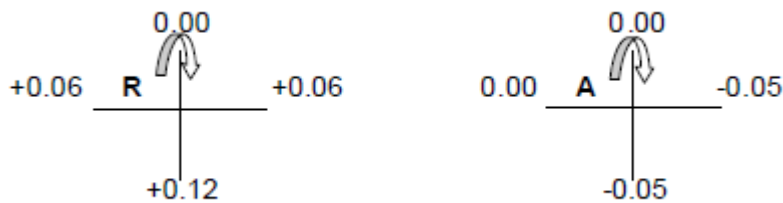
Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint (mm)
1	Total Float	-	-	0.72
2	Coupling end Journal Bearing Clearance	0.22-0.23	-	0.16
3	Free End Journal Bearing Clearance	0.23-0.24	-	0.17
4	Coupling end Journal Bearing side Clearance	-	-	0.05
5	Free end Journal Bearing side Clearance	-	-	0.05

- Alignment readings are:

Before Preventive Maint:
{Dial on Motor shaft}



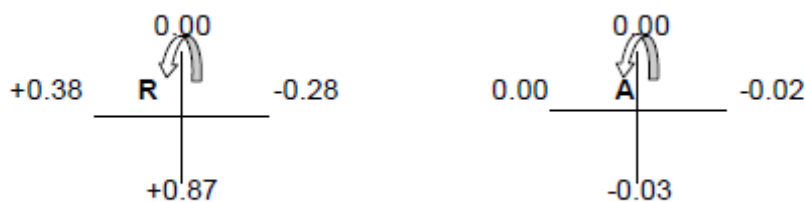
After Preventive Maint :
{Dial on Motor shaft}



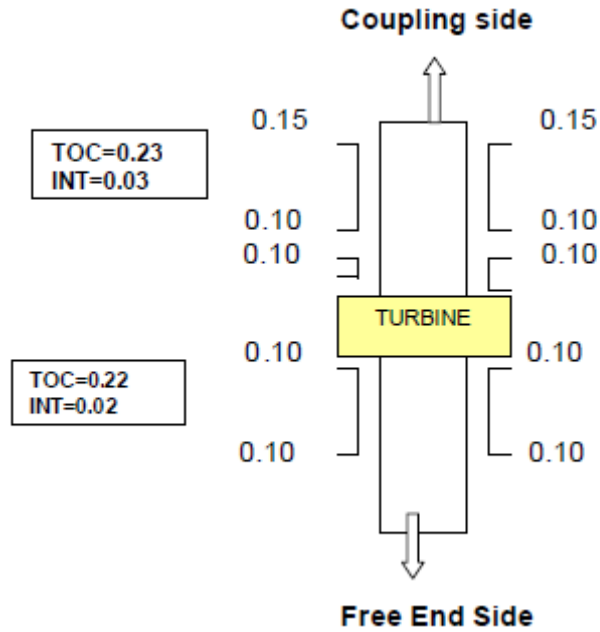
Turbine for Cooling Water Pump, P-4403 (Q-4403):

Following activities were carried out during PM

- Coupling between Turbine and Gear Box was decoupled.
- Before preventive maintenance Turbine to gear box alignment readings were checked and recorded.
-



- Turbine bearings were opened, cleaned, checked and found OK.
- Bearing clearances of turbine were checked and readings are:



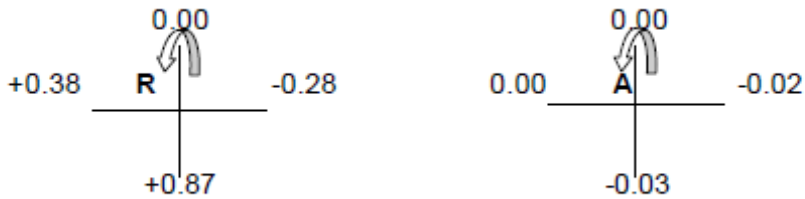
- Free float of the Turbine was measured as **2.00 mm**
- Thrust float of the Turbine was measured as **0.32 mm**
- After preventive maintenance alignment between Turbine to Gear box was checked.
- Governor was removed from the position, complete over hauled and again boxed up.
- Oil cooler was opened, cleaned and then boxed up.
- All connected oil pipe lines were also cleaned and checked.
- Oil console was cleaned and then charged with fresh oil.
- Final Clearance Chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint (mm)
1	Free Float	-	-	2.00
2	Thrust Float	0.25-0.30	-	0.32
2	Coupling end Journal Bearing Clearance	-	-	0.23
3	Free End Journal Bearing Clearance	-	-	0.22
4	Coupling end Journal Bearing side Clearance	-	-	0.10
5	Free end Journal Bearing side Clearance	-	-	0.10
6	Coupling end Journal Bearing Interference	-	-	0.03
7	Free end Journal Bearing Interference	-	-	0.02

- Alignment readings are as under:

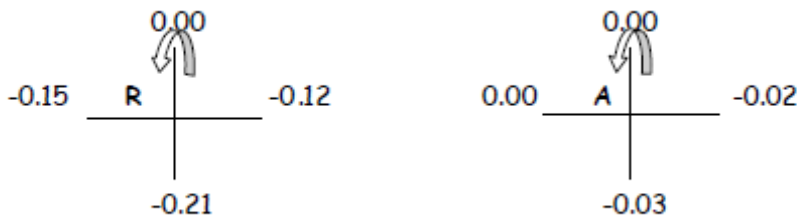
Before Preventive Maint:

{Dial on gear box}



After Preventive Maint:

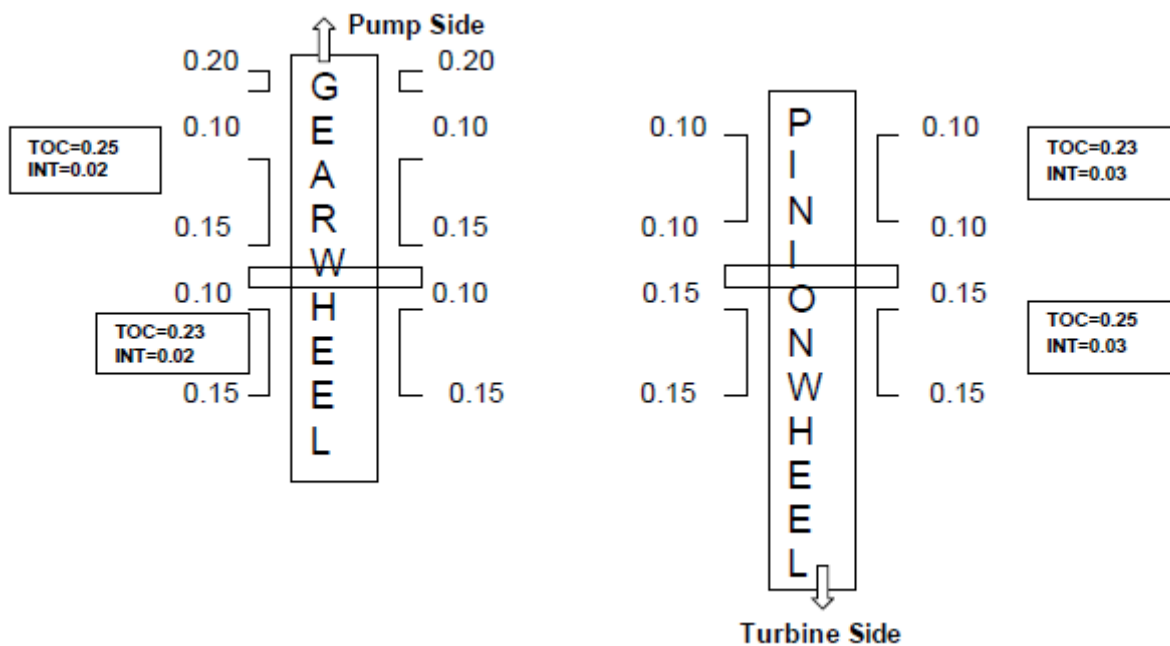
{Dial on gear box}



GEAR BOX FOR COOLING WATER PUMP P- 4403:

Following activities were carried out during PM

- Bearings of gear box was opened, cleaned, checked and found ok.
- Bearing clearances of Gear Box were checked and recorded in mm.



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

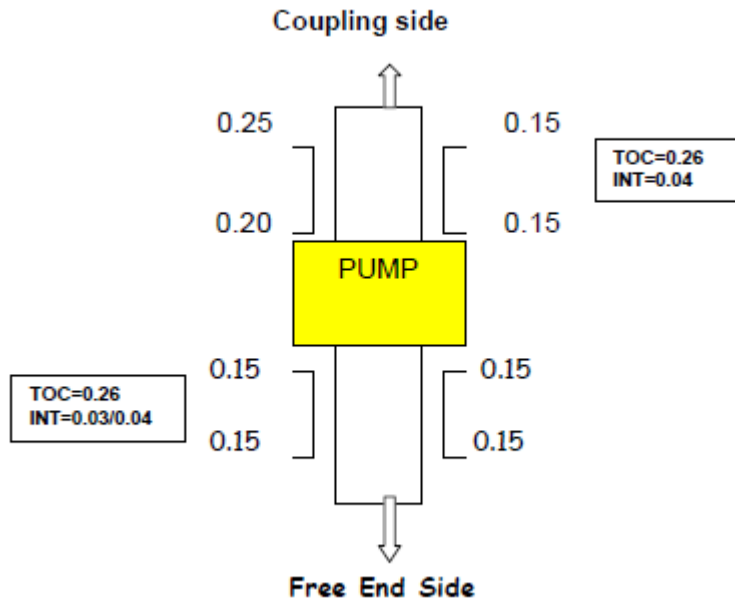
- Gear wheel Float was measured as **0.20mm**
- Pinion wheel float was measured as **0.20mm**
- Backlash was measured as **0.62mm**
- Final clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint,mm
1	Gear Wheel Thrust Float	-	-	0.20
2	Pinion Wheel Thrust Float	-	-	0.20
3	Gear wheel pump end Journal Bearing Clearance	-	-	0.25
4	Gear wheel free end side Journal Bearing Clearance	-	-	0.23
5	Gear wheel pump side Journal Bearing side Clearance	-	-	0.10-0.15
6	Gear wheel free end side Journal Bearing side Clearance	-	-	0.10-0.15
7	Gear wheel pump side Journal Bearing Interference	-	-	0.02
8	Gear wheel free end side Journal Bearing Interference	-	-	0.02
9	Pinion wheel free end Journal bearing clearance	-	-	0.23
10	Pinion wheel turbine end Journal bearing clearance	-	-	0.25
11	Pinion wheel free end Journal bearing side clearance	-	-	0.10
12	Pinion wheel turbine end Journal bearing side clearance	-	-	0.15
13	Pinion wheel free end journal bearing interference	-	-	0.03
14	Pinion wheel turbine end journal bearing interference	-	-	0.03

COOLING WATER PUMP, P-4403:

Following activities were carried out during PM

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, cleaned, checked & found OK.
- Bearing clearances were checked & recorded, in mm.



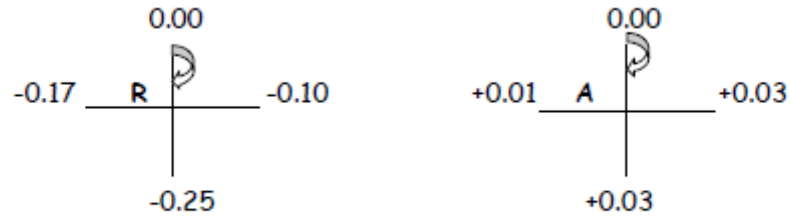
TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

- Total float of the pump was measured as = **0.75/0.80** mm
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint,mm
1	Total Float	-	-	0.75-0.80
2	Coupling end Journal Bearing Clearance	0.20-0.21	-	0.26
3	Free End Journal Bearing Clearance	0.23-0.24	-	0.26
4	Coupling end Journal Bearing side Clearance	-	-	0.15-0.25
5	Free end Journal Bearing side Clearance	-	-	0.15
6	Coupling end Journal Bearing Interference	-	-	0.04
7	Free end Journal Bearing Interference	-	-	0.03-0.04

- Alignment readings are as under
After Preventive Maint.

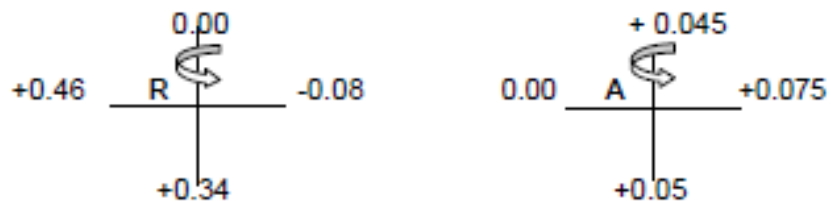


BFW PUMP TURBINE (Q – 5111):

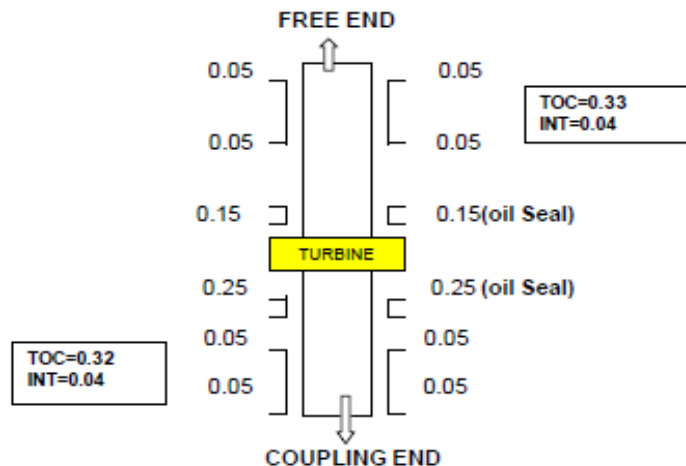
Activities carried out are:-

- Coupling float of Turbine to Pump is measured which was observed 10.00 mm.
- Coupling between Turbine to pump is decoupled.
- Before Preventive maintenance of the Q5111 Turbine to pump Alignment was checked.

Dial on Turbine}



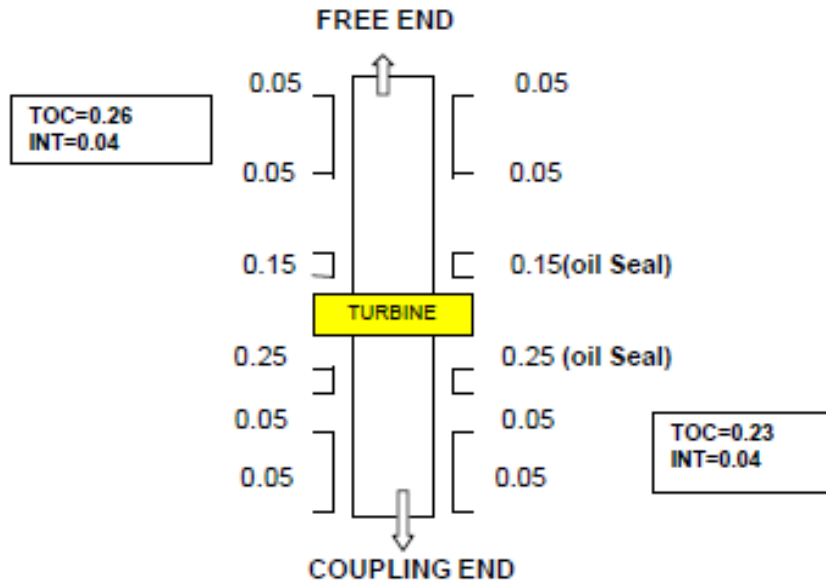
- Turbine both ends bearings were opened cleaned properly and clearances were measured using lead wire.
- Clearances of Turbine Bearings were checked and found on higher side i.e 0.33 MM and 0.32 MM at free end and coupling end respectively. (As Shown in fig.)



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

- As the clearances of bearings were on higher side, both ends bearings were replaced. (Item Code NDE Bearing: 142110203400, DE Bearing: 142110203410)
- Clearances of Turbine Bearings were again checked after replacement of bearings and recorded.



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

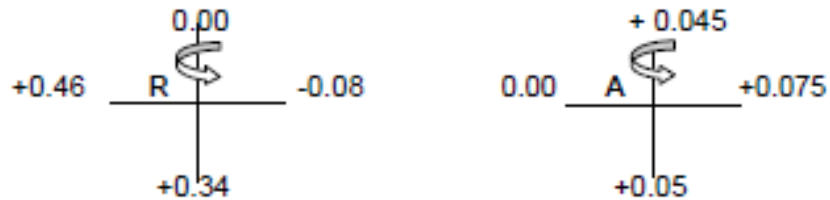
- Turbine Thrust float is measured and observed as **0.18/0.19 MM**
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Coupling Float	-	10.0	10.0
1	Thrust Float	0.2-0.4	-	0.18-0.19
2	Coupling end Journal Bearing Clearance	0.12-0.17	0.32	0.23
3	Free End Journal Bearing Clearance	0.12-0.17	0.33	0.26
4	Coupling end Journal Bearing side Clearance	-	0.05	0.05
5	Free end Journal Bearing side Clearance	-	0.05	0.05
6	Coupling end Journal Bearing Interference	-	0.04	0.04
7	Free end Journal Bearing Interference	-	0.04	0.04

- Alignment Readings:

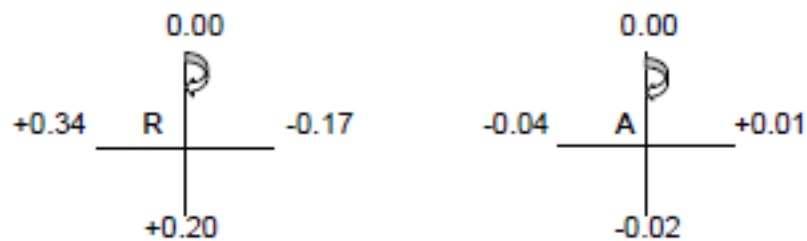
Before Preventive Maint:

{Dial on Turbine}



After Preventive Maint:

{Dial on Turbine}

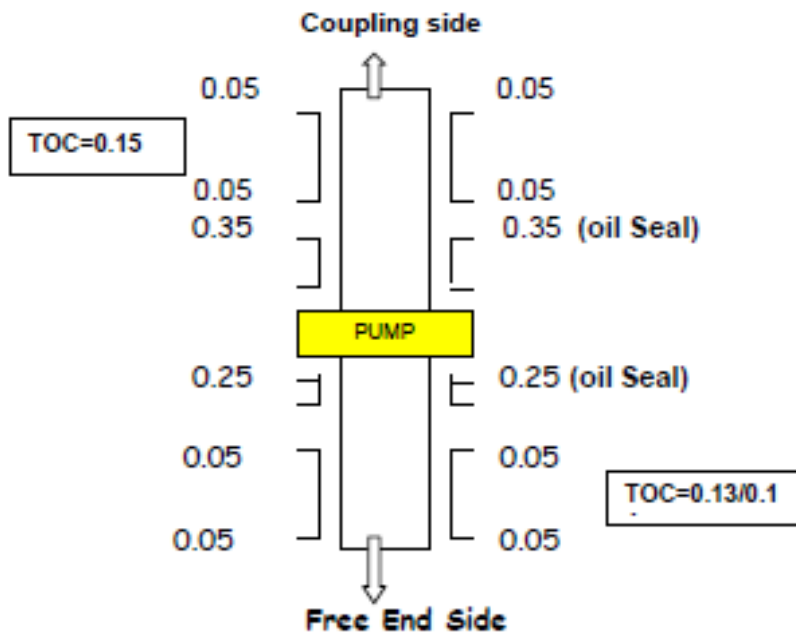


- Governor was cleaned and flushed with the oil.
- Oil filters cleaned and box up
- Oil cooler was opened & box up after hydro jetting.
- Oil from the oil sump was completely drained, cleaned properly and charged with the fresh oil. (Servo Prime-68)

BFW PUMP (P- 5111):

Activities carried out are:

- Coupling float of Turbine to pump is 10.0 mm
- Alignment between turbine to pump was checked and recorded:
- Bearings of pump was opened, cleaned, checked and found ok.
- After re assembling the bearings, clearances were measured.



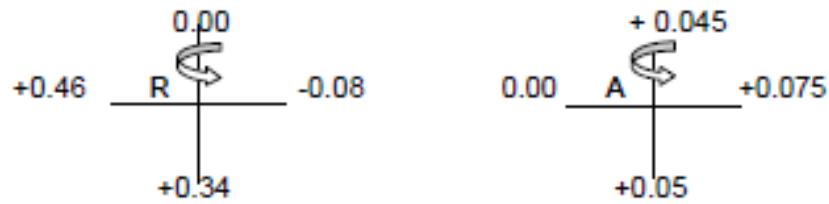
TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing.

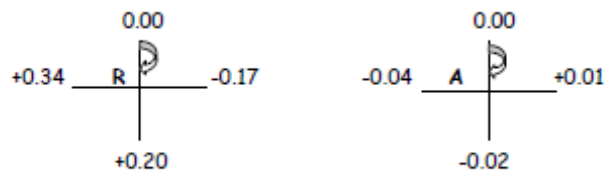
- After preventive maintenance, alignment readings between pump and turbine were again checked.
- Thrust float of the pump was recorded as **0.40** mm
- Pump free float was recorded as **6.58** mm
- “O” ring was replaced in oil sump top cover connected pipe line
- Oil filters were opened, cleaned and boxed up.
- Oil sump was cleaned and charged with fresh oil.
- All connected oil pipe lines were also cleaned and checked.
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Coupling Float (Turbine to Pump)	-		10.0
2	Thrust Float	0.28-0.33	-	0.40
3	Coupling end Journal Bearing Clearance	0.13-0.18		0.15
4	Free End Journal Bearing Clearance	0.13-0.18		0.13
5	Coupling end Journal Bearing side Clearance	-		0.05
6	Free end Journal Bearing side Clearance	-		0.05

- Alignment Readings are as under:
Before Preventive Maint.



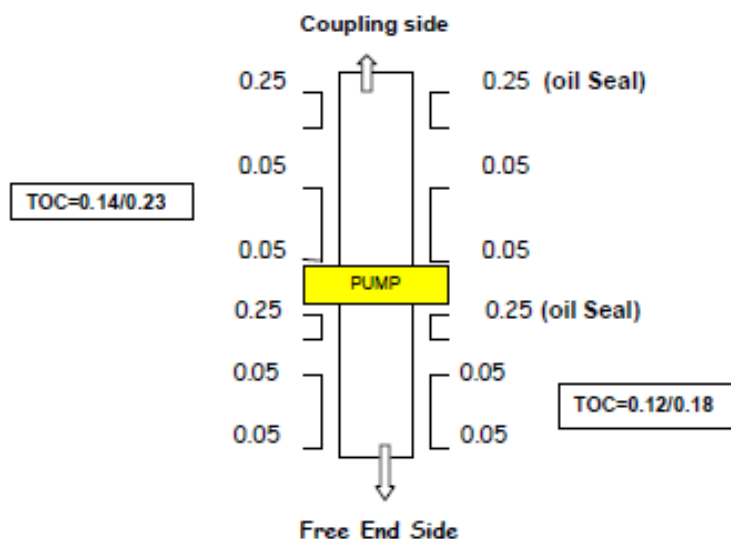
After preventive Maint:



BFW PUMP MOTOR DRIVEN (P-5112):-

Activities carried out are:

- Before decouple, coupling float of motor to gear box coupling was measured and recorded as 6.70mm
- Before decouple, coupling float of Pump to gear box coupling was measured and recorded as 8.67/8.68 mm.
- Motor and Pump was decoupled.
- Pump bearings were opened, cleaned, checked and found OK.
- Bearing clearances of Pump was measured and readings are as under:



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

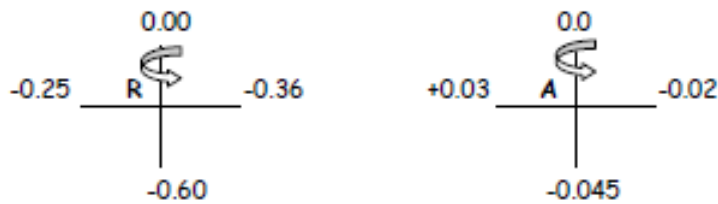
- Motor to gearbox Alignment readings were checked.

{Dial on gear box}



- Pump to gear box alignment readings were also checked.

{Dial on gear box}



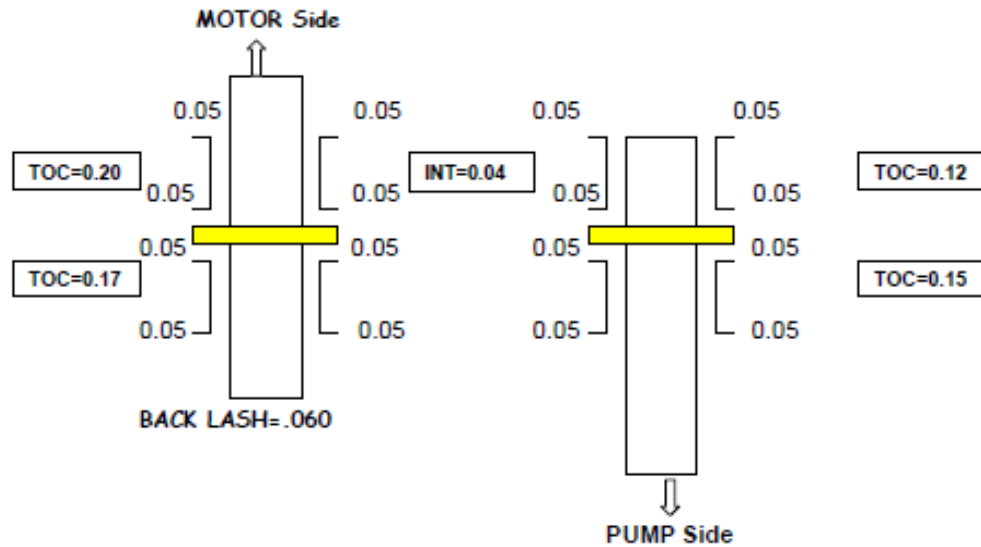
- Thrust float of the pump was measured and recorded as **0.36** mm
- Pump free float was measured as **5.98** mm
- “O” ring was replaced in oil sump top cover connected pipe line.
- While opening the top bearing housing of free end of the pump, lot of rust deposited in thrust as well as journal bearings were observed.
- Oil cooler was opened, cleaned, hydro test and then boxed up.
- Pump suction strainer opened, cleaned and boxed up.
- Oil sump was cleaned and charged with fresh Servo Prime-68 oil.
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Coupling Float (Motor to GB)	-	-	6.70
2	Coupling Float (GB to Pump)	-	-	8.67/8.68
3	Thrust Float	0.28-0.33	-	0.36
4	Coupling end Journal Bearing Clearance	0.13-0.18	-	0.14/0.23
5	Free End Journal Bearing Clearance	0.13-0.18	-	0.12/0.18
6	Coupling end Journal Bearing side Clearance	-	-	0.05
7	Free end Journal Bearing side Clearance	-	-	0.05

GEAR BOX FOR MOTOR DRIVEN BFW PUMP (P-5112):-

Activities carried out are:

- Gear box bearings were opened, cleaned, checked..
- Bearing clearances of Gear Box were checked and clearances of High speed pinion bearings were observed on higher side.
- High speed pinion bearings of both sides of gearbox were replaced due to more clearance. (NDE Side: 0.23 mm, DE Side: 0.24 mm)



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

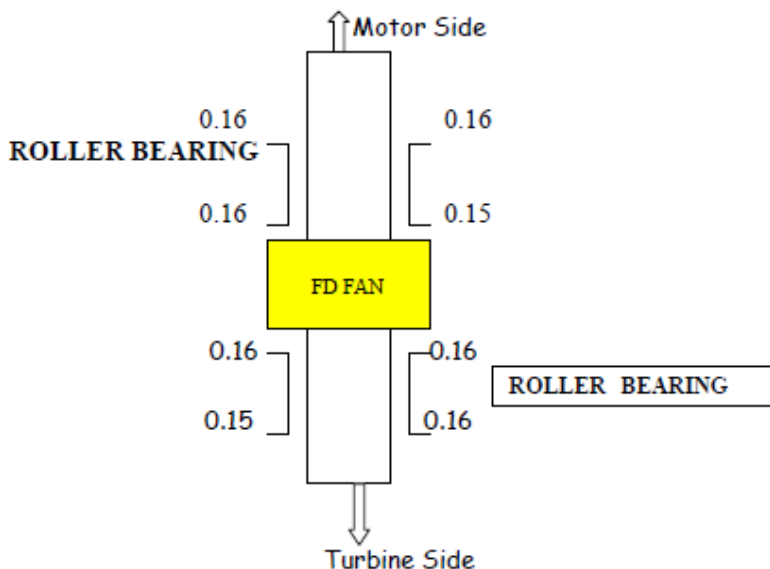
- Gear box Bearings end covers “O” rings are replaced(04 Nos)
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Gear wheel Motor end Journal Bearing Clearance	-	-	0.20
2	Gear wheel free end Journal Bearing Clearance	-	-	0.17
3	Gear wheel Motor end Journal Bearing side Clearance	-	-	0.05
4	Gear wheel free end Journal Bearing side Clearance	-	-	0.05
5	Pinion wheel free end Journal bearing clearance	-	0.23	0.12
6	Pinion wheel Pump end Journal bearing clearance	-	0.24	0.15
7	Pinion wheel free end Journal bearing side clearance	-	-	0.05
8	Pinion wheel Pump end Journal bearing side clearance	-	-	0.05
9	Backlash	-	-	0.60

F.D FAN (K-5113):

Activities carried out are:

- Before Preventive maintenance of FD fan clutch to Motor Alignment readings were checked.
- FD fan bearing pedestal top half was removed.
- Both sides of roller bearings were cleaned, checked and found ok.
- Bearing Clearances of FD Fan are checked with Feeler gauge.



- On turbine side roller bearing pedestal end cover hair crack was observed which was sealed with M-seal.
- Bearing Clearance Chart is as under:

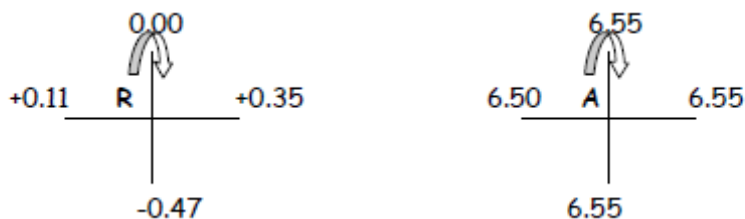
Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Motor side roller bearing clearance	-	-	0.15/0.16
2	Turbine side roller bearing clearance	-	-	0.15/0.16

- Alignment readings are as under:

FD Fan to Motor Side Clutch

After PM:

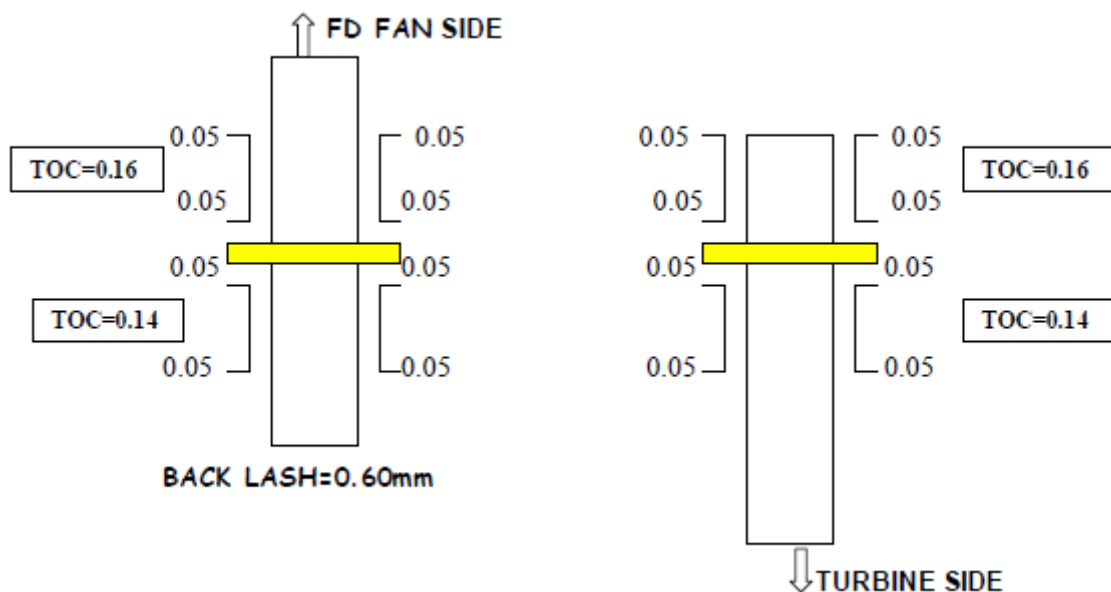
{Dial on Motor shaft}



FD FAN TURBINE WITH GEARBOX (Q-5113):

Activities carried out are:-

- Oil was drained from gear box.
- Gear box top cover was opened.
- Gear box bearings were opened one by one, checked, cleaned and found OK.
- Bearing clearances of Gear Box was checked.



TOC : Top Oil Clearance (Bearing Diametrical Clearance)

INT : Interference between bearing and housing

- While overhauling Emergency trip device lever was broken which was replaced with new one (Item Code: 142130558800)
- Two nos. of damaged parting plane bolts were changed.
- MOP of turbine was removed, cleaned and again boxed up.
- Main oil pump coupling sleeve (Fig. No 290, Part No. : 290 00.17) was changed. (Item No. 142130315800)
- Oil console and all connected oil pipelines were removed, cleaned and then boxed up.
- Oil cooler was opened; hydrojet cleaned and then boxed up.
- Fresh oil SERVO PRIME 68 was charged in oil console.
- Final Clearance chart is as under:

Sr. No.	Description	Design Value (mm)	Value before Prev.Maint	Value after Prev.Maint
1	Gear wheel Fan end Journal Bearing Clearance	-	-	0.16
2	Gear wheel free end Journal Bearing Clearance	-	-	0.14
3	Gear wheel Fan end Journal Bearing side Clearance	-	-	0.05
4	Gear wheel free end Journal Bearing side Clearance	-	-	0.05
5	Pinion wheel free end Journal bearing clearance	-	-	0.16
6	Pinion wheel Turbine end Journal bearing clearance	-	-	0.14
7	Pinion wheel free end Journal bearing side clearance	-	-	0.05
8	Pinion wheel Turbine end Journal bearing side clearance	-	-	0.05
9	Backlash	-	-	0.60

BHEL BOILER JOBS (F-5111):

RLA STUDY:

Remnant Life Assessment (RLA) Study of the boiler was due in Year 2010 as per the IBR regulations. For the RLA study of the boiler W.O No. 20091313 dated 08/03/2010 was placed on M/S Alstom Projects India Ltd.

For the cutting and welding of Tube samples required for the RLA Study W.O No. 20091133, dated 21/01/2010 was placed on M/s Shree Ganesh Engg. Company.

Technical details of our Boiler and its pressure parts are given as:

TECHNICAL DETAILS OF BHEL BOILER:

1.1	Boiler Registration No.	GT 2068 CIB Gujarat.
1.2	Make	M/s BHEL Tiruchirapalli
1.3	Type	27 VP 20 W , Bi - drum
1.4	Year of commissioning	1982
1.5	Fuels Fired	RLNG
1.6	Capacity	80 Ton / Hr
1.7	Maximum permissible working pressure	61.5 kg/Cm ²
1.8	Maximum working temperature	410 °C + / - 5 °C
1.9	Quantity	01 No

DETAILS OF TUBES:

Sr. No	Location	No. of Tubes	Size of Tubes (In MM)	Material
2.1	Furnace 'D' tube	71	76.1 OD X 4.5 Thk.	SA 192
2.2	Furnace corner tube	33	76.1 OD X 4.5 Thk	SA 192
2.3	Furnace rear tube	16	76.1 OD X 4.5 Thk.	SA 192
2.4	Baffle wall tube	90	76.1 OD X 4.5 Thk.	SA 192
2.5	Boiler side wall tubes	66	76.1 OD X 4.5 Thk.	SA 192
2.6	Boiler shield wall tubes	34	76.1 OD X 3.2 Thk	SA 192
2.7	Boiler shield wall tubes	4	51.0 OD X 4.0 Thk	SA 192
2.8	Boiler bank tubes	72 1120	51.0 OD X 4.0 Thk 63.5 OD X 3.2 Thk	SA 192
2.9	Furnace tubes	3	76.1 OD X 4.5 Thk.	SA 192

DETAILS OF BOILER DRUM:

	Steam Drum	Water Drum
Quantity	One	One
Inside diameter (MM)	1371	914
Thickness, (MM)	97	78
Material	SA 299	SA 299

DETAILS OF SUPERHEATER HEADERS:

	Primary Inlet SH Header	Primary Outlet SH Header	De-Superheater Header	Secondary Inlet SH Header	Secondary Outlet SH Header
Quantity	One	One	One	One	One
OD (MM)	273	273	273	273	273
Thickness (MM)	25	32	32	25	25
Material	SA 106 Gr.C	SA 335, P22	SA 335, P22	SA 106 Gr.C	SA 106 Gr.C

SUPER HEATER COILS:

	Primary Super Heater Coils	Secondary Super Heater Coils
Quantity	36	34
Outside Diameter (MM)	51	51
Thickness (MM)	7.1	5.6
Material	SA 213 T 22	SA213T22

FEED PIPE LINE:

- Outside Diameter (MM): 159
- Thickness (MM) : 10
- Material : SA 106 Gr.B

MAIN STEAM LINE:

- Outside Diameter (MM): 273
- Thickness (MM) : 25
- Material :SA 106 Gr.B

SUPER HEATER CONNECTING PIPES:

- Outside Diameter (MM) : 159 & 219
- Thickness (MM) : 10 & 14.2
- Material : SA 106 Gr.B

WATER WALL TOP HEADERS

- Outside Diameter (MM): 219
- Thickness (MM) : 25
- Material : SA 106 Gr.B

RLA Plan:

After technical discussion and pre-outage meeting with the Party & instruction from the Boiler inspector final RLA Plan was finalized which is given below:

SCOPE OF WORK FOR BOILER UNIT # GT-2068, IFFCO, KALOL											
Tests	VT	MPT	UT	IMT	DA	HM	UTM	DM	DPT	FOI	DT
Components	1	2	3	4	5	6	7	8	9	10	11
Feed water pipe line	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	No
Steam Drum & Water Drum	Yes	Yes WJ	Yes WJ	Yes	Yes	Yes	Yes	Yes	Stub WJ	No	No
Furnace Bottom and Top headers	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No
Furnace WW	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes
Boiler bank tubes	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes
Main steam pipe	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No

LEGENDS

VT	-	VISUAL INSPECTION
MPT	-	MAGNETIC PARTICLE TEST WITH WHITE BACKGROUND PAINT
UT	-	ULTRASONIC TEST ON WELDS-ULTRASONIC SHEAR WAVE
IMT	-	INSITU METALLOGRAPHY TESTING - ABOUT 50-60 REPLICAS
DA	-	DEPOSIT ANALYSIS
HM	-	HARDNESS MEASUREMENT (EQUOTIP)
UTM	-	ULTRASONIC THICKNESS MEASUREMENT
DM	-	DIMENSIONAL MEASUREMENT AND IN CASE OF HEADERS OD, SWELL MEASUREMENT
DPT	-	DYE-PENETRANT TEST
FOI	-	FIBRE OPTICS INSPECTION
DT	-	DESTRUCTIVE TESTING OF SELECT SAMPLES(C/S MICRO, Deposit, Chemical, TS, YS, Elong., Hardness) Tentative 18 sample tubes
IOS	-	INSITU OXIDE SCALE THICKNESS MEASUREMENT

Details of Tube Sampling:

Tube samples are taken from the following locations for the destructive testing:

Sr. No.	Tube Description	Tube Size	MOC	Location
1	Front Wall Tube	76.1 MM OD X 4.5 MM Thick	SA 192	3 rd tube from South to North
2	Cut Corner Wall Tube	76.1 MM OD X 4.5 MM Thick	SA 192	3 rd tube from South to North
3	Rear Wall Tube	76.1 MM OD X 4.5 MM Thick	SA 192	3 rd tube from South to North
4	Baffle Wall Tube	76.1 MM OD X 4.5 MM Thick	SA 192	5 th tube from South to North
5	Bank Tube	63.5 MM OD X 3.2 MM Thick	SA 192	6 th tube from North to side in first row from rear side

Preliminary Report of RLA Study:

Party has conducted all the required tests at our site and after completion of RLA study preliminary report was submitted. Key observation and findings of the preliminary report is given below:

Sr. No	Component	Test Performed	Findings	Recommendations	Action taken
1	Steam Drum	Visual, UT, MPI, DPT, dimension & Thickness measurement, deposit collection, replica and hardness.	Corrosion observed on outer surface.	Accepted for future use	
2	Water Drum	Visual, UT, MPI, DPT, dimension & thickness measurement, deposit collection, replica and hardness.	No abnormality observed	Accepted for future use	
3	Furnace wall tubes (front, rear, 'D' wall, cut corner and baffle wall)	Visual, thickness measurement, tube sampling. Fiber optic inspection (selected location) and replica on 'D' tube.	Thickness was observed as 3.9 mm on front wall tube no.29 (counting from left to right) design thk 4.5 mm. Small depression was observed on 'D' wall roof tube no.66, counting from front to rear. DPT carried out and found satisfactory. Minor deposit present in D tubes ID surface.	Accepted for future use	
4	Water wall headers	Visual, DPT, MPI, dimension & thickness measurement, Fiber optic inspection and hardness.	No abnormality observed	Accepted for future use	
5	Water wall tubes (side wall and shield wall tubes)	Visual, thickness measurement (accessible locations), and replica (shield wall). Fiber optic inspection on shield wall tubes (selected locations)	No abnormality observed	Accepted for future use	
6	Boiler bank tubes	Visual, dimension & thickness measurement (accessible locations), Fiber optic inspection and tube sampling.	No abnormality observed	Accepted for future use	

7	Main steam pipe line	Visual, dimension & thickness measurement, replica and hardness measurement.	No abnormality observed	Accepted for future use	
8	Feed water pipe line after isolation valve	Visual, dimension & thickness measurement, DPT, MPI and hardness measurement.	No abnormality observed	Accepted for future use	
9	Super heater connecting pipes	Visual, dimension & thickness measurement, DPT, MPI and hardness measurement.	No abnormality observed	Accepted for future use	
10	Riser pipes	Visual, thickness measurement and Fiber optic inspection	Small dent was observed on FFP-1 riser pipe no.1 (Counting from left to right) DPT carried out and found satisfactory. Minor deposit present	Accepted for future use	

Some photographs of RLA Study job are given below:



DPT on Top Front Header Stub joints



Top Rear Header & Riser Tubes



Location of tube sample in



Location of tube sample in

Rear wall



Dent mark observed in D-Panel Roof Tubes

Baffle Wall



DPT at Dent mark



Riser Tubes



Riser Tubes



Thickness measurement in Saturated Steam line



Main Steam line



Replica location in Main Steam line



Replica location in main steam
Near Co2 compressor floor



Mud Drum



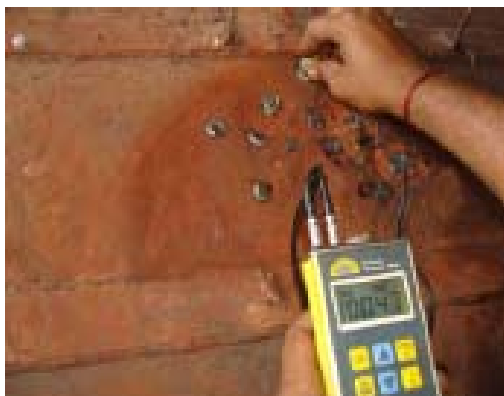
Inside micrometer for Drum ID
Measurement



MPI in Steam Drum Dish End
Circumferential seam



Corrosion spot on Steam Drum



Thickness measurement at corrosion



Feed water line

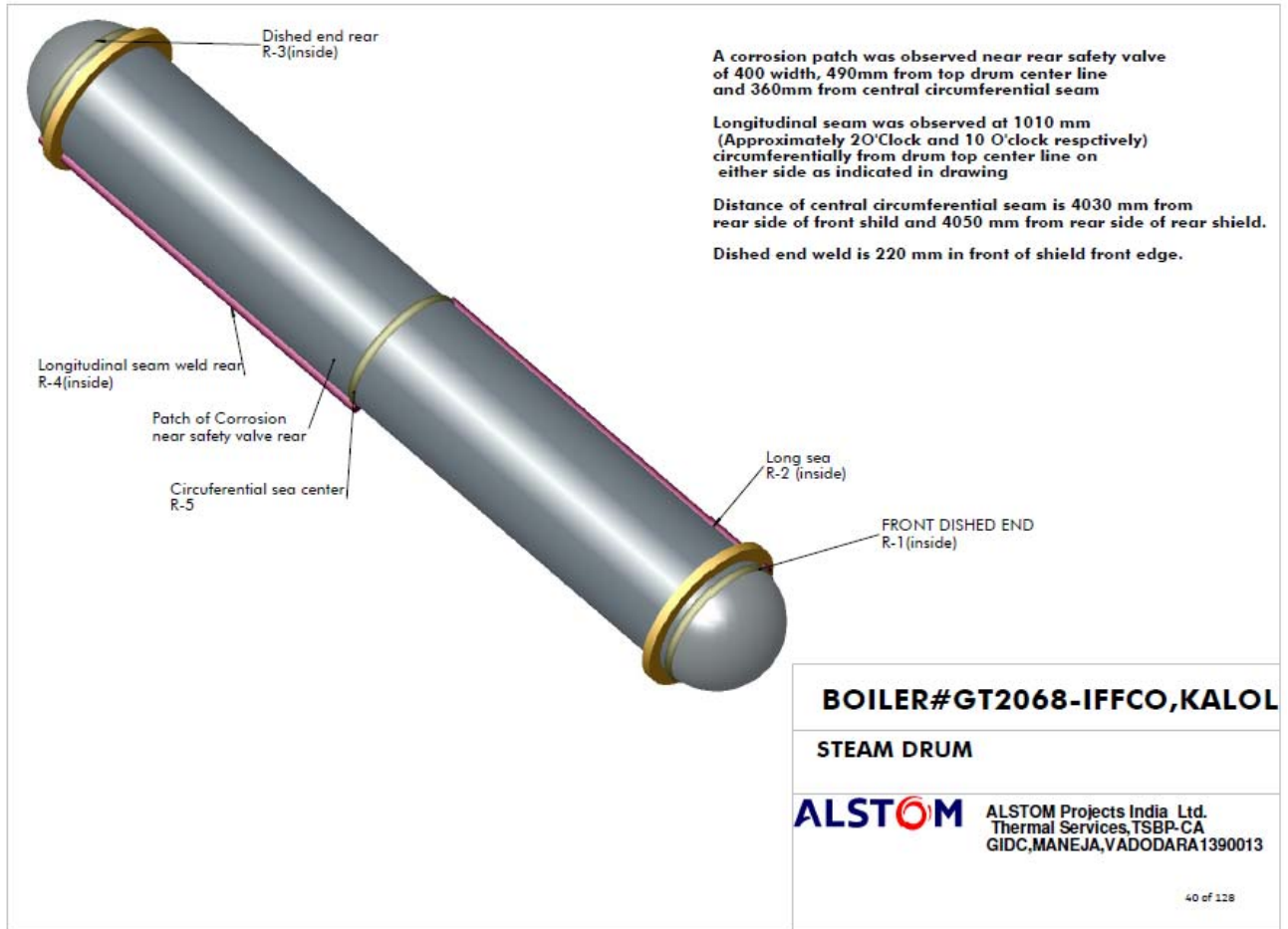
Spot on Steam Drum



DPT of Feed water line attachment welds



Tube samples cut from various locations for destructive testing



Sketch showing welding seam locations on steam drum

BHEL BOILER INSPECTION:

- Boiler was inspected by Boiler Inspector in open condition on 26.03.2010 & Hydrotest was carried out at 89.0 kg/cm² pressure on 01.04.2010 and witnessed by Boiler Inspector.
- RV's were overhauled by M/s EFCO MASCHINENBAU INDIA PVT. LTD against WO No. 20091033 dated 02/01/2010. The nozzle seats of all three safety relief valves were in-situ hand lapped & then assembled. The RVs were floated on and their readings were as follows:

Description	Popping Pressure Kg/cm ² g	Reset Pressure Kg/cm ² g
Drum Rear R.V.	71.76	69.33
Drum Front R.V.	69.41	66.03
Super Heater R.V.	65.25	62.20

- Steam drum connected all first and second isolation valves gland packing were repacked. M/s Amrutha Engineering was engaged for valve gland repacking job. (Ref: WO No 20090923 dated 05/12/2009).
- All 4 nos. inspection window glasses were checked, Cleaned & replaced the gasket of all glasses.

- All dampers of air duct (FD Fan Inlet & Outlet damper, RAH Inlet, Outlet & Bypass damper) were checked and made free by greasing for smooth operation. RAH outlet south side (boiler side) top bearing replaced.
- P.M. of LRB-1 & LRB-2 was done. Gland Packing of both LRB were replaced and Gear box oil flushed & new oil charged.
- P.M. of RB-3, RB-4, RB-5 & RB-6 was done. Gland packing was replaced and Gear box oil flushed & new oil charged.

RE-GENERATIVE AIR HEATER H-5111:

- General condition of Cold End & Hot End baskets was found OK.
- Hot End & Cold End side circumferential seals and radial seals were checked and no damage found.
- Both End Rotor Bearings (Self-aligning Spherical Roller Bearing 22330 CCK/C3 W 33 with Adapter sleeve H 2330 T) housing were opened for inspection. Hot End side Oil seal found damaged, condition of both end bearings were found OK. So it was boxed-up after replacement of Hot End side Oil seal (125 X 95mm) and fresh oil (Servo Prime C 100, 8 liters approx.) charged.
- RAH Drive unit (Electric motor with Gear Box & sprocket) was replaced by Re conditioned gearbox lying in stores. (Code : 141110925100)
- Bearings Clearances were checked by feeler gauge and their readings were as follows:

Sr. No.	Description	Actual Value (Inch)
1	Hot end bearing	0.008"
2	Cold end bearing	0.009"

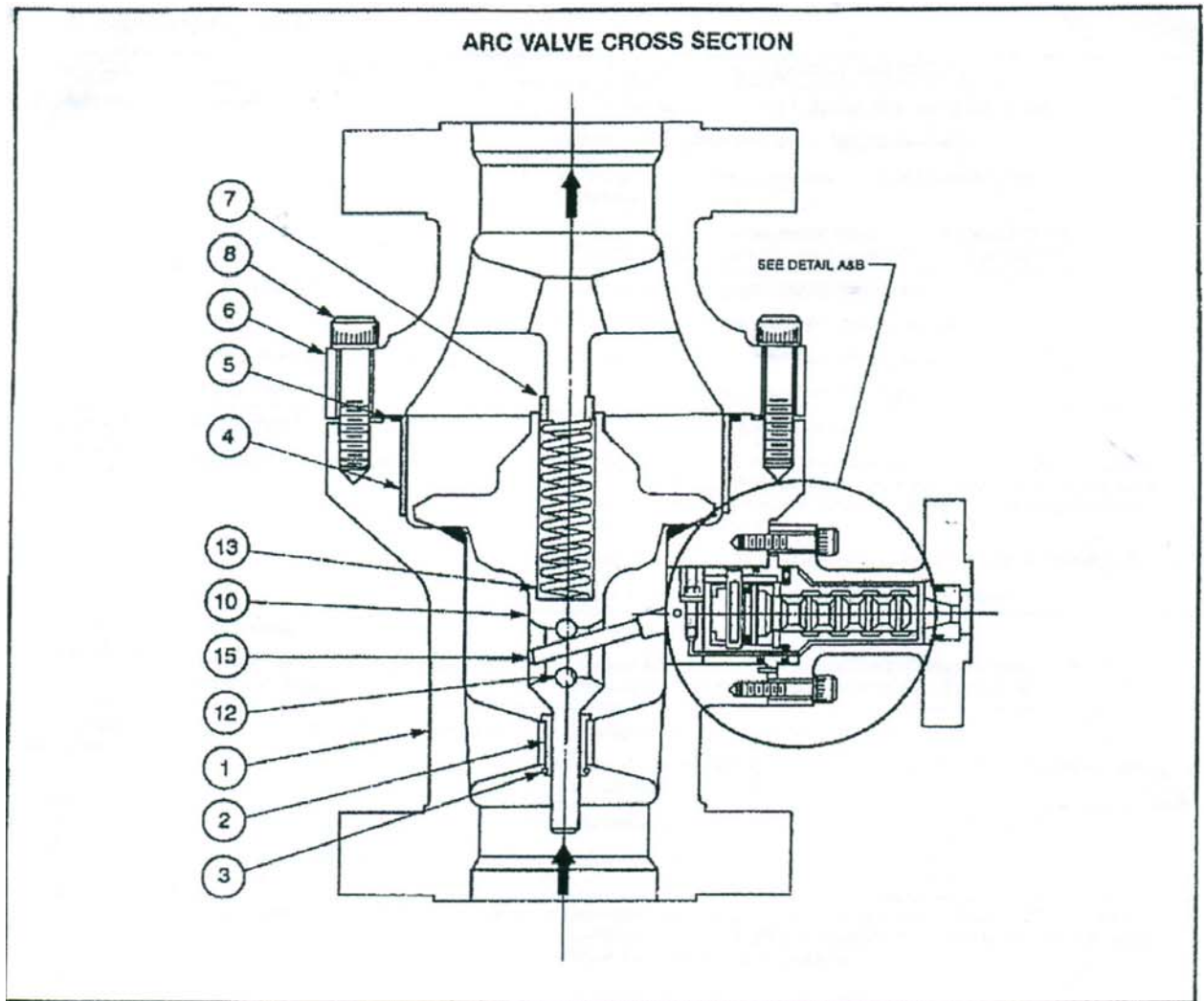
- Overhauling of RAH Air Motor done, oil seal replaced. Air Motor Clutch oil flushed & new oil charged.
- Steam nozzle for swivel type soot blower of RAH unit was cleaned and gear box oil replaced.

OVERHAULING OF ARV OF P-5111:

For feeding the boiler feed water two pumps are installed in our plant, one is turbine driven and other one is Motor driven. During normal plant operation, turbine driven pump is in operation. During scheduled changeover of the pump from turbine driven to motor driven and then back to operation of turbine driven pump, difference in pressure and flow was observed which may be due to malfunctioning of the Automatic recirculation valve. So it was decided to check the ARV during Annual turnaround.

Automatic re-circulation (ARC) valve installed in the discharge line of P-5111 was dropped down for the overhauling. On dismantling the ARC valve, threads of the nut of Pilot valve was found damaged due to which position of the adjusting nut was disturbed. Lever and pin of the ARC was also found damaged. Adjusting nut was manufactured in our workshop. Damaged parts are changed with new ones and ARC was again assembled and adjusting nut setting was kept as 2.62 mm while kept pilot valve under compression against its seat. Position of the adjusting nut was shown in the below attached fig.

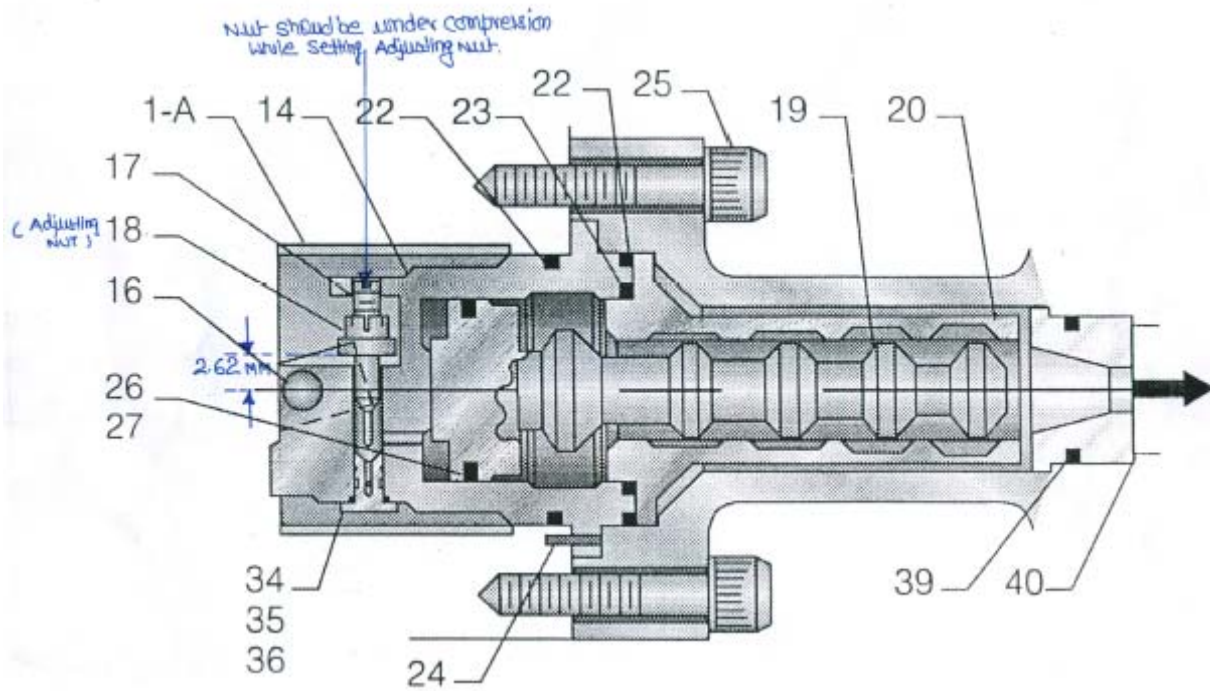
Cross section and details of the parts is shown in the given fig.



ARC VALVE PARTS LIST

Item	Name of Part	Material	Item	Name of Part	Material
1	Body	Cast Steel	19	Cascade Piston	Stainless Steel
2	Body Bushing	Stainless Steel	20	Cascade Seat Bushing	Stainless Steel
3	Retaining Ring	Stainless Steel	21 Δ	Piston Guide Pin	Stainless Steel
4	Liner	Stainless Steel	\rightarrow 22 \circ	O-Ring	Elastomer
5	O-Ring	Elastomer	\rightarrow 22A \circ	O-Ring	Elastomer
6	Bonnet	Cast Steel	23	O-Ring	Elastomer
7	Guide Ring	Stainless Steel	24	Guide Pin	Stainless Steel
8	Cap Screw	Alloy Steel	25	Cap Screw	Alloy Steel
9	Bypass Body	Cast Steel	26	Seal Ring	Teflon
10	Disc	Cast Steel	27	O-Ring	Elastomer
12	Disc Pins	Stainless Steel	28	O-Ring	Elastomer
13	Spring	Stainless Steel	29	Bypass Orifice	Stainless Steel
14	Control Head	Stainless Steel	30	O-Ring	Elastomer
15	Lever	Stainless Steel	34 \square	Pilot Valve Seat	Stainless Steel
16	Pivot Pin	Stainless Steel	35 \square	O-Ring	Elastomer
17	Pilot Valve	Stainless Steel	36 \square	O-Ring	Elastomer
18	Pilot Valve Nut	Stainless Steel			

- Δ Not used on Valves with 6000 Series Serial Numbers.
- \square Used only on Valves with 6000 Series Serial Numbers.
- \circ 4" and 6" Valves require one 22 and one 22A.
- 3", 8" and larger Valves require two 22 (22A replaced by 22).



Following components of ARV were replaced.

Sr. No.	Item Description	Quantity	Store Code
1	"O" RING ITEM NO 5, DRAWING NO 044399-5331 REV A	01 No	1431111395B0
2	RE CIRCULATION VALVE PILOT VALVE 951904	01 No	143111140400
3	RE CIRCULATION VALVE LEVER	01 No	143111134800
4	TRIM SET OF ITEM NO 19,20,26 & 27 OF DRAWING NO 044399-5331 REV-A	01 Set	143111158510
5	RE CIRCULATION VALVE SEAL RING	01 No	143111148400
6	"O" RING ITEM NO 22, DRAWING NO 044399-5331 REV A ,	01 No	143111139560
7	"O" RING ITEM NO 28, DRAWING NO 044399-5331 REV A	01 No	143111139590

COOLING TOWER AREA JOBS:

- Removed 6 nos. Rubber Expansion Bellows from 42” Dia. Cooling Water Supply / Return line & replaced by 42” diameter spool pieces as per the Flexibility analysis study report.
- Cooling Water Pump P-4401-B discharge line bellow (Size: 24” Dia.) replaced. (Store Code: 139040104510).
- The cooling tower distribution valves were attended for smooth operation and replaced one valve of Ammonia Cooling Tower Cell H-4401-4 (Admn. side).

DM PLANT JOB:

The Man hole of Degasser tower sump was opened for cleaning & inspection. Degasser sump was found OK and then boxed up with new gasket..

RELIEF VALVE OVERHAULING & TESTING:

The following Relief valves were removed, overhauled & tested with nitrogen medium on valve test bench. The services of M/s FLOTEC ENGINEERING SERVICES (Ref. WO No. 20090973 dated 21/12/2009) were taken for overhauling of Relief valves.

Sr. No.	RV Tag No.	Description	Size	Set Pressure Kg/cm2	Reset Pressure Kg/cm2
1	RV-Q-5113	F.D. Fan Turbine Exhaust R.V.	3" X 4"	4.5	4.0
2	RV-Soot Blower	Soot Blower R.V.	1½"	42.5	38.0
3	RV-Q-5111	BFW Pump Turbine Exhaust R.V.	4" X 6"	5.0	4.5
4	RV-40 ata	40 ata Header R.V.	4" X 6"	44.0	40.0
5	RV-V-5111	De-aerator R.V.	5" X 8"	4.1	3.6
6	RV- CBD Drum	CBD Drum	1½"	6.0	-

STEAM LEAK & FABRICATION JOBS:

- De-aerator top & sump side manhole opened for internal inspection. De-aerator trays were found in damaged condition. Bottom two trays were replaced with new one & then boxed up. Manhole Gasket size: 20" X 150# - 2 nos.

Sr. No	Item Description	Quantity	Code No.
1	BIG TRAY SS304L 1140 X 410 X 3 MM PT-1	05 Nos	145050158400
2	SMALL TRAY SS304L 1140 X 224.5 X 3MM PT-2	02	145050158410

- Simplified Cooling Water Supply / Return lines of steam sample coolers & replaced corroded water collecting tray of sample coolers.
- Patch Ring welded on C.W. Pump P-4401-C Discharge lines
- SS 304 Pad welding on Cooling Water Supply & Return lines of Hogging Ejector & Surface Condenser emerging from ground level.
- Replaced level gauge (water side) 1st I/V of IBD tank.
- Replaced corroded tapping & removed unwanted tapping from Cooling Water Pump P-4401-C discharge line.
- Replaced all steam traps which were not working.
- Provided nozzles for PI & TI tapping on DM water line going to BHEL Boiler de-aerator.
- Removed 14 ata attemperator lines.
- Isolation valves are provided in synthesis gas cooling line of both synthesis gas burners.
- Isolation valve is provided air filter in between IG/Air/4 ata steam line.

PAINTING JOBS:

Painting of BHEL Boiler House Pipelines & Structure was carried out by M/s. Vaidehi & Company.

B&MH PLANT

RECLAIM MACHINE M -2116 :

Reclaim machine was taken for Preventive maintenance / overhauling. Overhauling was carried out under the supervision of M/s EMTICI, V.V. Nagar against IFFCO W.O.No. 20091072 dt.02/02/2010.

The following major jobs were carried out during shutdown.

Overhauling of scraper Mechanism:

The following activities were carried out after thorough inspection of complete scraper chain assembly

- Dismantled the Scraper shaft assembly from its position and found small and big bearing housing, sleeves, sprockets and shaft in good condition.
- UT of Scraper shaft carried out. Shaft run out is 0.02 mm.
- Checking of the scrapper chain, pin, washer and circlips done and replaced damaged spares.
- Assembly of the scrapers blades & proper tightening and tack welding of nuts to avoid looseness during running.
- Chain was tightened and required tension was given by adjusting the Tensioning device.

Gear Train Assembly:

Following jobs were carried out in Gear train assembly

- Complete overhauling of Gear train assembly carried out
- Opened the gear train cover plate, removed Idler Gears and Gear wheels. Found one idler Gear teeth broken, Idler Pin found in good condition.
- Installed Ingico make Gear -2Nos. and Idler -1 No. One no. idler gear of M/s Elecon supply was installed due to backlash limitation with Ingico pinion.

Main Drive gear box:

The following activities were carried out

- Preventive maintenance of GB done .Opened the Gear box top casing, checked the bearings, and inspected the gear teeth. Condition was found satisfactory.
- Replaced Input and output shaft oil seals
- Duplex chain found damaged, replaced it.
- Checked the Bearings of FC-20 coupling output shaft, found in good condition.
- Align the gear box with motor & coupled with new Coupling bushes.
- Fluid coupling checked, found in good condition. Replaced the oil of fluid coupling.

Overhauling of Bucket Elevator Mechanism:

The following activities were carried out:

- Checked all the Buckets, pins, washers and circlips. Replaced damaged items.
- Cleaning and painting of all the buckets done.
- UT of Bucket shaft carried out.
- Checked the Bucket elevator (Top) shaft with end bearings, adopter sleeve and seals as a preventive maintenance requirement. Condition of shaft was satisfactory.
- Take-up unit was over hauled.
- Checking & lubrication of bearings, shaft & sprockets was carried out.

Traveling Gear box

The following activities were carried out

- Preventive maintenance Of Gear box done, replaced oil seal of input shaft, lubricating oil.
- Coupled with motor after checking alignment.
- Replaced coupling bushes.
- Chain & chain sprocket cleaned and checked, found in good condition.

Slewing Gear box

The following activities were carried out

- Preventive maintenance Of Gearbox done.
- Grease pack arrangement for output shaft with two nos. of oil seals was made in consultation with Elecon engineers to prevent oil leakage.
- Coupled the gear box after proper alignment with motor.
- Replaced coupling bushes.
- Checked output shaft pedestal bearing block, bearing, sleeve, washer, lock nut & found ok.
- Increase root gap between twelve teeth pinion & Rack pins & accordingly gear box & motor positioned. After that checking of out put shaft run out ,found satisfactory
(0.10 mm)
- Assembled with Repaired hub & pinion with new shear pins.
- Strengthening of the structure was carried out by welding near by twelve teeth pinion.

King Post Assembly

Preventive maintenance of Bottom king post carrying roller base assembly done.

- Inspection of Rack pins done, found in good condition. Greasing for the same was done.
- Strengthening of top side king post structure.

Link conveyor:

The following activities were carried out

- Pivot block assembly (bottom end) of link conveyor replaced.
- Checked the Head end & Tail end pulley bearings found satisfactory.
- Preventive maintenance of Gear box done, replaced the oil seals, & coupled with new bushes.
- Cleaning & over hauling of carrier rollers and return rollers of Link conveyor carried out. Skirt sealing system checked & adjusted.
- Thorough cleaning of accumulated Urea inside the supporting structure of Link conveyor belt carried out.

Hoisting mechanism of Reclaim machine:

The following activities were carried out

- Thruster oil replaced and brake shoes checked.
- Replaced damaged coupling bush and bolts after alignment of Gear box to motor.

Complete greasing carried out at all points of bearings of Reclaim machine.

Complete cleaning and painting of Reclaim machine carried out.

After completion of overhauling “no load” and “load” trial of Reclaim machine was carried out and the machine was found working satisfactorily.

SPARES CONSUMED IN RECLAIM MACHINE(HM-122)

SR.No.	Item Description	Qty. (No.)
Scraper Mechanism		
1.	Disc washer	02
2.	Scraper blade	05
3.	Scraper shaft Bearing (Needle-NA 4824)	08
4.	Oil seal (130x160x16) for scraper shaft	02
5.	Oil seal (130x160x13) for O/P shaft of GB KCN 250	01
6.	Oil seal (45x60x10) for I/P shaft of GB KCN 250	01
7.	Bearing for Idler Gear (NA 4914)	04
8.	Scraper mechanism gear train gears	04
9.	Duplex chain	01
Slewing Mechanism		
1.	Slewing Pinion (12 Teeth)	01
2.	Slewing Hub	01
3.	Shear Pin	04
4.	Rubber Bush for coupling	06
5.	Ball Bearing(6208) of Gear box CVS 280	01
6.	Oil seal for Out put shaft 130 x 150 x 10	02
7.	Oil seal for out put shaft 160 x 190 x 15 (Inside of casing)	02
Hoist Mechanism		
1.	Rubber Bush for coupling	06
Travel Mechanism		
1.	Rubber Bush for coupling	06
Link Conveyor		
1.	Input Oil seal for Gear box (50x62x7)	02
2.	Output Oil seal for Gear box (130x105x16)	02
3.	Pivot bracket with Pin for tie rod	01

CONVEYOR BELT JOBS

CONVEYOR M-2110 :

Following jobs were carried out.

- Inspection of Head pulley found satisfactory. Free end bearing found damaged Replaced with new bearing.
- Replaced two bearings of tail end pulley.
- Preventive maintenance of Gear Box carried out & coupling done after proper alignment.
- Replaced coupling bushes.
- Head pulley brush roller bearing replaced
- Bend pulleys replaced with higher size bearings. Original shaft diameter 50 mm has been changed to 60 mm diameter in new pulleys.
- All damaged and noisy Impact rollers, carrying rollers, return rollers, and guide rollers were replaced.
- All pedestal bearings of snub pulley, head pulley and gravity pulley checked and greasing done.
- Skirt rubber replaced.
- Inspection of flap valve done. Key between flap shaft & Bracket found damaged. Replaced the key & link pin.
- Complete cleaning and painting done on the conveyor structure.

CONVEYOR M - 2112 :

Following jobs were carried out

- Preventive maintenance of Gear Box carried out & Coupling done after proper alignment.
- Bend pulley replaced with higher size bearings.
- Replaced gravity pulley with new bearing.
- All noisy and damaged Impact, Carrying, guide and return rollers replaced with new rollers.
- Skirt rubber replaced.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Preventive maintenance of Tripper system carried out.
- Bend pulley bearing found damaged replaced the same.
- Realigned the gearbox with motor.
- Replaced coupling bushes.
- Complete cleaning & painting of conveyor structure done.

CONVEYOR M-2117 :

Following jobs were carried out

- Preventive maintenance of Gear Box done and Coupling done after proper alignment.
- Replaced coupling bushes and damaged coupling bolts.
- All noisy and damaged carrying, guide and return rollers replaced with new rollers.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Complete cleaning of conveyor structure done.

CONVEYOR M-2121 :

Following jobs were carried out

- Preventive maintenance of Gear Box done and Coupling done after proper alignment.
- Replaced damaged oil seal, coupling bushes and coupling bolts.
- Complete skirt board sealing system adjusted.
- Replaced all damaged and noisy Carrying, Return, Impact and guide rollers with new rollers.
- Replaced Self aligning carrying roller frame, Self aligning return roller frames which was found damaged. Provided two more nos. of self aligning roller frame to avoid off centre of belt.
- Complete greasing of all pedestal bearings done.
- Complete cleaning and painting of structure done.

CONVEYOR M - 2122 :

Following jobs were carried out

- Preventive maintenance of Gear Box done and Coupling done after proper alignment.
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers.
- Skirt rubbers were replaced.
- Complete greasing in all pedestal bearings done.
- Complete cleaning and painting of conveyor structure done.

CONVEYOR M- 2122/A1:

Following jobs were carried out

.Preventive maintenance of Gear Box carried out and Coupling done after proper alignment.

- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers
- Replaced damaged coupling bushes and bolts
- Skirt rubber replaced.
- Cleaning and painting of complete structure done.

CONVEYOR M-2122/A2:

Following jobs were carried out

- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment.
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers
- Replaced damaged coupling bushes and bolts
- Replaced Skirt rubber with new one.
- Cleaning and painting of complete structure done.

CONVEYOR M – 2142/1 :

Following jobs were carried out

- Replaced complete length of belt.
- Preventive maintenance of Gear Box and Coupling done after proper alignment.
- Replaced all damaged and noisy Carrying, return and guide rollers with reconditioned rollers.
- Skirt rubber replaced.
- Cleaning of complete structure done.

DUST CONVEYOR M-2137:

Following jobs were carried out

- Preventive maint. Of Gear -box done.
- All damaged return rollers replaced.
- All carrying rollers attended for free operation.
- Skirt rubber adjusted.
- Complete greasing of all bearings done.

PAY LOADER CONVEYOR M-2113 :

Following jobs were carried out

- Preventive maintenance of Gear Box and Coupling done after proper alignment.
- Overhauling of carrying and return rollers.
- Cleaning of complete structure done

VIBRATING SCREEN:(A,B,C&D)

Following jobs were carried out on the Vibrating Screen,

- All the screens were cleaned thoroughly. All the screen gaskets/ V seals were checked and found ok.
- During checking of vibrator screens some of the springs were found damaged. Replaced the damaged springs with new springs.
- Cleaning of structure for all the screens was carried out.

PREVENTIVE MAINTENANCE OF PACKER SCALES :

- New complete S.S. structure Flap assemblies, weighing receptacle assemblies & Sack grip assemblies replaced along with main frame in Packer Scale No. 2, 4 , 8 & 9 B.
- In Packer scale No. 1, 3, 7 , 9A ,10 A &10 B. Replaced all the bearings in flap case assemblies, weighing receptacle & sack grip assemblies, load cell tie rod bearing replaced. Replaced the sealing rubbers weighing receptacle.
- Servicing of all cylinders. Replaced the seal kits of all the cylinders.
- Replacement and Alignment of stabilizer plate.
- Calibration of all packer scales.

SLAT CONVEYOR M-2124

Following jobs were carried out on the slat conveyors

- New fabricated slat conveyor installed at No.9 B. Removed the old slat conveyor
- Preventive maintenance of Gear box done. Gear box shifted to new foundation.
- Conveyor adjusting mechanism servicing.
- Cleaning of all slat conveyors.
- Replacement of damaged Coupling bushes and bolts.
- Complete cleaning and painting.

SPARES CONSUMED IN SLAT CONVEYOR:

- Drive shaft sprocket
- Driven shaft sprocket
- Drive chain - 48 meter
- Slats – 250 Nos.
- Fasteners -1000 Nos.
- Bearings UCPX- 12 – 2 Nos
- Bearings UCTX -12 – 2 Nos.

STITCHING MACHINES:

All the Stitching machines were completely overhauled with the help of M/s Gabbar Engg. Co. against our Servicing Contract.

Following spares were replaced in all the stitching machines:

Needle, Looper, Pressure Foot, Throat Plate and Feed Dog, needle bar, looper holder, pressure bar, pressure bar spring regulator knob, thread Eyelet assembly, tension disk and thread cutter were also replaced in the stitching machines as per the requirements.

WAGON LOADER:

Following jobs were carried out.

- Replaced the wear out four wheels with new bearings during pre shutdown activity.
- Preventive maintenance of Gear Box and Coupling done after proper alignment. Main drive chain is adjusted
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers
- Cleaning of complete structure done.

TRUCK LOADER:

Following jobs were carried out.

- Preventive maintenance of Gear Box and Coupling done after proper alignment.
- Replaced all damaged and noisy Carrying and return rollers with new rollers
- Cleaning of complete structure done.

INSPECTION

AMMONIA PLANT

The following major inspection activities were performed in Ammonia Plant.

- Inspection of primary reformer, catalyst tubes and risers with various NDT Techniques. Details are given at **Annexure-1 to 6**
- Visual inspection of equipments.
- Ultrasonic flaw detection on selected weld joints and parent metal of elbows of New Converter(S-50) loop and other critical pipelines was carried out .Details are given at **Annexure-7**
- Thickness measurement of various equipment was carried out. Details are given at **Annexure-8**
- Thickness measurement of various pipelines was carried out .Details are given at **Annexure-9**
- Measurement of residual magnetism at various parts of rotating equipments and demagnetization of the same wherever required. Details are given at **Annexure-10**
- In-situ metallographic of selected equipment and pipelines were carried out. Detailed summary of observations and microstructure analysis is given at **Annexure-11**
- Inspection of newly fabricated pipelines and fabrication jobs carried out departmentally by Maintenance and Technical department.
- Magnetic Particle Inspection of weld joints of Refrigerant Flash Drums 110-F, and 112-F from inside of the vessels.
- Qualification tests of welders employed by contractors.

The detailed observations and recommendations for corrective actions required on individual equipment are given below. All the observations were recorded during inspection and were handed over to concerned Maintenance and Operation group for necessary corrective action.

PRIMARY REFORMER 101-B:

RADIANT ZONE:

VISUAL INSPECTION:

Visual inspection of the entire furnace radiant zone, including harp assemblies, refractory and insulation, burner-blocks, etc. was carried out. The detailed report on observations made is enclosed herewith at **Annexure-1**.

OTHER NDT ACTIVITIES:

- DP test of 16 nos. of outlet manifold field weld joints, riser tube to weldolet weld-joints was carried out for all the risers. NO service defects were revealed.
- Creep measurement of all the catalyst tubes was carried out using GO-NOGO Gauge at tunnel slab level. Creep was found in the range of 0 - 0.17 % for 323 nos. of tubes and between 0.17 to 0.70 % in 13 nos. of tubes. Creep measurement of the riser tubes at tunnel slab level was also carried out using digital micrometer. Creep was found in the range of 0 – 0.33 % for 07 nos. of Riser tubes and 01 no. riser tube was found to have creep in the range of 0.33-1.1%. The report is attached at

Annexure 2. Creep measurement of accessible catalyst tubes in row no. 1 to 4 was carried out using GO-NOGO Gauge at top level. Creep was found in the range of 0 – 0.17 % for 44 nos. of tubes and between 0.17 to 0.70 % in 05 nos. of tubes. The report is attached at **Annexure 3.**

CONVECTION ZONE:

Visual inspection of HT and LT convection zone from bottom and top manhole was carried out and observations made are as under:

H.T. CONVECTION SECTION:

From Bottom Manhole:

- Hard scaling was observed on all the tubes of mixed feed coil.
- Between H.T Convection zone and Radiant zone roof refractory was found detached from its position and roof plate was completely exposed near east end of the H.T. Convection zone.
- Insulation covering plate of east and west wall were completely burnt off and insulation material was found exposed.
- One no. of thermowell pipe was found bent near damaged refractory area.
- Bottom floor was found sagged at many locations

From Top Manhole:

- HT and LT super heater coils were found in satisfactory condition.
- Supports of LT/HT steam super heater coils were found in satisfactory condition.
- Extreme east side duct distribution plate was hanged down and few fastners were found loose.
- Extreme east side insulation protection sheet was found detached and fell down from its position.
- 5 Loose insulation protection sheet was found lying inside the overhead distributor ducting between H.T. & L.T. Convection Zone.

L.T.CONVECTION SECTION:

- Tube supports of BFW coil & NG feed preheater coil were found in satisfactory condition as seen from the bottom.
- Few fins of tubes of NG feed preheater coil were found covered with refractory debris at scattered locations.
- Loose refractory debris was found on the bottom floor of LT convection zone.

VESSELS & OTHER EQUIPMENTS:

101CA, PRIMARY WASTE HEAT BOILER SHELL:

Visual inspection of Primary Waste Heat Boiler shell liner was carried out after removal of its tube bundle. Observations made are as under:

1st Liner Piece from top:

- 1st course was found satisfactory except scattered pitting of 1-1.5 mm depth was observed at few locations. Its longitudinal weld seam was found satisfactory.
- Gas outlet nozzle liner was found in satisfactory condition.
- 2nd course was found to have approx. 1-2 mm deep pitting in approx. 40 % surface of liner segment. Its longitudinal weld seam was found eroded in its partial length below the liner surface. Its circumferential weld was found slightly eroded in approx. 200-300 mm length.

2nd Liner Piece from top:

- Scattered pitting of approx. 1.0 mm depth was observed at few locations in approx. 5 % of the liner area.
- Inward bulging of approx. 5 mm was observed at South-West side.
- Debris of refractory dust was found adhered to the liner surface at South-East side.

3rd Liner Piece from top:

Found satisfactory except debris of refractory dust was found adhered to the liner surface at South-East side

4th Liner Piece from top:

- Bulging of approx. 5-7 mm was observed just above the gas distributor.
- Two nos. patch mark of approx. 50 mm dia. Were observed at the center portion of liner segment at South-East quadrant.
- Condition of gas distributor was found satisfactory. Water & debris were found accumulated at bottom.

101CB, PRIMARY WASTE HEAT BOILER SHELL:

Visual inspection of Primary Waste Heat Boiler shell liner was carried out after removal of its tube bundle. Observations made are as under:

1st Liner Piece from top:

- 1st course was found satisfactory except scattered pitting of 1-1.5 mm depth was observed at few locations. Its longitudinal weld seam was found satisfactory.
- Gas outlet nozzle liner was found in satisfactory condition.
- 2nd course was found to have approx. 1-2 mm deep pitting in approx. 40 % surface of liner segment. Its longitudinal weld seam was found eroded in its full length below the liner surface. Its circumferential weld was found eroded in approx. 300- 400 mm length.

2nd Liner Piece from top:

- Scattered pitting of 1-1.5 mm depth was observed at few locations in approx. 20 % of the liner area.
- Inward bulging of approx. 5-7 mm was observed at South-West side.

3rd Liner Piece from top:

- Found satisfactory.

4th Liner Piece from top:

- Bulging of approx. 5-7 mm was observed at the longitudinal weld seam just above the gas distributor.
- A crack of approx. 150 mm length was observed at the longitudinal weld seam located at South side of gas distributor.

103 – D ,SECONDARY REFORMER:

BOTTOM DOME:

- Erosion of refractory and scattered cracks was observed at few locations and same were found more prominent around both the gas inlet nozzles.
- Skirt liner was found buckled inward (away from shell) at scattered locations.
- Upper layer of refractory was found damaged at scattered locations having depth of appx 20-30mm.
- Loose refractory material was found at Bottom floor.
- Top Dome refractory was found intact except some of the refractory brick slots were found chocked with alumina balls.

101-CA/CB GAS INLET NOZZLE:

- Inward bulging and distortion of approx. 20-40mm was observed at the ID of liner segments of both 101-CA and 101-CB gas inlet paths.
- Scattered circumferential cracks were observed at second liner plate from 103D side at previously repair welds .

107 – D ,TRANSFER LINE (From outside)

- Minor buckling/distortion of the liner was observed throughout the length of the transfer line.
- Thermowell was found intact in position.

102-EB, CO2 STRIPPER:

Visual inspection of vessel from top and bottom manhole was carried out and observations are as under:

TOP MANHOLE:

- Demister pads were found sagged in middle portion.
- Demister pad supporting strips and rods were found buckled in middle portion.
- All liquid inlet nozzle flange bolts were found in sheared condition.
- East side stiffener (1" size) of distributor header support was found in broken condition.
- U-Clamp nuts were found missing in west side distribution header.
- U-Clamp nuts were found loose in central distribution header.
- Few fasteners of west side trays were found missing.
- Bottom support plate of East Side Distributor was found broken
- All above markings were marked by yellow chalk

BOTTOM MANHOLE:

- Blackish coloration was observed from inside.
- Nozzle condition was satisfactory.
- Thick scaling was observed from inside.
- Overall condition was found satisfactory

LP FLASH VESSEL (103-E2 LP):

TOP MANHOLE COMPARTMENT:

- Demister pad was found intact in its position in satisfactory condition.
- Condition of weld joints was found satisfactory.
- Condition of bubble caps found satisfactory.
- Grinding mark(2mm deep x 3 mm wide x 1.5 feet long approx) observed on top dished end on south side. Same was also observed in previous S/D.
- 05 no. of bolts of bubble cap support tray were missing. These were marked by yellow chalk.

MIDDLE MANHOLE COMPARTMENT:

- Rectangular riser box and other fittings found intact in position.
- 3 no. of holding bolts of top bubble cap tray found missing, marked by yellow chalk.
- Condition of weld joints was found satisfactory.

BOTTOM MANHOLE COMPARTMENT:

- Blackish brown coloration was observed inside the vessel.
- Weld joint condition was found satisfactory.
- Demister pad condition was found satisfactory.
- Overall condition was found satisfactory

101-F,STEAM DRUM:

- Grayish black coloration was observed inside the drum.
- All Cyclone Separators were found intact in position.
- Demister pads were found intact in position.
- Minor fitting of approx. 0.5 to 0.75mm depth was observed at scattered locations.
- One of the holes at south end of phosphate dosing line (1" NB) was found enlarged.
- Grill covering the Down Comers were found bent at few locations.
- Few bolts of Demister Pad holding cover plate were found sheared.

102-F , RAW GAS SEPARATOR:

- Epoxy paint condition was found peeled off at scattered locations.
- One segment of demister pads (from east side) was found missing. Condition of remaining demister pad segments was found satisfactory.
- Putty applied on the circumferential weld joint of manhole nozzle with shell was found peeled off at some places where as in other places gap was observed at the edges of the putty.

103-F, REFLUX DRUM:

- Demister pads were found intact in its position.
- Epoxy paint was found peeled off from many locations at bottom half of the vessel.
- Over all condition of the vessel was found satisfactory.

104-F, SYN GAS COMPRESSOR SUCTION SEPARATOR:

- Demister pads were found intact in position and their condition was found satisfactory.
- Scattered hard scales were observed at bottom dish end.
- Condition of weld joints was found satisfactory.
- Grayish black coloration was observed on bottom area, where as brownish coloration was observed on remaining surface.

105-F, SYN. GAS COMPRESSOR 1ST STAGE SEPARATOR:

- The coloration of vessel was brownish black from inside.
- Demister pads were found intact in position.
- Scattered minor fitting were observed throughout the shell surface, the same was observed in past also.
- Entire internal surface was found oily.
- The Overall condition of the vessel was found satisfactory.

107-F, PRIMARY AMMONIA SEPARATOR:

- Blackish brown coloration was found inside the vessel.
- Scattered thin scales were observed on the shell and dished end.
- Internal surface was found oily.
- The condition of all the weld joints of the shell, dished ends and nozzles was found satisfactory.
- Scattered fitting were observed on entire shell surface.
- Condition of target plate was found satisfactory.

109-F, REFRIGERANT RECEIVER:

- Coloration of the shell was found grayish black.
- The condition of all the weld joints of the shell, dished ends and nozzles was found satisfactory.
- Thin scales were observed on both the dished ends.
- Minor scattered fitting / scales were observed in a width of approx. 250mm throughout the length of vessel at its bottom most portion. The same was observed in past also.
- Internal surface was found oily.
- Overall condition of the vessel was found satisfactory.

110-F, FIRST STAGE REFRIGERANT FLASH DRUMS:

- Brownish black coloration was observed inside the drum.
- Entire internal surface was found oily.
- The demister pads were found intact in position.
- Scattered scales were observed on the surface of the dish ends and shell.
- Magnetic particle examination of all the weld joint was carried out from inside. Minor indications observed were removed by sanding and reexamined, No recordable service defect was found.
- Overall condition of the vessel was found to be satisfactory.

111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

- Blackish gray coloration was observed inside the shell surface.
- Entire internal surface was found oily.
- The demister pads were found intact in position, where as one bolt was found missing from middle support of the demister pad (marked with Yellow Chalk).
- Dish ends were found covered with scattered scales.
- Condition of all shell weld joints was found satisfactory.
- Seal weld (approx. 2") was missing from 10" nozzle on top of shell in the middle of the vessel (marked with yellow chalk).

112-F, THIRD STAGE REFRIGERANT FLASH DRUMS:

- The demister pads were found intact in position.
- The colouration of the inside surface of shell was dark blackish.
- Surface of the vessel was found oily.
- Hard scales were observed in the shells which were more prominent on the dished ends.
- Condition of all nozzles was found satisfactory.
- Magnetic particle examination of all the weld joint was carried out from inside. Minor indications observed were removed by sanding and reexamined, No recordable service defect was found.

R1 & R2, DRYING VESSEL:

- Loose Alumina balls and Molecular Sieves were found at top and bottom compartment.
- Wire mesh of both the ball supporting grid and molecular sieve supporting grid were found cracked at previously repaired locations and at some new locations also.

MISCELLANEOUS JOBS:

WELDER QUALIFICATION TESTS:

- Performance qualification test of 12 Nos. welders offered by M/s General Engineering was carried out. 05 nos. of welders were qualified during the test. These welders were allowed to perform various miscellaneous non-critical departmental welding jobs in the plant.
- Performance qualification test of 05 Nos. welders offered by M/s.Ganesh Engg. Was carried out. 04 nos. of welders were qualified during the test. These welders were allowed to perform welding on BHEL boiler tube welding (sample taken for RLA) and Autoclave liner repairing job.
- Welder qualification test of 07 Nos. welders of M/S. Rambahadur & Co. was carried out. 01 welder was qualified. These welders were qualified for performing general purpose welding jobs.
- Welder qualification test of 03 Nos. welders of M/S. Skywin was carried out. All welders were qualified. These welders were qualified for performing Technical Department's welding jobs.

D.P. TEST:

- Dye penetrant examination of weld joints of all the pipelines fabricated by contractors/departmentally, new pipeline fabrication / repairing / modifications job done by technical and maintenance groups etc. was carried out after root run welding and after final welding, as per requirement. Any defects observed during the tests were rectified in the presence of inspector followed by DP test for acceptance.

RADIOGRAPHY:

- In order to ensure immediate radiography work and urgent processing of films, teams were hired on round the clock basis during entire shutdown period. Radiography was performed on the weld joints of the pipe lines fabricated / repaired by all contractors as well as departmentally as per the requirement.

INSITU METALLOGRAPHY EXAMINATION:

- In order to evaluate the condition of certain critical plant equipment and pipelines operating at more than 300 deg. C temperatures, parent metal, HAZ and welds , weld joints of dissimilar material, Insitu metallographic examination was carried out. List of the lines/equipment checked along with observations and remarks are mentioned at **Annexure-12**

ULTRASONIC FLAW DETECTION OF WELDS:

- Weld joints (selected only) of the critical pipe lines and equipment were ultrasonically examined for assessing any development of service defects/growth of the acceptable defects. No abnormalities were observed in any of the weld joints inspected. No discontinuity was required to be repaired.
- The detailed list of pipeline inspected is mentioned at **Annexure-8**

ULTRASONIC THICKNESS MEASUREMENT:

- During the shutdown, ultrasonic thickness measurement was carried out on various pipelines and equipment in the plant. The detailed results of inspection are attached herewith at **Annexure-9** (for equipment) and **Annexure- 10**(for pipelines).

GAUSS MEASUREMENT:

- During this shutdown measurement of residual magnetism (gauss) on rotary and stationary parts of various rotary equipment were carried out. Wherever residual magnetism was higher than acceptable limits, same was demagnetized and brought down within acceptable limits. The detailed results of inspection are attached herewith at **Annexure-11**

INSTALLATION OF NEW PIPELINES:

- During this shutdown, various pipelines in Ammonia Plant were installed for different schemes and various tapping were taken by Technical Group. Inspection activities viz. DP Test, Radiography review and repairs etc. were carried out on the weld joints as per fabrication procedures.

OVER SPEED TRIP TEST:

- Before startup, speed measurement and vibration measurement of 101-BJ Turbine, 104-JAT was carried out.

ANNEXURE-1

VISUAL INSPECTION REPORT OF PRIMARY REFORMER RADIANT ZONE AND CONVECTION ZONE:

RADIANT ZONE:

- Visual inspection of the entire furnace radiant zone, including refractory and insulation, burner-blocks, etc. was carried out. The detailed report on observations made is as under:

BURNER BLOCKS: Following burner blocks were found damaged:

Burner Row No.

Burner Block No.

- 2,4,5,8,10
- 3,4,9,10,14
- 5,9,14
- 1,2,3,5,6,8 to12
- 1,4,9,10,11,12
- 1,3,4,6,7,8,9,11
- 4,5,8,10,11,13,14
- 1,4,5,7,8,9,11,12,13
- 2,4,10,13

BOTTOM HEADER INSULATION:

- Header insulation was found damaged near following tube nos.:
- Header No. Tube nos where insulation found damaged
- Near tube no. 30
- 5 Outer Insulation on both sides of Riser, Tube no. 25-33
- 8 16-21

ROOF INSULATION:

Roof insulation was found damaged/ gap has been observed at following locations:

- Burner Row 2nd Burner no.1,2 & between burner no. 13-14
- Burner Row 3rd Burner no. 3,4,5
- Burner Row 4th between burner no. 13-14
- Burner Row 5th between burner no. 3-4, Near tube no. 503-508 dropped.
- Burner Row 6th Burner No. 1,3,9,10,13,14
- Burner Row 7th Burner No. 3,6, Near tube no. 715-718 dropped.
- Burner Row 8th Burner No. 3, Near Riser dropped

REFRACTORY WALLS:

North Wall & West Wall:

- East and West wall Z- Module Insulation was found in satisfactory condition.
- Gap in insulation was observed at bottom location on 1st peephole from West on North wall.
- Gaps in Z-module insulation were observed above 4th tunnel from West on South-wall.
- Refractory bricks just above tunnel no. 8 were found damaged

TUNNEL SLAB:

- 1 no. of tunnel slab was found damaged in burner row no. 1 & 6 each.

Annexure – 2 (1/5)

TUBE NOS 101 TO 242

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT SLAB LEVEL**

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
101	X			201	X		
102	X			202	X		
103	X			203	X		
104	X			204	X		
105	X			205	X		
106	X			206	X		
107	X			207	X		
108	X			208	X		
109	X			209	X		
110	X			210	X		
111	X			211	X		
112	X			212	X		
113	X			213	X		
114	X			214	X		
115	X			215	X		
116	X			216	X		
117	X			217	X		
118	X			218	X		
119	X			219	X		
120	X			220	X		
121	X			221	X		
122	X			222	X		
123	X			223	X		
124	X			224	X		
125	X			225	X		
126	X			226	X		
127	X			227	X		
128	X			228	X		
129	X			229	X		
130	X			230	X		
131	X			231	X		
132	X			232	X		
133	X			233	X		
134	X			234	X		
135	X			235	X		
136	X			236	X		
137	X			237	X		
138	X			238	X		
139	X			239	X		
140	X			240	X		
141	X			241	X		
142	X			242	X		
Total	42			Total	42		

Annexure – 2 (2/5)

TUBE NOS 301 TO 442

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT SLAB LEVEL**

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
301	X			401	X		
302	X			402	X		
303	X			403	X		
304	X			404		X	
305	X			405	X		
306	X			406		X	
307	X			407	X		
308	X			408		X	
309	X			409	X		
310	X			410	X		
311	X			411	X		
312	X			412	X		
313	X			413	X		
314	X			414	X		
315	X			415	X		
316	X			416	X		
317	X			417	X		
318	X			418	X		
319	X			419	X		
320	X			420	X		
321	X			421	X		
322	X			422	X		
323	X			423	X		
324	X			424	X		
325	X			425	X		
326	X			426	X		
327	X			427	X		
328	X			428	X		
329	X			429	X		
330	X			430	X		
331	X			431	X		
332	X			432	X		
333	X			433	X		
334	X			434	X		
335	X			435	X		
336	X			436	X		
337	X			437	X		
338	X			438	X		
339	X			439	X		
340	X			440	X		
341		X		441	X		
342	X			442	X		
Total	41	01		Total	39	03	

Annexure – 2 (3/5)

TUBE NOS 501 TO 642

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT SLAB LEVEL**

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
501	X			601	X		
502	X			602	X		
503	X			603	X		
504	X			604	X		
505	X			605	X		
506	X			606	X		
507	X			607	X		
508	X			608	X		
509	X			609	X		
510	X			610	X		
511	X			611	X		
512	X			612	X		
513	X			613	X		
514	X			614	X		
515	X			615	X		
516	X			616	X		
517	X			617	X		
518	X			618	X		
519	X			619	X		
520	X			620	X		
521	X			621	X		
522	X			622	X		
523	X			623	X		
524	X			624		X	
525	X			625	X		
526	X			626	X		
527	X			627	X		
528	X			628	X		
529	X			629	X		
530	X			630	X		
531	X			631	X		
532	X			632	X		
533	X			633	X		
534	X			634	X		
535	X			635	X		
536	X			636	X		
537		X		637	X		
538	X			638	X		
539		X		639	X		
540	X			640	X		
541	X			641	X		
542	X			642	X		
Total	40	02		Total	41	01	

Annexure – 2 (4/5)

TUBE NOS 701 TO 842

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT SLAB LEVEL**

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
701	X			801	X		
702	X			802	X		
703	X			803	X		
704	X			804	X		
705	X			805	X		
706	X			806	X		
707	X			807		X	
708	X			808	X		
709	X			809	X		
710	X			810	X		
711	X			811	X		
712	X			812	X		
713	X			813	X		
714	X			814	X		
715	X			815	X		
716	X			816	X		
717	X			817	X		
718	X			818	X		
719	X			819	X		
720	X			820		X	
721	X			821	X		
722		X		822	X		
723	X			823	X		
724	X			824	X		
725	X			825	X		
726	X			826	X		
727	X			827	X		
728	X			828	X		
729	X			829		X	
730	X			830	X		
731	X			831		X	
732	X			832	X		
733	X			833	X		
734	X			834	X		
735	X			835		X	
736	X			836	X		
737	X			837	X		
738	X			838	X		
739	X			839	X		
740	X			840	X		
741	X			841	X		
742	X			842	X		
Total	41	01		Total	37	05	

Annexure – 2 (5/5)

RISERS

**CREEP MEASUREMENT OF PRIMARY
REFORMER RISER TUBES AT SLAB LEVEL**

Riser No.	Creep in Percentage		
	0 – 0.33	0.33 – 1.10	1.10 – 1.44
1	X		
2	X		
3	X		
4	X		
5		X	
6	X		
7	X		
8	X		

Annexure – 3 (1/2)

TUBE NOS 101 TO 242

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT TOP ELEVATION**

- Creep was measured at accessible locations.

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
101				201			
102				202			
103				203			
104				204			
105				205			
106	X			206	X		
107	X			207	X		
108	X			208	X		
109	X			209	X		
110	X			210		X	
111	X			211	X		
112	X			212	X		
113	X			213	X		
114	X			214	X		
115	X			215	X		
116	X			216			
117	X			217			
118	X			218			
119	X			219			
120				220			
121				221			
122				222			
123				223			
124				224			
125				225			
126				226			
127				227			
128				228			
129				229			
130				230			
131				231			
132				232			
133				233			
134				234			
135				235			
136				236			
137				237			
138				238			
139				239			
140				240			
141				241			
142				242			
Total	14			Total	09	01	

Annexure – 3 (2/2)

TUBE NOS 301 TO 442

**CREEP MEASUREMENT OF PRIMARY REFORMER
CATALYST TUBES AT TOP ELEVATION**

- Creep was measured at accessible locations.

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
301				401			
302				402			
303				403			
304				404			
305				405			
306				406	X		
307	X			407	X		
308	X			408	X		
309	X			409	X		
310	X			410		X	
311		X		411	X		
312	X			412	X		
313	X			413		X	
314	X			414		X	
315	X			415	X		
316	X			416	X		
317	X			417	X		
318	X			418	X		
319				419			
320				420			
321				421			
322				422			
323				423			
324				424			
325				425			
326				426			
327				427			
328				428			
329				429			
330				430			
331				431			
332				432			
333				433			
334				434			
335				435			
336				436			
337				437			
338				438			
339				439			
340				440			
341				441			
342				442			
Total	11	01		Total	10	03	

Annexure – 4

**TUBE SPRING HANGER LOAD READINGS OF PRIMARY REFORMER
HARP ASSEMBLY(101-B) : COLD LOAD READINGS IN MM:**

R O W	TUBE NOS. (SOUTH TO NORTH)																					
	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-1	-3	-9	-9	-11	-11	-13	-8	-3	-3	0	0	-3	-3	-10	-9	-10	-8	-9	0	2	3
2	-12	-3	-4	-4	-2	-2	-8	-5	-2	-3	-1	0	0	2	-2	-8	-8	5	-5	-3	-3	-8
3	-3	0	0	-4	0	0	-2	0	0	0	2	1	2	0	-4	-6	-5	-3	-3	-1	0	2
4	0	2	0	-1	-1	0	0	0	2	0	10	0	3	0	0	0	0	-2	-1	1	3	
5	3	4	0	0	0	-3	-7	-2	-3	0	0	0	2	0	0	2	4	1	1	0	3	0
6	2	3	1	0	0	-1	0	3	0	0	0	-15	3	6	-3	-2	-7	-5	-2	1	0	4
7	0	4	0	-1	-1	-3	-3	-2	0	0	0	0	0	0	-1	-2	-3	-5	-4	0	0	2
8	3	0	0	0	0	0	-8	-6	0	0	0	0	0	1	-6	-4	0	0	0	-19	3	3

TRANSFER LINE SPRING HANGER LOAD READINGS

ROW	1	2	3	4	5	6	7
READINGS	-38	-34	-32	-36	-38	-20	-19

BOTTOM DRAIN READINGS

ROW	1	2	3	4	5	6	7	8
READINGS	96	98	99	95	90	97	98	96

AUXILIARY BOILER SPRING READINGS

SPRING	S-E	N-E	S-W	N-W
READINGS	65	63	60	59

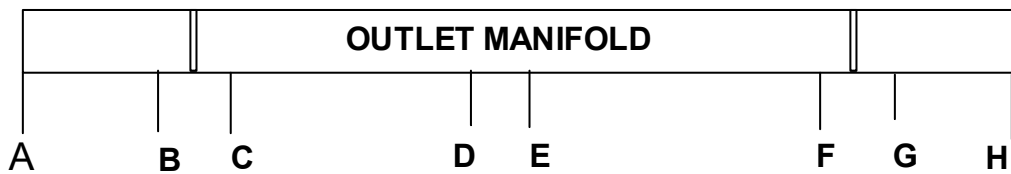
ANNEXURE- 5

CLEARANCE OF OUTLET MANIFOLD FROM
GROUND FLOOR IN COLD CONDITION

HEADER NO.	LOCATION OF MEASUREMENT					
	B	C	D	E	F	G
1	300	300	310	310	300	300
2	280	280	290	290	290	290
3	270	280	280	280	270	270
4	280	270	270	270	290	280
5	270	270	280	280	290	280
6	280	280	300	290	280	280
7	280	280	290	290	280	280
8	300	300	310	310	300	300

NOTE : (1) All readings are in MM

(2) Readings are taken without insulation.



ANNEXURE- 6

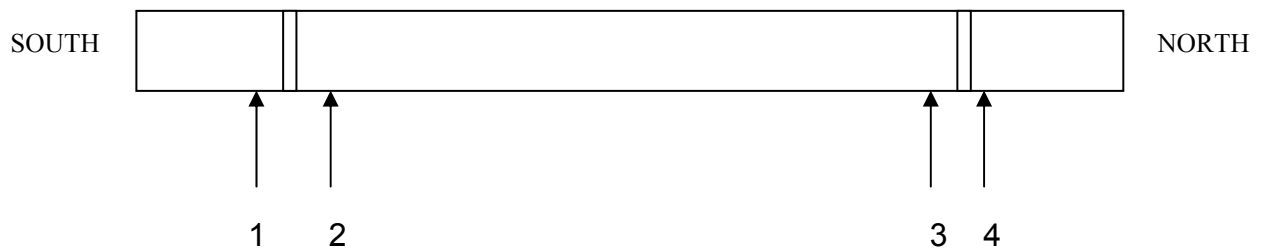
CREEP MEASUREMENT OF OUTLET MANIFOLD OF PRIMARY REFORMER

ROW NO	1		2		3		4	
	XX	YY	XX	YY	XX	YY	XX	YY
1	141.23	141.32	141.65	141.47	141.33	140.93	141.06	141.59
2	141.67	141.90	141.73	141.32	141.38	141.43	141.62	141.53
3	141.50	141.63	141.38	141.47	141.39	141.50	141.52	141.58
4	141.73	141.49	141.83	141.25	141.69	141.19	141.90	141.92
5	141.35	141.42	141.47	141.53	141.37	141.41	141.40	141.39
6	141.97	141.86	141.22	141.62	141.27	141.71	141.89	141.91
7	141.93	141.65	141.72	141.63	141.42	141.46	141.69	141.63
8	142.02	142.26**	141.02	141.61	141.68	141.53	141.98	142.11

* Design O.D. of Manifold= $141.3^{+0.8}_{-0}$

** Maximum measured creep = 0.113 %

Note: All dimensions are in MM



Annexure – 7

UFD OF WELD JOINTS OF FOLLOWING PIPELINES WAS CARRIED OUT

Sr. No.	Line No.	Size	Sch.	From	To	No. of weld joint	No. of Elbows	Remarks
1	SG-1303-08-14"	14	120	SG-33-14" (105-D)	108-D Inlet (Bottom)	15	05	No significant defect was observed.
2	SG-1303-09-10"	10	120	SG-1303-08-14" (105-D)	108-D Inlet (Bottom)	08	04	
3	SG-1303-08-10"	10	120	SG-1303.08-14"	108-D Inlet (Top North)	06	03	
4	SG-1303-12-10"	10	120	SG-1303.08-14"	108-D Inlet (Top South)	06	03	
5	SG-1303-10-14"	14	120	108-D	107-C	12	05	
6	SG-1303-11-14"	14	140	107-C	123-C	11	05	
7	SG-1303-02-14"	14	100	121-C	137-C	10	01	
8	SG-1303-06-14"	14	100	121-C	137-C	04	00	
09	SG-1303-04-8"	8	100	137-C	SG-51-8	04	00	
10	SG-1303-08-14"	14	100	121-C	124-C	06	01	
11	NG-09-12"	12	100	101-B	103-D	02	00	

Annexure – 8

THICKNESS MEASUREMENT SUMMARY OF EQUIPMENT

Sr. No.	Equipt. No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min. Measured	% Red.	Nom./ Design	Min. Measured	% Red	Nom./ Design	Min. Measured	% Red.
1	101-CA	Primary Waste Heat Exchanger	60.33	-	-	22.23	-	-	6.70 (Liner)	6.7	-
2	101-CB	Primary Waste Heat Exchanger	60.33	-	-	22.23	-	-	6.70 (Liner)	6.6	1.49
3	108-C1A	Amdea Solution Cooler	12.70	11.70	7.87	12.70	15.50	-	12.70	12.00	5.50
4	108-C2A	Amdea Solution Cooler	12.70	12.60	0.71	12.70	15.70	-	12.70	12.00	5.50
5	121-C	NH3 Converter Feed / Converter Effluent Exchanger	NA	38.00	-	-	-	-	NA	81.30	-
6	122-C	NH3 Feed Water Exchanger	-	-	-	76.20	71.90	5.60	-	-	-
7	123-C	NH3 Feed Water Exchanger	83.00	85.10	-	44.00	48.40	-	-	-	-
8	172-C	Condensate Stripper Overhead Condenser	10.00	9.50	5.00	-	-	-	-	8.70	-
9	176-C	Natural Gas Compressor After Cooler	NA	11.40	-	NA	8.6(N), 20.0(S)	-	NA NA	11.00 19.20	-
10	103-D	Secondary Reformer	-	-	-	34.93	-	-	6.35 (Jkt)	6.20 (Jkt)	2.30
11	105-D	Synthesis Covertor	-	-	-	83.82 83.82	89.5(T) 88.1(B)	-	-	-	-
12	107-D	Transfer Line	3.20 (Liner)	3.70	-	-	-	-	-	-	-
13	102-EB	CO2Stripper (Tray 1 to 11) (tray 11 & below)	9.53 15.90	10.00 16.50	-	11.9(T) 15.9(B)	20.50	-	-	-	-
14	104-F	Synthesis Gas Compressor Suction Drum	24.60	26.10	-	23.82	29.60	-	-	-	-
15	105-F	Synthesis Gas Compr. 1 st Stage Separator	47.63	48.50	-	46.03	51.30	-	-	-	-

16	107-F	Primary Ammonia Separator	14.29	14.40	-	14.29	17.20	-	-	-	-
17	109-F	Refrigerant Receiver	21.40	21.80	-	18.30	19.50	-	-	-	-
18	110-F	Ist Stage Refrigerant Flash Drum	9.52	9.50	-	9.52	12.30	-	-	-	-
19	112-F	Illrd Stage Refrigerant Flash Drum	9.52	9.90	-	19.05(E) 9.52 (W)	22.80 12.40	-	-	-	-
20	117-FB	Amdea Carbon Filter	10.00	9.10	9.00	10.00	7.90	21.00	-	-	-
21	142-F	New Instrument Air Receiver	NA	13.10	-	NA	11.80	-	-	-	-
22	2005-F	New Instrument Air Receiver	8.00	8.30	-	8.00	7.70	3.75	-	-	-
23	2012-U	Resin Trap	NA	7.80	-	NA	8.60	-	-	-	-
24	2003-LA	Instrument Air Drier	NA	8.00	-	NA	8.20	-	-	-	-
25	2003-LB	Instrument Air Drier	NA	8.10	-	NA	8.20	-	-	-	-

THICKNESS MEASUREMENT SUMMARY OF HT & LT COILS.

SR. NO.	DESCRIPTION	DESIGN THICKNESS	MEASURED THICKNESS	% REDUCTION
1	BFW COIL OFFSITES (LT Convection, bottom most)	5.54	4.00	27.79
2	BFW COIL OFFSITES (LT Convection, 2 nd from bottom)	5.54	4.40	20.57
3	FEED PRE HEAT COIL(LT Convection, 3 rd from bottom)	3.9	3.50	10.25
4	BFW HEATER COIL(LT Convection, 4 th from bottom)	5.54	4.10	25.99
5	LT STEAM SUPER HEATER COIL(LT Convection, 5 th from bottom)	7.01	6.20	11.55
6	HT STEAM SUPER HEATER COIL(HT Convection, 3 rd from bottom)	8.0	7.80	2.50
7	AIR-PREHEATER COIL(HT Convection, 2 nd from bottom)	6.55	6.20	5.34
8	MIXED FEED COIL(HT Convection, bottom most)	8.0	11.80	-

ANNEXURE- 9

AMMONIA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY :

SR. NO.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
						FROM	TO		
1.	BF-1304.01	3	160	11.13	CS	142-CB	107-C	10.70	3.86
2.	BO-01	1.5	80	5.08	CS	BO-1H	BO-21	5.5	-
3.	BO-02H	1.5	XXS	10.15	CS	101-F	BO-02	9.80	3.40
4.	BO-03H	1	160	6.35	CS	102C	156F	4.10	35.41
5.	BO-04	1	80	4.56	CS	BO-6H(103-C)	BO-14 (156F)	3.80	16.66
6.	BO-06	1	80	4.56	CS	BO-12H	BO-11	4.60	-
7.	BO-06H	1	160	6.35	CS	103-C	BO-4	5.80	7.40
8.	BO-11	1.5	80	5.08	CS	AUX BLR	BO-14-3"	4.60	9.44
9.	BO-1304.04	2	40	3.91	CS	107-C	156-F	3.60	7.43
10.	BO-14BH	2	160	8.74	CS	COIL-A	BO-7	10.80	-
11.	BO-17	1	80	4.56	CS	101-CA	BO-14 (156F)	4.4	3.50
12.	BO-20	1	80	4.56	CS	101-CB	B0-17	5.70	-
13.	BO-21	1.5	80	5.08	CS	BO-2	BO-14	4.5	11.41
14.	CO-11	16	20	7.92	CS	CO-8	CO-12	12.90	-
15.	CW HEADER	52	-	10	CS	UREA PLANT	COOLING TOWER	9.10	9.0
16.	CW-06	36	-	7.93	CS	CW-5	127-C	5.60	29.38
17.	CW-06	36	-	7.93	SS	CW-5	127-C	6.20	21.81
18.	DR-08	8	40	8.18	CS	101-U	SEWER	7.30	10.57
19.	DR-24	3	40	5.49	CS	101-U	DR-8	4.60	16.21
20.	FG-03	8	40	8.18	CS	AG HEADER	101-B	8.00	2.20
21.	HS-1304-02	8	60	10.31	CS	107-C	101-B	9.90	3.97
22.	HW-12	10	30	7.80	CS	128-C	HW-41	5.70	26.92
23.	HW-22	16	20	7.93	CS	108-C	HW-20	3.80	52.00*
24.	HW-25	10	30	6.35	CS	124-C	HW-5	5.30	16.53
25.	HW-34	6	40	7.11	CS	130-JC	HW-15	4.70	33.89
26.	MDEA 24A	3	40	5.50	CS	108-J	aMDEA 25	5.20	5.45
27.	MDEA 24B	3	40	5.50	CS	108-JA	aMDEA25	5.10	7.27
28.	MDEA 25	3	40	5.50	CS	aMDEA24A&B	aMDEA24A&B	4.60	16.36
29.	MDEA-1202.01	18	XS	12.70	CS	101-EA	MDEA-1202.02	11.10	12.59
30.	MDEA-1202.02	18	XS	12.70	CS	MDEA-1202.01	115-HT	11.20	11.81
31.	MDEA-1202-02	18	10S	4.78	SS	115-JT	103-E1	6.90	-
32.	MDEA-1202-02	18	40S	12.70	SS	115-JT	103-E1	11.00	13.38
33.	MDEA-1203.02	18	10S	4.78	SS	HV-435 (MDEA-1202.03-14")	103-E1/E2	5.00	-
34.	MDEA-1204.01	24	10S	6.35	SS	103-E2 HP	LV-416	6.60	-
35.	MDEA-1209-01	24	40	17.48	CS	103-E2LP(MDEA-1209-01-24")	115-JA	18.60	-
36.	MDEA-1209-02	24	STD	9.53	CS	103-E2LP (MDEA-1209-01-24")	115-JA	9.90	-
37.	MDEA-1209-03	24	40	17.48	CS	103-E2LP (MDEA-1209-01-24")	115-JB	16.90	3.31
38.	MDEA-1209-03	24	STD	9.53	CS	103-E2LP (MDEA-1209-01-24")	115-JB	9.40	1.36

39.	MDEA-02	4	40	6.02	SS-304	aMDEA-2	101-L	4.90	18.60
40.	MDEA-07	10	40S	9.27	SS	MDEA-61-12"	MDEA-9B-10"	8.50	8.30
41.	MDEA-09B	10	10S	4.19	SS	MDEA-17-10"	102-EB	4.70	-
42.	MDEA-1209-06	12	20	6.35	CS	103-E2LP (MDEA-1209-01-24")	MDEA-1209-07/08 (116JA/JB)	5.80	8.66
43.	MDEA-1209-07	12	10S	4.57	SS	103-E2LP (MDEA-1209-01-24")	116-JB	5.10	-
44.	MDEA-1209-08	12	10S	4.57	SS	103-E2LP (MDEA-1209-01-24")	116-JA	6.40	-
45.	MDEA-1212-01	16	XS	12.70	CS	115-JA	101-EA (MDEA-1212-03)	10.10	20.47
46.	MDEA-1212-02	16	XS	12.70	CS	115-JB	101-EA (MDEA-1212-03)	10.10	20.47
47.	MDEA-16B	12	20	6.35	CS	108-C2A	MEA-62	7.60	-
48.	MDEA-17	16	20	7.92	CS	MEA-62	MEA 41 (107-J)	7.00	11.61
49.	MDEA-62	16	20	7.92	CS	HEADER	MEA-17	7.40	6.56
50.	MDEA-62	16	20	7.92	CS	HEADER	MEA-17	7.40	6.56
51.	MDEA-6B	8	40S	8.18	SS	109C1B/C2B	MDEA-7	6.70	18.09
52.	MS-28	3	40	5.50	CS	MS-2	FG-3	5.20	5.45
53.	NG-22	8	40	8.18	CS	176-F	NG-30-24"	6.10	24.42
54.	NG-28	2.5	40	5.20	CS	NG-27	102-B	5.10	1.92
55.	PG-1212.01	14	10	6.35	CS	101-EA	136-C	6.10	3.93
56.	PG-14	16	40	12.70	CS	106-C	102-F	11.30	11.02
57.	PW-13	6	80	10.97	CS	PW-12	SEWER	6.80	38.01
58.	PW-17	4	120	11.13	CS	PW-1	170-C	10.80	2.96
59.	PW-17	4	40	6.02	SS304	PW-1	170-C	6.30	-
60.	PW-19	4	10S	3.05	SS	LC-3A	104-E	2.06	14.75
61.	PW-19	2	10S	2.77	SS	LC-3A	104-E	2.70	2.52
62.	PW-19	4	120	11.13	CS	LCV-3A	104-E	9.50	14.65
63.	PW-20	6	80	10.97	CS	104-E	170-J	13.70	-
64.	PW-20A	6	80	10.97	CS	PW-20	170-JA	10.7	2.46
65.	PW-24	4	120	11.13	CS	173-C	CONT VALVE	10.50	5.60
66.	PW-27	6	80	10.97	CS	PW-20	PW-28	11.40	-
67.	PW-29	10	60	12.70	CS	171-C	PW-30	8.60	24.40
68.	PW-29A	10	60	12.70	CS	171-C	PW-30	9.60	32.95
69.	PW-31	12	40	10.31	CS	PW-30	104-E	14.30	-
70.	RV-28	6	40	7.11	CS	RV-SG-39	V-16	6.30	11.39
71.	RV-33	4	40	6.02	CS	SG-39	RV-SG-39	5.20	13.62
72.	SC-07	2.5	80	7.01	CS	SC-42	101-JC	4.70	31.22
73.	SC-17	3	80	7.62	CS	156-F	SEWER	6.10	19.94
74.	SC-17	1.5	80	5.08	CS	BYPASS		4.00	21.25
75.	SC-42	4	40	6.02	CS	CV-A	LC-2	4.90	18.60
76.	SC-44	2	80	5.54	CS	171-C	STS-45	3.30	40.72
77.	SC-47	10	40	9.27	CS	101-JC	112-J	5.80	37.43
78.	SC-47A	10	40	9.27	CS	101-JC	112-J	6.00	35.27
79.	SG-1303-08	14	120	27.79	P22	105-D	SG-33	24.20	12.91
80.	SG-1303-08	10	120	21.44	P22	SG-1303.08	108-D INLET (TOP NORTH)	21.00	1.86

81.	SG-1303-09	10	120	21.44	P22	105-D	SG-1303.08-14"	21.20	1.11
82.	SG-1303-10	14	120	27.79	P22	108-D	107-C	25.20	9.31
83.	SG-1303-11	14	140	31.75	P11	107-C	123-C	27.80	12.44
84.	SG-1303-12	10	120	21.44	P22	SG-1303-08-14"	108-D INLET (TOP SOUTH)	21.80	-
85.	V-92	6	40	7.11	CS	101D/102D INLET	VENT (SP-73)(PRC-1)	6.00	15.61
86.	WA-34	6	40	7.11	CS	WA-37/38	5.30	25.45	24.45
87.	WA-37	4	40	6.02	CS	WA34	105J LO CONSOLE	4.00	33.55
88.	WA-38	4	40	6.02	CS	WA34	105J LO CONSOLE	5.40	10.29

***Patch plate provided at this area.**

Annexure-10

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	INITIAL (Gauss)	AFTER DEGAUSSING (Gauss)
<u>101-BJT</u>			
Journal Bearing Liner	East Side(CT side)	1.2	
	West Side(Silo side)	1.7	
Shaft Journal	East Side	3.0	1.2
	West Side	3.1	1.5
<u>101-BJR (High Speed Drive Pinion)</u>			
Journal Bearing	East Side	1.2	
	West Side	1.3	
Shaft Journal	East Side	1.4	
	West Side	0.5	
<u>101-BJR(Low Speed Driven Gear)</u>			
Journal Bearing Liner	East Side	0.5	
	West Side	0.7	
Shaft Journal	East Side	0.3	
	West Side	1.5	
<u>101-BJ</u>			
Journal Bearing Liner	East Side	0.5(Top) , 1.1(Bottom)	
	West Side	1.3(Top), 1.3(Bottom)	
Shaft Journal	East Side	1.8	
	West Side	0.9	
<u>101-JT</u>			
Journal Bearing Pad	Thrust End	1.6	
	Non Thrust End	0.5	
Journal Bearing Base ring	Thrust End	1.3	
	Non Thrust End	0.9	
Thrust Bearing Pads	Active	1.3	
	Inactive	1.1	
Thrust Bearing Base ring	Active	1.1	
	Inactive	1.1	
Shaft Journal	Thrust End	0.9	
	Non Thrust End	2.2	

<u>101-JLP</u>			
Journal Bearing Pads	Thrust End	2.1	
	Non Thrust End	1.2	
Journal Bearing Base ring	Thrust End	1.8	
	Non Thrust End	1.4	
Thrust Bearing Pads	Active	1.2	
	Inactive	0.8	
Thrust Bearing Base ring	Active	1.1	
	Inactive	0.9	
Shaft Journal	Thrust End	2.1	
	Non Thrust End	2.4	
<u>101-JR</u>			
Gear Journal Bearing	North side	1.2	
	South Side	1.1	
Pinion Journal Bearing	North side	1.7	
	South Side	1.9	
Thrust Bearing	Active	1.1	
	Inactive	2.0	
Oil Guard for thrust Bearing	North side	1.1	
	South Side	2.1	
Shaft Journal	Thrust End	1.5	
	Non Thrust End	1.1	
<u>101-JHP</u>			
Journal Bearing Pads	Thrust End	0.9	
	Non Thrust End	1.7	
Journal Bearing Base ring	Thrust End	1.2	
	Non Thrust End	1.2	
Thrust Bearing Pads	Active	0.9	
	Inactive	0.7	
Thrust Bearing Base ring	Active	1.7	
	Inactive	2.0	
Shaft Journal	Thrust End	2.7	
	Non Thrust End	2.4	
<u>104-JT</u>			
Journal Bearing Sleeve	Thrust End	1.2	
	Non Thrust End	1.4	
Thrust Bearing Pads	Active	1.2	
	Inactive	0.8	
Thrust Bearing Base ring	Active	1.8	
	Inactive	1.9	
Shaft Journal	Thrust End	0.9	
	Non Thrust End	0.7	

<u>104-J</u>			
Journal Bearing Sleeve	Thrust End	1.0	
	Non Thrust End	0.8	
Thrust Bearing Pads	Active	1.0	
	Inactive	1.0	
Thrust Bearing Base ring	Active	0.9	
	Inactive	1.2	
Shaft Journal	Thrust End	0.8	
	Non Thrust End	0.9	
<u>107-JT</u>			
Journal Bearing Governor End	Top Half	1.1	
	Bottom Half	2.0	
	Shaft	1.3	
Journal Bearing Coupling End	Top Half	1.1	
	Bottom Half	2.0	
	Shaft	1.3	
Thrust Bearing	Collar	2.2	
	pads	2.2	
Shaft Journal	Thrust End	1.8	
	Non Thrust End	1.6	
<u>115-JAT</u>			
Journal Bearing Liner	Thrust End	1.7	
	Non Thrust End	1.2	
Shaft Journal	Thrust End	1.1	
	Non Thrust End	2.0	
Thrust Collar	Active	1.6	
	Inactive	1.7	
Thrust Bearing Pads	Active	1.3	
	Inactive	1.8	
<u>115-HT(Hydraulic Turbine)</u>			
Shaft Journal	Thrust End	1.2	
	Non Thrust End	1.4	
Journal Bearing	Thrust End	2.3	
	Non Thrust End	1.7	
Thrust Collar	Active	2.1	
	Inactive	1.8	
Thrust Bearing Pads	Active	0.6	
	Inactive	1.7	

<u>115-JA (Gear Box)</u>			
Gear,Journal Bearing	North End	1.5	
	South End	1.2	
Pinion Journal Bearing	North End	2.2	
	South End	1.9	
Thrust bearing	Active	2.0	
	Inactive	2.1	
<u>115-JA (Pump)</u>			
Journal bearing sleeve	Thrust End	3.0	
	Non Thrust End	2.6	
Thrust Pads	Active	3.0	
	Inactive	2.8	
Thrust Bearing Base ring	Active	2.1	
	Inactive	2.0	
<u>103-JLT</u>			
Journal Bearing pads	Thrust End	1.4	
	Non Thrust End	1.9	
<u>103-JLP</u>			
Journal Bearing sleeve	Thrust End	1.4	
	Non Thrust End	1.9	
<u>103-JHP</u>			
Journal Bearing sleeve	Thrust End	1.7	
Shaft Journal	Thrust End	2.0	
<u>103-JAT</u>			
Journal Bearing Sleeve	Thrust End	2.0	
	Non Thrust End	1.3	
Thrust Bearing Pads	Active	1.4	
	Inactive	1.9	
Thrust Bearing Base ring	Active	1.7	
	Inactive	2.0	
Shaft Journal	Thrust End	1.7	
	Non Thrust End	1.4	
<u>103-JBT</u>			
Journal Bearing Sleeve	Thrust End	1.5	
	Non Thrust End	1.7	
Thrust Bearing Pads	Active	1.4	
	Inactive	1.6	
Thrust Bearing Base ring	Active	0.9	
	Inactive	6.6	0.3
Shaft Journal	Thrust End	1.5	
	Non Thrust End	0.8	

ANNEXURE-11

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1.	Location: 1 (Weld/HAZ) SG-1303,10-14 (H-36) On 108D converter outlet nozzle	P-22	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained ferrite and bainite structure. Where as at parent metal microstructure sows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	IIInd stage of creep degradations. Monitor after 1 year of service.
2.	Location: 2 (Weld/HAZ) SG-1303,10-14 (H-36) On 107C Gas inlet nozzle of pipe	P-22	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows ferrite and bainite structure. In situ spheroidization of bainite is observed. Indications of isolated creep cavities are observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
3.	Location: 3 (Weld/HAZ) SG-1303,09-10 (H-36) On 108D converter inlet nozzle	P-22	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained ferrite & bainite structure. Where as at parent metal microstructure shows non-uniformly distributed fine-grained ferrite and bainite/pearlite structure. In-situ spheroidization of bainite/pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
4	Location: 4 (Weld/HAZ) SG-1303,09-10 (H-36) On 108D converter inlet nozzle of bend at bottom	P-22	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained bainite and ferrite structure. Where as at parent metal microstructure sows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	SEM interpretation is kept below to find out the degradations based on creep damage.
	Location: 4 SEM Observation after gold sputtering	P-22	Microstructure is free from creep damage at the grain boundaries.	Monitor after two years of service
6	Location: 5 (Weld/HAZ) SG-1303,11- 14(H-34) On 107C Gas outlet nozzle & HAZ of pipe	P-11	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows in situ spherodization of ferrite and pearlite/bainite structure. Indications of isolated creep cavities are observed	IIInd stage of creep degradations. Monitor after 1 year of service

7	Location: 6 (Weld/HAZ) SG-1303,11-14(H-34) On 107C Gas outlet nozzle	P-11	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows in situ spheroidization of ferrite and pearlite/bainite structure. Indications of isolated creep cavities are observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
8.	Location: 7 (Weld/HAZ) SG-1303,10-14 (H-36) On 108D converter outlet nozzle of pipe	P-22	Weld microstructure shows ferrite and carbides in dendrite form. Microstructure at HAZ shows fine-grained ferrite and bainite structure. Where as at parent metal microstructure sows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	IIInd stage of creep degradations. Monitor after 1 year of service.
9.	Location: 8 (Parent Metal) 101B RISER NO.6	G-4852M	Microstructure shows network of primary precipitates including carbides in a cast structure. The primary and secondary precipitate seems to have coarsened within the matrix.	No significant degradation observed. Monitor after 1 year of service.
10	Location: 9 (Weld/HAZ) 101B RISER No.-6, Weldolet to Riser Weld Joint	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	It was recommended to grind the location by 500 microns and then take metallography. Microstrucure after grinding is kept below.
11.	Location: 43 (Weld/HAZ) 101B RISER No.-6, Weldolet to Riser Weld Joint (After Grinding)	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	Inter granular cracks are observed at HAZ even after grinding. SEM observation of the same is kept in the next page.
12.	Location: 43 SEM Observation after gold sputtering	G-4852M	Microstructure at HAZ shows inter-granular cracks and they are filled with oxide nature of scale. The nature of cracking seems to be due to creep as oriented creep cavities are observed near the crack regions.	Recommended by M/S TCR during next opportunity to repair the location.
13.	Location: 10 (Weld/HAZ) 101B Tube No.- 622, Weldolet to tube Weld Joint	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	It was recommended to grind the location by 500 microns and then take metallography. Microstrucure after grinding is kept below.

14.	Location: 44 (Weld/HAZ) 101B Tube No.- 622, Weldolet to tube Weld Joint (After Grinding)	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	Inter granular cracks are observed at HAZ even after grinding. SEM observation of the same is kept below.
15.	Location: 44 SEM Observation after gold sputtering	G-4852M	Microstructure at HAZ shows inter-granular cracks and they are filled with oxide nature of scale. The nature of cracking seems to be due to creep as oriented creep cavities are observed near the crack regions.	During next opportunity recommended to repair the location.
16.	Location: 11 (Weld/HAZ) SG-1303,11- 14(H-34) On 123C Gas outlet inlet nozzle	P-11	Microstructure at weld shows dendritic structure ferrite/carbides and bainite structure. Microstructure at HAZ shows fine & coarse-grained pearlite/bainite and ferrite structure. Parent metal microstructure shows fine-grained ferrite and pearlite/bainite structure. Ferrite observed at prior austenite grain boundaries.	IIInd stage of creep degradations. Monitor after 1 year of service.
17	Location: 12 (Weld/HAZ) SG-1303,11-14 (H-34) On 123C Gas inlet nozzle HAZ of bend	P-11	Microstructure at weld shows dendritic structure ferrite/carbides and bainite structure. Microstructure at HAZ shows fine & coarse-grained pearlite/bainite and ferrite structure. Parent metal microstructure shows fine-grained ferrite and pearlite/bainite structure. Ferrite observed at prior austenite grain boundaries.	IIInd stage of creep degradations. Monitor after 1 year of service.
18.	Location: 13 (Parent metal) SG-1303,10-14 On 108-D outlet to 107C Gas inlet elbow-5	P-22	Microstructure shows coarse-grained ferrite and bainite structure.	No significant degradation observed. Monitor after 1 year of service.
19.	Location: 14 (Parent metal) SG-1303,10-14 On 108-D outlet to 107C Gas inlet elbow-3	P-22	Microstructure shows fine-grained essentially ferrite and bainite structure. Indications of creep cavities are observed at grain boundaries.	IIInd stage of creep damage. Monitor after 1 year of service.
20	Location: 15 (Parent metal) SG-1303,10-14 On 108-D outlet to 107C Gas inlet elbow-2	P-22	Microstructure shows fine-grained ferrite-bainite structure. Initial stage of degradations in terms of carbide formation at bainite regions are observed however prior bainite regions are maintained.	IIInd stage of creep damage. Monitor after 1 year of service.

21	Location: 16 (Parent metal) SG-1303,10-14 On 108-D outlet to 107C Gas inlet elbow-1	P-22	Microstructure shows fine tempered bainite structure.	No significant degradation observed. Monitor after 1 year of service.
22.	Location: 17 (Parent Metal) SG-34-14 On face of gas outlet bend	P 11	Parent metal microstructure shows fine-grained ferrite and pearlite/bainite structure. Ferrite observed at prior austenite grain boundaries. In situ spheroidization of pearlite/bainite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
23.	Location: 18 (Weld/HAZ) SG-34-14 On weld & HAZ of gas outlet bend	P 11	Microstructure at weld metal shows ferrite and bainite in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite & pearlite/bainite structure. Parent metal shows fine-grained ferrite and pearlite/bainite structure. Initial stage of in-situ spheroidization of pearlite/bainite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
24.	Location: 19 (Weld/HAZ) SG-34-14 On weld & HAZ of pipe of gas outlet bend	P 11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite and pearlite/bainite structure. Parent metal shows fine-grained ferrite/pearlite structure. In-situ spheroidization of pearlite is observed. Indications of creep cavities are observed.	IIInd stage of creep degradations. Monitor after 1 year of service. It is recommended to evaluate microstructure under SEM after gold sputtering for Creep damage evaluation.
25.	Location: 19 SEM Observation after gold sputtering	P 11	Microstructure is free from any creep damage.	. IIInd stage of creep monitor after 1 year of service.
26.	Location: 20 (Weld/HAZ) SG-28-6" MICA-16 Up stream weld joint	Carbon steel	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.

27.	Location: 21 (Weld/HAZ) SG-26-6" MICA-14 Up stream weld joint	Carbon steel	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure with presences of few widmanstatten ferrites. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
28.	Location: 22 (Weld/HAZ) SG-27-6" MICA 13 Up stream weld joint	Carbon steel	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure with presences of few widmanstatten ferrites. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
29.	Location: 23 (Weld/HAZ) SG-27-6" MICA-15 Up stream weld joint	Carbon steel	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure. In situ spherodization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
30.	Location: 24 (Parent Metal) SG-1-12" On face of 1 st bend of gas intlet line	P-11	Microstructure sows fine-grained ferrite and pearlite structure. Ferrite observed at prior austenite grain boundaries. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
31.	Location: 25 (Parent Metal) SG-1-12" On face of 3 rd bend of gas intlet line	P-11	Microstructure shows fine-grained banded ferrite and pearlite structure. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.
32.	Location: 26 (Weld/HAZ) On Weld Between BW outlet Nozzle BW-11H-8" &103-C Shell at bottom towards East side	P-11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse grained ferrite/pearlite structure. Parent metal shows fine grained ferrite/pearlite structure. Initial stage of in-situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.

33.	Location: 27 (Weld/HAZ) On weld bet ⁿ . flange & Bend of gas inlet nozzle.PG-6-18" towards east side of 103-C	P 11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse-grained essentially ferrite structure. Parent metal shows fine grained essentially ferrite structure. Indications of creep cavities are observed at grain boundaries.	II nd stage of creep degradations. Monitor after 1 year of service. It is recommended to evaluate microstructure under SEM after gold sputtering for Creep damage evaluation.
34.	Location: 27 SEM Observation after gold sputtering	P 11	Microstructure is free from any creep cavities.	II nd stage of creep monitor after 1 year of service.
35.	Location: 28 (Weld/HAZ) On Weld Between BFW outlet Nozzle BW-9H-8" & 103-C Shell at top towards East side	Carbon Steel	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure with presences of widmanstatten ferrites. In situ spheroidization of pearlite is observed.	II nd stage of creep degradations. Monitor after 1 year of service.
36	Location: 29 (Parent Metal) PIC 13B inlet spool piece	Carbon Steel	Microstructure shows fine-grained ferrite and pearlite structure. In situ spheroidization of pearlite is observed.	II nd stage of creep degradations. Monitor after 1 year of service.
37	Location: 30 (Parent Metal) MIC-22 Up stream piece	Carbon Steel	Microstructure shows fine & coarse-grained ferrite and pearlite structure. In situ spheroidization of pearlite is observed.	II nd stage of creep degradations. Monitor after 1 year of service.
38	Location: 31 (Parent Metal) On face of 1 st Elbow of NG-9-12" (101B-mixed feed coil outlet to NG-11)	P 11	Microstructure shows essentially fine-grained ferrite and spheroidal carbide structure. Degradation of pearlite observed in terms of spherodization. Possibilities of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service. It is recommended to evaluate microstructure under SEM after gold sputtering for Creep damage evaluation.
39	Location: 31 (Parent Metal) SEM Observation after gold sputtering	P 11	Microstructure shows isolated creep cavities at the grain boundaries. initial stage of alignment of cavities are observed.	Creep cavities are present. II nd stage of creep monitor after 2 year of service.

40.	Location: 32 (Weld/HAZ) On weld bet ⁿ . Pipe & Elbow(elbow side) of NG-9- 12" (101B- mixed feed coil outlet to NG-11)	P 11	Microstructure at weld shows ferrite and bainite in dendritic form where as at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows essentially fine-grained ferrite and spheroid carbide structure. Degradation of bainite is observed. Possibilities of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service.
41.	Location: 33 (Weld/HAZ) On weld bet ⁿ . Pipe & Elbow(pipe side) of NG-9- 12" (101B- mixed feed coil outlet to NG-11)	P 11	Microstructure at weld shows ferrite and bainite in dendritic form where as at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows essentially fine-grained ferrite and spheroid carbide structure. Degradation of bainite is observed. Possibilities of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service. It is recommended to evaluate microstructure under SEM after gold sputtering for Creep damage evaluation.
42.	Location: 33 SEM Observation after gold sputtering	P 11	Microstructure shows creep cavities at the grain boundaries with indication of getting oriented in the direction of stress.	Creep cavities are present. Approaching 3 rd stage of creep monitor after 1 year of service.
43	Location: 34 (Weld / HAZ of P-11) On dissimilar Weld between pipe & Nozzle of header, NG- 9-12" (101B- mixed feed coil outlet to NG-11)	P 11 to 304H	Microstructure at parent metal (P11) shows fine-grained ferrite and carbides. Where as at HAZ microstructure shows fine and coarse-grained bainite and ferrite structure. Possibility of creep damage is observed at P11 side. Weld metal microstructure shows dendritic structure of ferrite pools in austenite matrix.	II nd stage of creep degradations. Monitor after 1 year of service. It is recommended to evaluate microstructure under SEM after gold sputtering for Creep damage evaluation.
44	Location: 34 SEM Observation after gold sputtering	P 11 to 304H	Isolated cavities are observed at the grain boundaries on P11 metal side.	Creep cavities are present. II nd stage of creep monitor after 1 year of service.
45	Location: 35 (Weld/HAZ) On dissimilar Weld Between pipe & Nozzle of Header, NG- 9-12" (101B- mixed feed coil outlet to NG-11)	304H to 304H	Microstructure at parent metal (SS 304H) shows austenite grains with twins whereas at HAZ microstructure shows coarse-grained austenitic structure, Weld metal shows dendritic structure of ferrite pools in austenite matrix.	Monitor after 1 year of service.

46	Location: 38 (Parent Metal) Pre reformer R-112 Outlet line pipe parent after 1 st outlet elbow	P-22	Microstructure shows ferrite and spheroid carbide structure. Degradation of bainite is observed. Possibilities of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service.
47.	Location: 39 (Weld/HAZ) Pre reformer R-112 Outlet line pipe to 2 nd elbow	P-22	Microstructure at weld shows ferrite and bainite in dendritic form where as at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows ferrite and spheroid carbide structure. Degradation of bainite is observed. Possibilities of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service.
48.	Location: 40 (Parent metal) SG-1303,10-14" On 108-D outlet to 107C Gas inlet elbow-4	P-22	Microstructure shows in situ spheroidization of ferrite/pearlite & bainite structure. Indications of isolated creep cavities are observed.	II nd stage of creep degradations. Monitor after 1 year of service.
49.	Location: 45 (Weld/HAZ) 101B Tube No.- 722, Tube to Weldolet Weld Joint	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	SEM interpretation is kept on the next page to find out the degradations based on creep damage.
50.	Location: 45 SEM Observation after gold sputtering	G-4852M	Microstructure at HAZ shows inter-granular cracks and they are filled with oxide nature of scale. The nature of cracking seems to be due to creep as oriented creep cavities are observed near the crack regions.	During next opportunity recommended to repair the location.
51.	Location: 46 (Weld/HAZ) 101B Riser No.- 7, Riser to Weldolet Weld Joint	G-4852M	Microstructure at weld shows ferrite pools in austenite matrix with carbides, whereas HAZ microstructure shows coarse-grained austenitic grains. Microstructure at parent metal shows fine & coarse-grained austenitic grain with twins. Presence of inter-granular cracks observed at HAZ region.	SEM interpretation is kept on the next page to find out the degradations based on creep damage.
52	Location: 46 SEM Observation after gold sputtering	G-4852M	Microstructure at HAZ shows inter-granular cracks and they are filled with oxide nature of scale. The nature of cracking seems to be due to creep as oriented creep cavities are observed near the crack regions.	During next opportunity recommended to repair the location.

Note: Location no. 9/43, 10/44 and 45 are recommended by M/S TCR to repair during next opportunity. However, same shall be monitored during next turnaround in detail and at more number of points.

UREA PLANT

INSPECTION JOBS:

- Internal inspection of High-pressure vessels viz Autoclave (V-1201), H.P Stripper (H-1201/A), H.P Condenser (H-1202)
- Inspection of Autoclave liner weld repair job in Compartment no.2 & 4.
- Eddy Current Testing of H.P. Stripper(H-1201/A) tubes, H.P. Condenser(H-1202) tubes by M/s TesTex NDT India Pvt. Limited.
- Internal inspection of other vessels in the Plant.
- Ultrasonic thickness measurement of HP lines in the Plant. Detailed report is attached at **Annexure-1.**
- Ultrasonic thickness measurement of lines (recorded more than 20% reduction during 2009 Shutdown) other than H.P lines in the plant. Detailed report is attached at **Annexure-2.**
- Ultrasonic thickness measurement of selected Ammonia lines to assess their condition (see **Annexure-3** and also the condition under the piping supports, detailed report is attached at **Annexure-4.**
- Ultrasonic thickness measurement of various equipment in the Plant. Detailed report is attached at **Annexure-5.**
- Radiography and Thickness measurement of parent metal and butt weld joints of fittings of High pressure lines. **Annexure-6.**
- Dye Penetrant examination and radiography of weld joints of lines fabricated, erected and offered by Mech. Maint./Technical Department as per the requirement.
- Qualification tests of welders employed by contractors.
- Residual magnetism measurement and demagnetization, wherever required of Hitachi compressor (K-1801) Train. Detail report is attached at **Annexure-7.**
- Insitu-Metallography at selected spots on some equipment was carried out. Summary of observations and microstructure analysis is given at **Annexure-8.**
- The detailed observations and recommendations for corrective actions required on individual equipment are given below. All the observations were recorded during inspection and were handed over to concerned maintenance and operation group for necessary corrective action.

HIGH PRESSURE VESSELS:

High-pressure equipment of the Urea Plant was inspected. Main observations are listed here:

AUTOCLAVE (V-1201):

VISUAL INSPECTION:

Thorough visual inspection of the liner, its welds, trays, internals and all the nozzles at bottom dish end including its inside surface wherever possible was carried out. Observations made on each compartments are mentioned below.

Compartment No.1 (Top Compartment):

- Minor Roughening /corrosion of dome liner was observed and grayish oxide layer was observed on dome and man way surface.
- Dark brown – grayish patches observed on East side of shell liner. Liner plate piece just below dome liner was found silver bright in colour.
- Overflow pipe funnel top piece longitudinal weld & its T-junction weld found eroded and have developed crevice. **Marked as D1 & D2 for repair.**
- Bulging on petal weld East side approx. in 3” length, same was observed during previous inspection.
- 02 nos. fasteners were found missing for tray segment just below funnel.

Compartment No.2:

- Minor roughening of tray holding clits and grayish brown oxide layer was observed on bottom side of trays, same was observed during previous inspection.
- Bulging in shell liner in NE direction 300mm. below C-seam, same was observed during previous inspection.

Compartment No.3:

- Very minor roughening was observed on insert liner.
- Bulging of approx. 8mm depth and 2.5” width was observed behind tray skirt in SW to South direction, same was observed during previous inspection.
- One no. tray holding bolt was found missing.
- 03 nos. of tray holding clits were found black and found to have severe corrosion attack including its welding. **Marked as D3,D4 & D5 for repair.**

Compartment No.4:

- Slight roughening of insert liner plate and tray holding clits was observed.
- Approx. 30 mm below circumferential weld a depression of approx. 100 mm dia. and 3 mm depth was observed at west side liner. Same was observed during last inspection also.
- Convex bulging of liner plate observed just above circumferential weld by approx. 4 mm height in complete circumference. Same was observed during last inspection also.
- Concave depression of approx 2-5 mm depth observed at approx. 200mm below the C-seam in approx. 80% of the periphery. Same was observed during last inspection also.
- Grayish and brownish oxide layer was observed on the bottom side of trays.
- 02 nos. of tray holding clits were found black and found to have sever corrosion attack including its welding. **Marked as D6 & D7 for repair.**
- Concave depression of liner plate of approx 6 mm depth was observed at approx 160mm below C seam in North West direction in approx 100 mm area. Same was observed during last inspection also.

Compartment No.5:

- Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 3 to 9 mm height in almost all the periphery. The same was observed during last inspection also.
- Concave depression of approx 2-6 mm was observed at approx. 500 mm below the C-seam in full periphery. The same was observed during last inspection also.
- Grayish and brownish oxide layer was observed on the bottom side of trays.
- Approx. 750mm. of NW long seam was found to have corrosion leading to weld reinforcement reduction. Same was observed during last inspection also.
- 02 nos. of tray holding clits were found black in colour, however its welding was found satisfactory.
- Crevice was observed at both the longitudinal weld seam having length of approx. 10 mm and 200 mm respectively. **Marked as D8 & D9 for repair.**

Compartment No.6:

- Convex bulging of liner plate was observed above the circumferential weld joint by approx. 3 to 10 mm height, which starts from north-west to south-east direction in approx. Length of 4500 mm. The same was observed during last inspection also.
- Concave depression of approx. 5 mm depth was observed at approx. One meter below C-seam from East to West side L-seam through North side of the shell. The same was observed during last inspection also.
- NW long seam above C seam found corroded. The same was observed during last inspection also.

Compartment No.7:

- Convex bulging of liner plate was observed above the circumferential weld joint by approx. 2-6 mm height in approx. 3 mtr. Circumference from North-East to West through south side. The same was observed during last inspection also.
- Concave bulging 1200mm below C seam and max. 5 mm. depth in approx. 60% periphery
- 02 nos. of tray holding clits were found black and one no. found to have crevice in its welding. **Marked as D10 for repair.**
- 01 no. corrosion cavity above Circumferential weld seam in North direction. **Marked as D11 for repair.**
- Circumferential weld seam found eroded up to the level of liner in approx. 75 mm length at South side. **Marked as D12 for repair.**

Compartment No.8:

- Concave bulging at the elevation of approx. 300 mm above tray and 3 to 6mm. deep from East to South & from NE to NW. The same was observed during last inspection also.
- 03 no. crevice/corrosion cavities on upper C seam of Insert liner and 01 no. on west side T joint. **Marked as D13-14-15 &16 for repair.**
- 01 no. corrosion cavity on L seam above the C seam in East direction. The same was observed during last inspection also.

Compartment No.9:

- Crevice in East side long seam 80mm above tray. **Marked as D17 for repair.**

Compartment No.10:

- Concave depression of approx 7mm depth at approx 70mm below the C-seam in south side of shell in approx. 100 mm dia was observed. Same as last Inspection.
- Concave depression of approx. 9 mm depth just above the C-seam towards the south side of man way and adjacent to L-seam in approx. 100 mm dia. was observed. Same as last Inspection.
- Vertical bulging of approx. 2-3 mm height 25mm wide was observed from the C-seam to the bottom of the compartment in north side of the shell. The same was observed during last inspection also.
- Concave depression of about 5mm depth at approx 70mm below C seam in west side just adjacent to L seam was observed in 100 mm area. The same was observed during last inspection also.
- 100mm. dia & 4 mm. concave bulging was observed in NE direction approx. 25mm. above tray. The same was observed during last inspection also.
- Crevice was observed on clit weld located on North side. **Marked as D18 for repair.**

Compartment No.11:

- Just below circumferential weld concave depression of approx. 4 to 6 mm depth in approx. 80mm dia. in North-West direction was observed. The same was observed during last inspection also.
- concave depression of approx. 5mm and 9mm deep in approx. 100mm dia. was observed just below the C-seam in north and west side of the shell respectively. The same was observed during last inspection also.
- 10 to 12 mm gap was observed between tray and shell liner from East to South side. The same was observed during last inspection also.
- On new liner segment convex bulging up to max. 3 mm height having width approx. 10 mm observed just above circumferential stitch welds (approx. 125 mm long). Same was observed during last Inspection also.
- Concave depression of about 5-6 mm was observed just above and below of C-weld in old and new liner. The same was observed during last inspection also.

Compartment No.12 (Bottom Compartment.):

- South side tray skirt is touching the shell liner. The same was observed during last inspection also.
- Down comer nozzle with dish end liner weld joint edges were observed exposed. The same was observed during last inspection also.
- Dark brown coloration on dish end. The same was observed during last inspection also.

- Concave depression of approx. 2-3 mm and approx. 5mm were observed at approx. 70mm above the C-seam in 4" dia in east and west direction of the shell respectively. The same was observed during last inspection also.
- Underside corrosion of tray bottom face has been observed at the location of Tray Segment joint. Approx. depth 1-2mm. The same was observed during last inspection also.
- 8" NB Carbamate inlet nozzle (from East) was found having 01 no. corrosion cavity. **Marked as D18 for repair.**
- Downcomer Fillet weld was found to have 03 nos. crevice cavities/undercut. **Marked as D18-19 & 20 for repair.**
- 3" Ammonia inlet nozzle found to have linear indication at its face, OD & ID. **Marked as D21 for repair.**

NOTE:

- Total 21 no. repairs D1 to D21 counting from top to bottom compartment were marked.
- Repair / welding of Long seams and Circumferential seams in compartment no. 2 & 4 from top.
- Severe etching observed on Downcomer in almost all the compartment.
- Ferrite was also measured on liner & welds, found Nil.
- NE-North East, SW-South West, NW-North West, SE- South East
- Long seam, C-Circumferential seam.
- In general, few tray holding bolts and tray segment fasteners were found loose in all the compartments hence it may be checked

REPAIR / WELDING JOB IN COMPARTMENT NO. 2& 4:

It was decided to carry out repair and re-welding of 02 nos. Longitudinal and only circumferential weld seam in Compartment no. 2 & 02 nos. longitudinal weld seams and only circumferential weld seam of old liner in Compartment no. 4.

The job was carried out by M/s Shri Ganesh Engg Co. The welder qualification test was carried out well before starting of the job to avoid any hindrance.

Steps for repair of the liner weld joints:

- Removal of existing weld crowning by grinding up to the surface of the liner.
- D.P. testing the flushed area and removal of any defect if observed.
- Welding by using 25-22-2 LMn filler wire dia. 2.4mm. Ferrite measurement was carried out in between welding job and found NIL.
- Final D.P. test.
- Clean and passivity the weld by washing with 10% HNO₃ and rinse with plenty of DM water.

DPT OF NOZZLES IN BOTTOM DISH END OF AUTOCLAVE:

Dye Penetrant testing of following nozzles was carried out in bottom dome of Autoclave and the observations are mentioned below:

- C1A/B 200NB Carbamate Inlet from H-1202 : 01 no. corrosion cavity observed.
Repaired, D.P. tested and found Satisfactory
- C3 80NB Ammonia Inlet Nozzle:
Cracks were observed in both longitudinal and circumferential direction on parent metal of the nozzle. All these were ground and re-welded. After re-welding, the nozzle was DP tested & Found satisfactory.
- C4 200NB Urea/Carbamate to H-1201: 03 nos. crevice cavities/undercut observed. Repaired, D.P. tested and found satisfactory
- C5 100 NB Carbamate inlet from Scrubber: Found satisfactory

THICKNESS MEASUREMENT:

Main Liner Thickness				
Location	Min. (mm)	Max. (mm)	Remarks (Mini.thk. observed on)	Design/ Installed Thk.(mm)
Compartment 1	3.79	4.94	East side.	5.00 (old)
Compartment 1 750 mm section BC.05 – replaced in 2002	6.76	7.03	South side.	6.50 (new)
Compartment 2	3.59	5.19	East side.	5.00
Compartment 3	3.64	4.79	East side.	5.00
Compartment 4	3.86	4.64	West side	5.00
Compartment 5	4.14	5.17	North side	5.00
Compartment 6	3.91	4.91	North side	5.00
Compartment 7	4.30	4.99	North side	5.00
Compartment 8	4.24	4.89	North side	5.00
Compartment 9	4.23	4.93	East side	5.00
Compartment 10	4.44	5.45	East side	5.00
Compartment 11	4.21	4.82	West side	5.00
Compartment 12	4.58	4.62	North side	5.00

Downcomer Thickness				
Location	Min. (mm)	Max. (mm)	Remarks	Design/ Installed Thk.(mm)
Compartment 2	7.08	7.65	The Complete Down-comer was replaced in S/D 1997.	10.00
Compartment 3	7.03	7.15		10.00
Compartment 4	7.07	7.46		10.00
Compartment 5	7.05	7.35		10.00
Compartment 6	7.38	7.87		10.00
Compartment 7	7.44	7.70		10.00
Compartment 8	7.65	7.86		10.00
Compartment 9	7.68	8.28		10.00
Compartment 10	8.37	8.45		10.00
Compartment 11	8.69	8.97		10.00

Tray Thickness measurement				
Location	Min. (mm)	Max. (mm)	Remarks	Design/ Installed Thk.(mm)
Compartment 1	4.91	5.20	The Trays were replaced in S/D 1997.	8.00
Compartment 2	4.79	5.14		8.00
Compartment 3	4.91	5.44		8.00
Compartment 4	5.21	5.51		8.00
Compartment 5	5.46	5.61		8.00
Compartment 6	5.65	6.06		8.00
Compartment 7	5.74	6.08		8.00
Compartment 8	6.05	6.93		8.00
Compartment 9	6.97	7.25		8.00
Compartment 10	7.16	7.68		8.00
Compartment 11	7.47	8.02		8.00

OTHER AREAS:

LOCATION	MIN.	MAX.		DESIGN.
Man way	6.88	7.02	Replaced 2002	6.5
Top dome	6.61	6.76	Replaced 2002	6.5
Bottom Dome	6.25	6.78	Replaced 1993	6.5
Reducer 10"	10.10	10.20		10.00
Reducer 8"	10.17	10.45		10.00
Distance Piece 8"	5.25	6.28	Replaced 2000	6.00
Nozzle Pipe 8"	4.67	5.19		6.00

INSERT LINER:

Compartment Nos.	Min. Thickness (MM)	Max. Thickness (MM)	Installed Thickness (MM)	Year of Replacement
3	6.80	6.97	-	1997
4	6.29	6.87	-	1999
8	6.48	6.73	-	2000
9	6.67	7.06	-	2001
10	6.59	6.65	-	2002
11	6.50	6.84	-	2002

HP STRIPPER (H-1201/A):**VISUAL INSPECTION:****TOP CHANNEL:**

- The condition of sealing face was satisfactory.
- A thin blue grey oxide layer covered the overlay welding and liner in the gas phase (man way, dome and part of cylinder), except for the areas between the strip beads. The liner and liquid inlet box in the liquid phase were grey and slightly etched. No corrosion has been observed.
- The overlay welding on the tube sheet was grey and slightly etched.
- The tube welds were bright and smooth. At some places between the tubes oxide deposition was observed on tube sheet area.
- The tubes were found smooth from inside.
- At the central tube sheet area some of the tube ends were found having minor damage.

BOTTOM CHANNEL:

- The condition of sealing face was found satisfactory.
- The overlay welds in the man way were grey and slightly etched.
- The overlay welds in the hemi-head were grey and etched.
- The liner in the cylindrical section was found having scattered brownish grey coloration.
- The tube sheet was covered with a thin blue grey oxide layer.
- The tubes from inside were smooth.
- The liquid outlet pipe and the gas inlet pipe were bright, shiny and showed no defects. Their nozzles and welds were in satisfactory condition.

BOTTOM COVER:

- The sealing face was in good condition.
- The overlay welding was very smooth and shows no defects.
- The vortex strips were in good condition.

THICKNESS MEASUREMENT:

The weld overlay thickness is measured with a Fischer Dual Scope MP40 & liner thickness was measured using Panametrics MG-2XT.

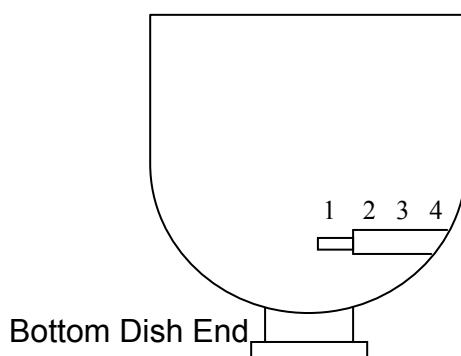
BOTTOM DOME:

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	19.2	23.90	8.0
Dome area (Overlay)	12.3	14.22	8.0
Cylindrical area (Liner)	8.20	10.90	8.0
Tube sheet-Overlay weld	13.2 (Machined)	15.4 (Machined)	8.0
Bottom Cover (Overlay)	15.9	19.0	8.0

TOP DOME:

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness, mm (Minimum)
Man way (Overlay)	19.2	23.9	8.00
Dome area (Overlay)	11.4	13.75	8.00
Cylindrical area (Liner)- Gas phase	8.14	8.74	8.00
Cylindrical area (Liner)- Liquid phase	8.10	8.86	8.00
Tube sheet-Overlay weld	12.2 (Machined)	14.9 (Machined)	8.00

RADIOACTIVE SOURCE WELL:



POINT NO.	DESIGN THK.	MEASURED THICKNESS			
		EAST	WEST	TOP	BOTTOM
1	7.5	8.68	8.23	8.77	8.27
2	19.0	18.68	18.19	18.90	18.53
3	19.0	18.85	18.23	18.91	18.61
4	19.0	18.82	18.34	18.86	18.66

All measurements are in mm.:

FERRITE MEASUREMENT:

Ferrite measurement was carried out at random locations on welds and parent metal. No ferrite was found.

EDDY CURRENT TESTING OF TUBES:

Eddy current inspection of tubes was carried out by M/s TesTex NDT India Pvt. Ltd. on 2599 tubes of Urea stripper from top tube sheet end to 4.5 meters maximum. 01 tube was plugged before inspection. (Total no of tubes 2600). The Results are as under:

- Wall loss: 0.300 to 0.500 mm observed in 924 tubes
- Wall loss: 0.510 to 0.600 mm observed in 1624 tubes
- Wall loss: 0.610 to 0.640 mm observed in 47 tubes
- Wall loss: 0.641 to 0.689 mm observed in 4 tubes

Result and Conclusion: It was observed that majority of the wall thinning 2nd to 5th baffle from top tube-sheet. (Tube sheet layout attached at **Annexure-9**)

H.P. CONDENSER(H-1202):

VISUAL INSPECTION:

TOP COVER:

- The liner was found grey and etched.
- Liquid inlet line welds were found bright and smooth.

TOP CHANNEL HEAD:

- The gasket sealing face was found satisfactory.
- The liner and welds in the man way were shiny and smooth.
- The liner and welds in the channel were shiny and slightly rough.
- The liners adjacent to the gas inlet were partly covered with a bluish grey oxide scale.
- 01 nos. crevice/corrosion cavity was observed on dome liner longitudinal weld joint and 01 on neck weld joint at North-West side.
- Minor roughening was observed on the tube sheet overlay near tube sheet to channel circumferential weld joint in complete periphery. It was observed more predominant in West & South direction.
- The tray support clips were shiny and slightly etched.
- The tube-to-tube sheet welds were found satisfactory.
- The few tube ends were found slightly damaged.
- Condition of the patch plates were found satisfactory.
- Many tube showed burn-through at ID of tube, these were also observed in earlier inspections.

BOTTOM CHANNEL HEAD:

- The sealing face was found satisfactory.
- The man way liner was shiny and smooth.
- In the hemi-head and cylindrical area the liner was silvery, shiny and etched.
- All liner welds and repairs were bright and smooth.
- The tube to tube sheet welds were bright shiny and smooth.
- Many tubes showed burn-through defects, these were also observed in earlier inspections.

BOTTOM COVER:

- The sealing face was found satisfactory.
- The liner was shiny and slightly etched.
- The vortex breaker and welds were smooth and intact.

THICKNESS MEASUREMENT:

Weld Overlay and Liner thickness measurement:

The wall thickness of the liner was measured using a Panametrics MG2-XT (accuracy 0.01 mm). The weld overlay thickness has been measured using a DualScope MP40.

BOTTOM DOME:

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness (mm)
Man way (Liner)	4.05*	7.48	6.0
Dome area (Liner)	6.67	7.02	6.0
Cylindrical area (Liner)	6.67	7.20	6.0
Tube sheet-Overlay weld	10.8	13.3	8.0 (Min)
Bottom Cover (Liner)	18.95	19.63	18.0

*Near vertical seam (Thickness was observed in the same range during previous inspection also)

TOP DOME:

	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Liner)	6.10	7.32	6.0
Dome area (Liner)	6.45	6.91	6.0
Cylindrical area (Liner)	6.32	6.98	6.0
Tube sheet-Overlay weld	10.3	14.4	8.0 (min)
Top Cover(Liner)	19.3	19.95	18.0

FERRITE MEASUREMENT:

- Random Ferrite measurement was carried out on welds and parent metal.No Ferrite was found.

EDDY CURRENT TESTING OF TUBES:

Eddy current inspection was carried out by M/s TesTex NDT India Pvt. Ltd. Total tubes in H.P. condenser are 1970 out of which 220 tubes were tested for 12000mm tube length and 1732 tubes tested for 3000mm length. 10 tubes could not be tested due to tray support pads obstructing the probe. 08 tubes were plugged before inspection. The observations are as under:

- No reduction in wall thickness or any abnormality was detected in inspected tubes with compare to Calibration tube.

(Tube sheet layout attached at **Annexure-10**)

INSPECTION OF H.P. LINE TAPPINGS:

Following activities were carried out on H.P. Line tapping:

- Radiography of butt weld joints of weldolet to nozzle &
- Thickness measurement of parent metal.

The detailed report is attached in **Annexure-6**.

INSPECTION OF H.P. AMMONIA LINES AT LOCATION OF PIPE SUPPORTS:

Detailed thickness measurement and visual inspection was carried out on the location of Supports provided on the H.P. Ammonia lines. All the supports were removed by Maintenance and offered for inspection.

The detailed report is attached in **Annexure-4**.

INSPECTION OF OTHER VESSELS:

H-1104 (CO₂ SPRAY COOLER):

- Demister pad condition was found satisfactory.
- Rectangular Risers holding clamps with Liquid distributor tray were found loose at several locations.
- Fasteners of hold down plate were found missing in East & West direction.
- Foreign material were lying on the Liquid distributor tray, need to be removed.
- Weld joint condition was found satisfactory.

H-1207(CIRCULATION SYSTEM –II COOLER):

- Heavy corrosion/ pitting and scaling was observed on the tube sheet area.
- Channel cover was found heavily pitted / corroded from inside.
- Scaling was observed on the inside surface of all tubes.
- CW return line at the top was found having thick milky scales.

H-1352 (REFLUX CONDENSER):

TOP TUBE SHEET:

- Tube to tube sheet welding was found satisfactory.
- Hard scaling was observed on the inside surface of all the tubes and also on tube-sheet area.

BOTTOM TUBE SHEET:

- Tube to tube sheet welding was found satisfactory on CW inlet side.
- Thick scaling was found on the CW outlet side tube sheet.
- On cooling water outlet side, hard creamy scaling was observed inside all the tubes and on the tube projections.
- Paint inside the channel area was observed peeled off & thick scales were found sticking on channel and baffle plate.
- Thermowells were found intact in position, however CW outlet side thermowell was found covered with paint/scaling.

H-1419 (PRE-EVAPORATOR CONDENSER):

TOP TUBESHEET:

- Tube to tube sheet weld was found satisfactory.
- Minor whitish scaling was observed inside the tubes.
- Brownish coloration was observed on the tube sheet at scattered location.
- Overall condition of heat exchanger was found satisfactory.

H-1420 (FINAL CONDENSER):

- Top & bottom tube to tube sheet welding was found satisfactory.
- Rusting/ brownish scaling was observed on inside surface of channel covers.
- Inside surface of the tubes was found clean.

H-1423 (FIRST STAGE EVAPORATOR CONDENSER):

- Tube to tube sheet welding was found satisfactory.
- Brownish scaling was observed on the tube to tube sheet weld joints.
- Minor scales were observed inside few tubes.
- Tube sheet was found brownish in coloration.
- All the tubes were found filled with water.

H-1424 (2nd STAGE EVAPORATOR):

- Bright surface was observed inside the vessel.
- Impingement cone was found bent in downward direction.
- Debris was found on the bottom of the dish end.
- Water was found accumulated in the impingement cone.

H-1425 (SECOND EVAPORATOR FIRST CONDENSER):

- Tube to tube sheet welding was found satisfactory..
- Minor scales were observed inside few tubes.
- Overall condition of heat exchanger was found satisfactory.

H-1426 (SECOND EVAPORATOR SECOND CONDENSER):

- Tube to tube sheet welding was found satisfactory.
- Thick brownish scales were observed on the tube sheet.
- All the tubes were found filled with water.

H-1814-A AND H-1814-B (L.O. COOLER OF HITACHI COMPRESSOR):

- Condition of tubes and tube sheet was found satisfactory.
- Most of the epoxy coating was found peeled off in the dome covers of H-1814A/B.
- Erosion on Flanged weld joint of H-1814-B dome cover (West end) was observed from Inside.

H-1815 (SURFACE CONDENSER FOR HITACHI COMPRESSOR):

NORTH SIDE HALF (EAST SIDE COVER):

- Tubes and tube sheet surface condition was found satisfactory.
- Epoxy coating was found peeled off at several locations.
- Thermo-well was found intact in position.

NORTH SIDE HALF (WEST SIDE COVER):

- Tubes and tube sheet surface condition found satisfactory.
- Epoxy coating was found damaged at many locations resulting in minor corrosion of shell material underneath.
- Thermo-well was found intact in position.

SOUTH SIDE HALF (WEST SIDE CHANNEL):

TOP HALF:

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside the tubes.
- Epoxy coating was found peeled off on baffle plate, channel & cover.
- Edges of the shell flange I.D. & Baffle plate were found eroded.

BOTTOM HALF:

- Tube sheet was found in satisfactory condition.
- Loose dust particles were observed inside the tubes.
- Thermowell was found intact.

SOUTH SIDE HALF (EAST SIDE CHANNEL):

TOP HALF:

- Tube sheet was found in satisfactory condition.
- Epoxy coating was found peeled off at few locations.
- Thermowell was found intact.

BOTTOM HALF:

- Tube sheet was found in satisfactory condition.
- Epoxy coating was found peeled off in channel area and also from the channel cover.

T-1301 (AMMONIA WATER TANK):

- Brownish coloration was observed on bottom plate and bottom half of shell and silver bright coloration was observed on top half of shell.
- Bottom plate was found bulged upwards at various locations. Same was observed in past inspection also.
- Weld joints and nozzle condition was found satisfactory.
- Tack weld of 2" line in East with bottom plate was found broken, need to be tacked. Marked with yellow chalk.
- Thermowell condition was found satisfactory.
- Internal surface of the shell was found oily.
- Condition of the Roof was found satisfactory.

T-1301-A (NEW AMMONIA WATER TANK):

- Brownish coloration was observed on bottom plate & bottom half of shell and silver bright coloration was observed on top half of the shell.
- All the weld joints and nozzle condition was found satisfactory.
- Thermowell was found intact.
- Overall condition was satisfactory.

T-1401 (UREA SOLUTION TANK):

- Bottom plate was observed having bulging upward near bottom plate to shell weld joint almost in complete periphery. It has been observed in the past inspections also.
- Weld joints condition was found satisfactory.
- Dark brown coloration was observed inside the tank.
- Stiffener provided on top roof plate was found intact in position.

T-1401-A (NEW UREA SOLUTION TANK):

- Brownish gray coloration was observed inside of the shell.
- Nozzles and weld joint condition was satisfactory.
- Overall condition was found satisfactory.

T-1501 (CONDENSATE TANK):

- Condition of weld joints was found satisfactory.
- Reddish brown coloration was observed inside the tank.
- 01 number support of 6" condensate inlet (west most) line was found broken.
- Water was found at the bottom of the tank.
- Overall condition of the tank was found satisfactory.
- Pitting was observed at the bottom of all condensate inlet lines.
- Thickness measurement was carried out and found satisfactory.

V-1101 (CO₂ KNOCK OUT DRUM):

- Epoxy paint was found loose, broken & peeled off almost in complete area of the vessel, found more prominent in bottom dish & 1st course. However, primer at these locations was found intact and no sign of corrosion underneath was observed.
- 03 nos. demister pads in West half were found lifted upward, need to be fixed. 2nd no. pad in East half from North was also found slightly lifted, need to be fixed. At few locations it was found with yellow colour debris.

V-1102 (NH₃ SUCTION FILTER):

- Colouration of vessel was found brownish from inside.
- Filter support ring and strips were found intact.
- Condition of the weld joint was found satisfactory.
- Condition of SS filter was found satisfactory.

V-1103 (NH₃ SUCTION VESSEL):

- Brownish colouration was found inside the vessel.
- The condition of longitudinal and circumferential weld joints was found satisfactory.
- Oily layer was found on the bottom dish end, shell and man way.
- Grayish colouration patch was observed on the top dome of the vessel.

V-1202 (RECTIFYING COLUMN):

FROM TOP MANHOLE:

- Colouration of vessel was grayish at manhole, dome and shell portion.
- Grey hard scales were observed on the top dish end and also on the shell portion.
- Some of the tacked nuts on the tray support ring was found having bolts with sheared head.
- 04 nos. nuts were found missing from the grating support ring in the man way.
- Cleats for holding the trays have fastener holes, these holes were observed elongated downwards.

FROM BOTTOM MANHOLE:

- Colouration of top cone was silver with black patches where as brown colouration was found on bottom-dish end and shell portion.
- Thick scaling was observed on shell just below dome to shell circumferential weld seam.
- Condition of the nozzles was found satisfactory.

V-1203 (L.P. ABSORBER):

FROM BOTTOM MANHOLE:

- Colouration of shell was observed brownish black whereas in some areas it was grayish.
- Bulging of appx. 30-35mm deep was observed in approx 01 feet dia. in west side of shell above Cir. Seam near nozzle of LIC-1203.
- Cracks of appx. 3 to 4 mm detected by dye penetrant test above nozzle of LIC-1203.
- 01 no. nut missing and 03 nos. nut found loose of grid support channel.

FROM TOP END:

- Coloration of shell was observed grayish black.
- Perforated support grid just below top hand hole was found intact in position.

V-1207 (L.P. SCRUBBER):

- Coloration of shell portion was observed grayish black.
- Grating condition on top was satisfactory. However, one no. nut was missing from the grating holding bolts.
- Condition of the top cover was found satisfactory.
- Irregular and insufficient welding was observed in ID of 4" nozzle at bottom end of the vessel in west direction. This was also observed in earlier inspections.

V-1301 (SECOND DESORBER):

BOTTOM COMPARTMENT:

- Brownish coloration was observed inside the vessel.
- One clamp of the tray was found loose and tied with the adjacent one with wire.
- Nozzle condition was found satisfactory.
- Thermowell was found intact.

TOP COMPARTMENT:

- Brownish coloration was observed inside the vessel.
- All fasteners and clamps of the tray were found in good condition.
- Top nozzle was found satisfactory.

V-1351 (HYDROLYSER):

Visual inspection of Hydrolyser was carried out (top compartment) and the observations are as follows

TOP COMPARTMENT:

- Top dish end and shell has assumed brownish black coloration. Oily surface & brownish sludge was found sticking on the edge of trays and shell.
- Blackish hard sludge was found sticking on North side of the shell (need to be cleaned).
- Brownish coloration was observed on the trays.
- Fasteners of top sieve tray were found intact in position.
- Condition of top sieve tray was found satisfactory.
- All nozzles in the east side on shell were found having loose scale from inside (need to be cleaned).

BOTTOM COMPARTMENT:

- Grayish black colouration was observed from inside.
- Oily surface was observed inside the vessel.
- 01 no. of fasteners of steam inlet flange was found loose. Need to be tightened.
- Condition of the trays, clamps & steam inlet pipe was found satisfactory.

V-1352 (FIRST DESORBER):

FROM BOTTOM MANHOLE:

- Brownish coloration was observed inside the vessel.
- Trays and its fasteners were found intact.
- Impingement plate was found intact.
- Weld joint condition was found satisfactory.

FROM TOP MANHOLE:

- Brownish coloration was observed inside the vessel.
- All fasteners were found intact
- Weld joint condition was found satisfactory.
- All internals were found intact in position.
- Leakage marks and channeling was observed from one of the inlet flange bolts of 1¹/₂" reflux line towards south. This was also observed in previous inspection.

V-1418 (PRE EVAPORATOR SEPARATOR):

- Grayish coloration at the top and brownish coloration at the bottom was observed in the vessel.
- Condition of the cone and weld joints was found satisfactory.
- Entire surface of the tube sheet was covered with grayish hard scales.
- Grayish hard scaling was observed inside the surface of all tubes.
- Tube to tube sheet weld appeared to be in satisfactory condition.
- Impingement cone was found in intact condition.
- Water was found on the bottom of the dish end.

V-1423 (1ST STAGE EVAPORATOR SCRUBBER):

Reddish Brown coloration was observed inside the vessel.

- Demister pads were found slightly damaged, loosened & lifted at several locations.
- Solidified urea solution particles were found adhered on demister pads at few locations.
- Support channels and outer ring of demister pads were found lifted in East direction, tied by metallic wires.
- Demister pad support rod was found detached in North side (marked with yellow chalk).
- 01 number nut of J- bolt was found missing & 01 number J- bolt was found loose (marked with yellow chalk).
- 01 number of bolt was found missing from top sieve tray in west side (marked with yellow chalk).
- 01 number bolt found missing from channel above sieve tray in west side. (marked with yellow chalk).
- In middle sieve tray, 02 number of bolts were found missing & 02 number of bolts were found loose near manhole (north side).
- 03 number of bolts were found missing from vertical tray in between top and middle sieve tray (marked with yellow chalk).

V-1501 (4 ATA STEAM DRUM):

- Shell and Dish ends were found Grayish with Reddish brown coloration at scattered locations.
- Distribution sparger was found intact in position.
- Demister pads were found intact in position and condition of the same was found satisfactory.
- Water was lying at bottom of the vessel.
- Condition of all the weld joints was found satisfactory.
- Minor pitting was observed on bottom of the shell.
- Hard scaling was observed on both the dished ends.

V-1502 (23 ATA STEAM DRUM):

- Brownish black coloration was observed inside the vessel.
- Scaling was observed at both dished ends.
- Overall condition was found satisfactory.
- Condition of distributor pipe was found satisfactory.
- Condition of all welds was found satisfactory.
- Condition of all nozzles was found satisfactory
- Condition of Thermowell pipe was found satisfactory.
- A pitting of 2-3 mm depth was observed above west manhole.
- Pitting of approx. 6mm dia and 2-3 mm depth was observed at both dish end.

V-1503 (9 ATA STEAM DRUM):

- Grayish black coloration was observed inside the vessel.
- Scattered scales were observed on both the dished ends.
- South side U-clamp of inlet steam header was found loose and its fasteners were found missing. Need to be provided.
- I.D. of 1" bottom nozzle for Level controller in East direction at center portion of the shell was found having pitting/cavities up to 1.5mm depth.
- Overall condition of the vessel was found satisfactory.

V-1811 (1ST STAGE SEPARATOR):

- Demister pads were found intact in position.
- Vortex breaker was found intact in position.
- Condition of the weld joints was found satisfactory.
- Demister drain pipe was found intact in position.
- Overall condition of the vessel was found satisfactory.

V-1812 (2ND STAGE SEPARATOR):

- Demister pads were found intact in position.
- Vortex breaker was found intact in position.
- Condition of the weld joints was found satisfactory.
- Demister drain pipe was found intact in position.
- Overall condition of the vessel was found satisfactory.

V-1813 (3RD STAGE SEPARATOR):

- Demister drain pipe (1" NB) seems to be detached from its weld joint and lying freely Inside the vessel (in vertical condition)

LO COOLER OF P-1102-A:

- Condition of tube to tube sheet weld was found satisfactory.
- Thick brownish scales were observed on the channel area & baffle plate.

LO COOLER OF P-1102-B:

- Thin creamy scales were observed inside the tubes.
- Thick brownish scales were observed on the tube sheet, channel area & baffle plate.

LO COOLER OF P-1102-C:

- Thin creamy scales were observed inside the tubes.
- Whitish powdered compound found adhered to the west side tube sheet.

LO COOLER OF P-1201- A & B:

- Condition of tube to tube sheet weld was found satisfactory.
- Overall condition of the coolers was found satisfactory.

T-1814 (OIL RESERVOIR FOR K-1801):

- Condition of all weld joints found satisfactory.
- Condition of all Nozzles and its weld joints found satisfactory.
- Overall condition of the tank was found satisfactory.
- Oil return Nozzle was found intact in position.
- Other nozzle (like RV, RV by pass, and Air line etc.) were found intact in position.
- Thickness measurement was carried out and readings are as under:
 - Thickness of Top/bottom plate was found in the range of 8.15 to 8.86mm.
 - Thickness of Side wall plates was found in the range of 5.73 to 6.13mm.
 - Thickness of Internal Partition plates was found in the range of 5.93 to 6.05mm.

ANNEXURE-1 (1/2)

UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY OF HP LINES

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
1	CO-F10-2119-PP25	8	160	23.01	K-1801,III	H-1813	19.20	16.56
2	CO-F10-2124	8	160	23.01	K-1801,DIS.	GA-1112	22.6	1.78
3	CO-F10-2140	4	160	13.49	K-1801,III	V-1813	13.1	2.89
4	CO-F10-2140	0.75	160	5.56	CO-F10-2140-PP25	DRAIN	5.6	-
5	CO-E10-2122	6	80	10.97	H-1813	V-1813	9.90	9.75
6	GA-1112	6	F2	14.20	K-1101-2	GA-1201	13.80	2.82
7	GA-1112	1.5	X1	5.08	FROM GA-1112	TO BYPASS	4.30	15.35
8	GA-1201	6	X4	13.33	GA-1112	H-1201	13.80	-
9	VENT	1.5		6.35			5.10	19.68
10	GA-1202	1	F2	6.35	GA-1112-6"	CHECK VALVE(GA-1203)	5.00	21.26
11	GA-1203	1	X1	4.51	GA-1202	H-1203	3.90	13.53
12	DRAIN	0.5		3.73			3.50	6.1
13	GA-1204	1	X1	4.51	H-1203	PR-1231	4.00	11.31
14	DRAIN	0.5		3.73			3.20	14.2
15	GA-1602	8	F2	22.83	K-1801	GA-1112	21.40	6.26
16	GA-1603	4	F2	11.13	GA-1602	GA-1604	10.30	7.46
17	MA-1106	6	120	14.27	P-1102-A	MA-1605	14	1.89
18	MA-1106	4	E2	8.56	P-1102-A	MA-1605	7.4	13.55
19	MA-1123	4	E2	8.56	P-1102/B	MA-1605	7.4	13.55
20	MA-1201	3	E2	7.62	MA-1605-6"	MA-1202-3"	7.3	4.20
21	MA-1201	2	E2	5.54	MA-1605-6"	MA-1202-3"	4	27.80
22	MA-1202	3	X4	7.62	MA-1201	V-1201	6.90	9.45
23	MA-1203	4	X4	9.14	MA-1106-6"	PR-1230	9.20	-
24	MA-1604	3	E2	7.62	P-1102 /C DIS.	MA-1604-4"	5.40	29.13
25	MA-1607	4	C2	6.02	MA-1605	MA-1116	5.6	6.98

ANNEXURE-1 (2/2)

UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY OF HP LINES

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
26	MA-1607	0.75	C2	3.91	DRAIN		3.1	20.72
27	PR-1201	8	X1	19.58	V-1201	H-1201	17.3	11.64
28	PR-1202	10	X1	24.33	HP-STRIPPER H-1201	HP-CONDENSER	21.10	13.28
29	PR-1203	8	X1	19.58	HP-COND H-1202	V-1201(VAPOR LINE)	19.2	1.94
30	PR-1204	8	X1	19.58	HP-CONDENSE R	V-1201(LIQUID LINE)	17.8	9.09
31	PR-1205	6	X1	15.24	PR-1205-8"	RECTIFYING COLUMN	14.2	6.82
32	PR-1205	8	X1	19.58	STRIPPER BOTTOM	V-1202	17.20	12.16
33	PR-1208	4	X1	10.40	AUTOCLAVE TOP	PR-1206-4"	8.9	14.42
34	PR-1213	2	X4	5.54	PR-1201	PR-1205-6"	4.4	20.58
35	PR-1212	4	X1	10.40	SCRUBBER	AUTOCLAVE BOTTOM	9.6	7.69
36	PR-1224	3	X4	7.62	P-1201B	PR-1638-4"	6.6	13.39
37	PR-1225	3	X4	7.62	P-1201A/B, PR1638-4"	H-1203	7	8.14
38	PR-1226	2	X4	5.54	PR-1224	H-1205	4.4	20.58
39	PR-1230	6	x1	15.24	MA-1203-4"	H-1202	14.4	5.51
40	PR-1230	1.5	x1	5.08	MA-1203-4"	H-1203	4	21.26
41	PR-1234	4	X4	10.41	PRC-1201(H-1203)	V-1203	9.6	7.78
42	PR-1234	3	X4	7.62	P-1201A	PR-1638-4"	6.6	13.39
43	PR-1637	4	9.14	9.14	P-1201C	PR-1638-4"	9.8	-
44	PR-1638	4	X4A	9.14	P-1201A/B/C	PR-1230-6"	12.60	-
45	PR-1666	2	X4A	5.54	PR-1637	PR-1226	4.80	13.36

ANNEXURE-2 (1/2)**UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY****(HAVING MORE THAN 20% REDUCTION)**

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
1	CO-E10-2139-PP25	4	80	8.56	CO-F10-2140-PP25, TV-1808	CO-E10-2112	7.00	18.22
2	CW-1201	16	B13	9.525	CW-1403,VIA F-1206 A/B	H-1206	5.5	42.26
3	CW-1203	10	B13	9.525	CW-1403	H-1207	8.0	16.01
4	CW-1204	10	B13	9.525	H-1207	CW-1405	5.4	43.31
5	CW-1210	10	B13	9.525	P-1202	H-1102	8.7	8.66
6	CW-1210	14	B13	9.525	P-1202	H-1102	8.2	13.91
7	CW-1217	6	B13	9.525	H-1209	CW-1409	5.4	43.31
8	CW-1218	6	B13	9.525	CW-1408	H-1209	6.5	31.76
9	CW-1351	12	B13	9.525	CWS 4410-42"-B13	H-1352	5.2	45.41
10	CW-1352	12	B13	9.525	H-1352	CWR 4410-42"-B13	6.1	35.96
11	CW-1352	4	B13	5.4	H-1352	CWR 4410-42"-B13	5.5	-
12	CW-1401	10	B13	9.525	CW-1403	H-1421	7.2	24.41
13	CW-1401	8	B13	9.525	CW-1403	H-1421	7.3	23.36
14	CW-1402	10	B13	9.525	H-1421	CW-1405	6.8	28.61
15	CW-1402	8	B13	9.525	H-1421	CW-1405	7.1	25.46
16	CW-1403	30	B13	9.525	B/L	H-1425	7.1	25.46
17	CW-1403	24	B13	9.525	B/L	H-1425	7.4	22.31
18	CW-1403	20	B13	9.525	B/L	H-1425	7.5	21.26
19	CW-1405	30	B13	9.525	H-1423	B/L	6.1	35.96
20	CW-1405	20	B13	9.525	H-1423	B/L	7.5	21.26
21	CW-1406	8	B13	9.525	CW-1403	H-1426	7.3	23.36
22	CW-1407	8	B13	9.525	H-1426	CW-1405 VIA H-1420	7.1	25.46
23	CW-1415	6	B13	9.525	CW-1403-30"-B13	H-1427	6.4	32.81
24	CW-1416	6	B13	9.525	H-1427	CW-1405-30"-B13	6.6	30.71
25	CW-1607	18	B13	9.525	CW-1403-	H-1419	5.4	43.31

ANNEXURE-2 (2/2)**UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY
(HAVING MORE THAN 20% REDUCTION)**

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
26	CW-1608	18	B13	9.525	H-1419	CW-1405-20"-B13	5.4	43.31
27	PR-1214	12	X6	4.57	V-1202	H-1204	4.6	-
28	PR-1214	8	X6	4.57	V-1202	H-1204	3.8	16.85
29	PR-1223	4	X3	3.06	LP SEPARATOR	P-1201 A/B SUCTION	2.8	8.50
30	PR-1260	6	X3	3.4	P-1210 A/B	H-1210	2.7	20.59
31	PR-1333	2	X3	2.77	P-1305A/B	H-1305	2.9	-
32	PR-1356	3	X7	3.05	V-1351	V-1352	2.6	14.75
33	PR-1359	4	X7	3.05	P-1351A/B	H-1351C	2.5	18.03
34	PR-1362	4	X7	3.05	V-1351,LIQ.	H-1351/A	2.60	14.75
35	PR-1403	6	X3	3.40	T-1401	P-1401/A	3.20	5.88
36	PR-1403	4	X3	3.05	T-1401	P-1401/A	2.80	8.20
37	PR-1404	4	X3	3.05	P-1401	V-1409	2.0	34.43
38	PR-1608	2	X6	2.77	H-1421	V-1200	2.0	27.80
39	PW-1301	4	X3	3.05	V-1301	H-1301	2.7	11.48
40	PW-1603	4	B2	7.02	PW-1352	T-1301-A	5.4	23.08
41	SC-1504	4	B4	6.02	V-1503	V-1501	4.8	20.27
42	SC-1523	3	B4	5.49	HEADER	SC-1409	3.7	32.60
43	ST-1205	12	C1	9.52	V-1502	H-1201	9.8	-

ANNEXURE- 3 (1/1)**H.P. AMMONIA PIPELINE THICKNESS MEASUREMENT**

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
1	MA-1102	6	C2	7.11	H-1102	V-1102	7.20	-
2	MA-1102	0.8	C2	3.91	H-1102	V-1102	3.70	5.37
3	MA-1102	1	C2	4.55	H-1102	V-1102	4.50	1.10
4	MA-1104	3	C2	5.49	V-1102	V-1103	5.70	-
5	MA-1104	6	C2	7.11	V-1102	V-1103	7.00	1.55
6	MA-1104	4	C2	6.02	V-1102	V-1103	5.50	8.64
7	MA-1105	6	C3	7.11	V-1103	P-1102-A	6.40	9.99
8	MA-1106-4"	4	E2	8.56	P-1102-A	MA-1605-6"	7.8	8.88
9	MA-1106-4"	1	E2	4.55	P-1102-A	MA-1605-6"	4.1	9.89
10	MA-1116	4	E2	8.56	MA-1106	V-1103	7.4	13.55
11	MA-1117	4	C2	6.02	RV-1103	MA-1116	4.88	18.94
12	MA-1122	6	C3	7.11	MA-1105	P-1102/B	6.1	14.21
13	MA-1125	4	C2	6.02	RV-1112	MA-1122	6.00	0.33
14	MA-1126	4	E2	8.56	MA-1128	MA-1116	8.00	6.54
15	MA-1126	1	E2	4.55	MA-1128	MA-1116	6.1	-
16	MA-1126	4	E2	8.56	P-1102/B	MA-1605	7.40	13.55
17	MA-1126	0.5	E2	3.73	P-1102/B	MA-1605	4.00	-
18	MA-1603	6	C2	7.11	MA-1122-6"	P-1102/CSUC	6.10	14.21
19	MA-1603	4	C2	6.02	MA-1122-6"	P-1102/CSUC.	5.20	13.62
20	MA-1603	0.75	E2	3.91	MA-1122-6"	P-1102/CSUC.	4.10	-
21	MA-1604	3	E2	7.62	P-1102 /C DIS.	MA-1604-4"	6.10	19.95
22	MA-1604	4	E2	8.56	MA-1604-3"	MA-1605-6"	8.1	5.37
23	MA-1604	1.5	E2	5.08	MA-1604-3"	MA-1605-6"	4.7	7.48
24	MA-1604	0.75	E2	3.91	MA-1604-3"	MA-1605-6"	3.1	20.72
25	MA-1605	6	E2	14.27	MA-1106	MA-1203	13.7	3.99
26	MA-1605	4	E2	8.56	MA-1106	MA-1203	7.2	15.89
27	MA-1605	0.75	E2	3.91	MA-1106	MA-1203	5.1	-
28	MA-1609	4	C2	6.02	MA-1603-6"	MA-1604-3"	5.20	13.62

ANNEXURE- 4 (1/3)

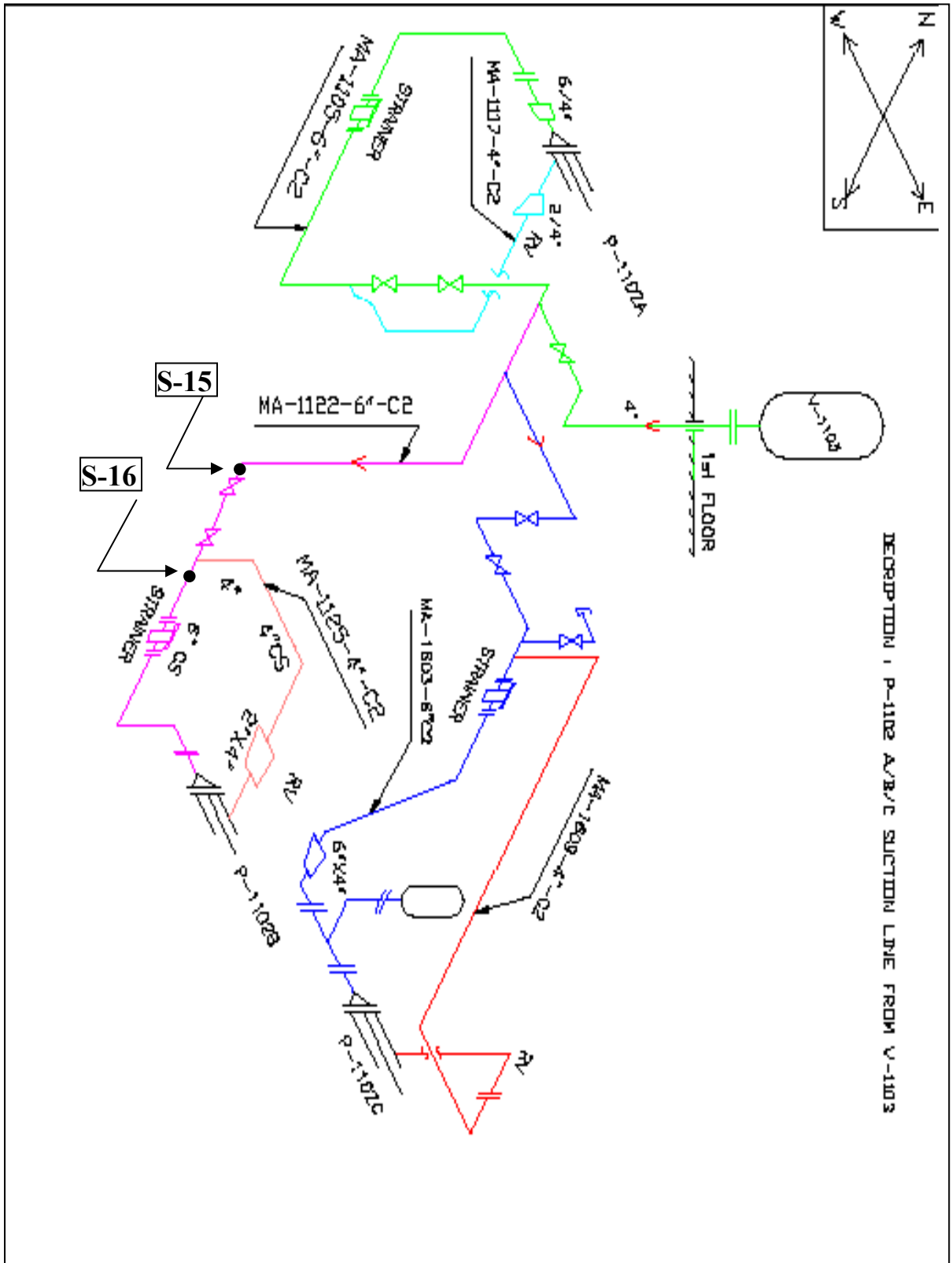
INSPECTION OF AMMONIA LINE CONDITION UNDER THE SUPPORTS

SUPP. NO.	SIZE	NOM. THK.	LOCATION OF MEASUREMENT						% RED.	REMARKS
			N	S	E	W	T	B		
1	4"	8.56	7.78	8.28	-	-	7.81	7.69	10.16	
2	4"	8.56	-	-	8.14	8.56	7.86	8.67	8.17	
3	4"	8.56	-	-	8.86	8.67	8.24	-	3.73	
4	4"	8.56	-	-	7.39	7.62	7.48	-	13.66	
5	4"	8.56	-	-	8.4	8.18	8.43	8.07	5.72	
6	4"	8.56	-	-	8.41	8.35	8.26	-	3.5	
7	4"	8.56	-	-	7.68	8.09	8.06	8.22	10.28	
8	4"	8.56	13.12	14.15	-	-	13.27	13.75	-	Measured on Dampner Nozzle
9	4"	11.12	-	-	11.8	11.12	11.81	-	-	Distance Piece
10	4"	11.12	-	-	14.7	12.4	12.8	-	-	Distance Piece
11	4"	8.56	-	-	7.17	7.03	7.05	-	17.87	
12	4"	8.56	13.6	13	-	-	14.2	14.3	-	Measured on Dampner Nozzle
13	4"	8.56	-	-	8.32	8.07	8.14	-	5.72	
14	4"	8.56	-	-	7.55	7.62	7.16	-	16.35	
15	6"	7.11	-	-	5.98	6.35	5.43*	-	23.62	Suction line Of P-1102-B
16	6"	7.11	-	-	7.52	7.68	7.71	-	-	Suction line Of P-1102-B

* Patch plate provided at this location.
All readings are in MM.

ANNEXURE- 4 (3/3)

INSPECTION OF AMMONIA LINE CONDITION UNDER THE SUPPORTS



ANNEXURE-5 (1/1)

UREA PLANT VESSEL THICKNESS MEASUREMENT SUMMARY

Sr. No	EQUIPT. No.	EQUIPT. Description	Shell			Dish End			Channel		
			Nom./ Design	Min./ Meas.	% Red.	Nom./ Design	Min./ Meas.	Red	Nom./ Design	Min./ Meas.	Red.
1	H-1205/A	ADDITIONAL L.P. CARBAMATE CONDENSER	12	12.3		10.0	10.4		8.0	8.3	
2	H-1207	CONDENSATE CIRCULATION SYSTEM-II WATER COOLER	10.0	8.8		13(N) 10(S)	8.6 (S) 9.6 (N)		8.0	10.4	
3	H-1207 A	CCS II SURFACE CONDENSATE HEAT EXCHANGER	10.0	10.1			9.1 (N) 8.5 (S)		8.0	8.3	
4	H-1418	PRE-EVAPORATOR SEPARATOR	12.0	11.5							
5	H-1420	FINAL CONDENSER		7.1			8.2			8.5	
6	H-1421	FLASH TANK CONDENSER	8.0	7.1		11(T) 7.0(B)	10.8 (T) 10.2 (B)				
7	H-1424	2ND STAGE EVAPORATOR /SEPERATOR	10.0	10.3		12.0	12.1				
8	T-1501	STEAM CONDENSATE TANK	10.0	9.8		10.0	10.1				
9	V-1204	STEAM CONDENSATE POT FOR H-1204	6.0	8.30							
10	V-1502	23 ATA STEAM DRUM	30.0	29.7		34.0	35.7				

ANNEXURE- 6 (1/2)

RADIOGRAPHIC / THICKNESS EXAMINATION OF HP UREA LINE FITTINGS

Sr No.	Fitting Identifi. No.	Line where Installed	Location		Size (OD)	Nom. Thick (mm)	Meas. Thick. (mm)	RT Observations	Result/ Remarks
1	TR-1201	V-1201 to H-1201	1st	Adjacent to Stripper	1.5" SCH 80	5.08	2.57-5.16	Thick-ness reduction observed.	Replacement recommended at available opportunity.
2	TR-1202	HPCC Liq O/L to V-1201	3rd	HPCC Bottom	1.5" SCH 80	5.08	4.30-4.69	Satisfactory	Satisfactory
3	TR-1203	Ammonia & Carbamate to HPCC	4th	HPCC Top	1.5" SCH 80	5.08	4.37-4.73	Satisfactory	Satisfactory
4	TR-1205	Ammonia to Autoclave	3rd	Autoclave Bottom	1.5" SCH 80	5.08	5.35-5.90	Satisfactory	Satisfactory
5	TR-1206	Autoclave Offgas to H-1203	5th	Autoclave Top	1.5" SCH 80	5.08	2.65-5.78	Thickness reduction observed.	Replacement recommended at available opportunity.
6	TR-1207	CO2 to HP Stripper	GF	Near Stripper Bottom	1.5" SCH 80	5.08	5.30-5.76	Satisfactory	Satisfactory
7	Elbolet TR-1209	Stripper Offgas to HPCC	4th	HPCC Top towards East	1.5" Weld	-	14.52-17.83	Satisfactory	Satisfactory
8	TR-1210	Stripper Liquid O/L Line	GF	Near Stripper Bottom	1.5" SCH 80	5.08	5.04-5.67	Weld Erosion observed.	Replacement recommended at available opportunity.
9	TI-1214	H-1203 to V-1201 Carbamate line	4th	Above 4 ata Steam Drum on P.T. Structure	1.5" SCH 80	5.08	4.31-5.65	Satisfactory	Satisfactory
10	TI-1209	Carbamate Pump Disch line to HPCC	3.5th	Near HPCC	1.5" SCH 80	5.08	5.87-6.20	Satisfactory	Satisfactory
11	HPF to PRCV-1201	H-1203 Offgas to V-1203	6th	East side from PRCV-1201	1" SCH 80	4.55	4.10-4.37	Satisfactory	Satisfactory
12	HPF to HICV-1202	V-1201 Offgas to H-1203	6th	North side from HICV-1202	1" SCH 80	4.55	3.91-4.52	Thickness reduction observed.	Replacement recommended in 2-3 Years.

ANNEXURE-6 (2/2)**RADIOGRAPHIC / THICKNESS EXAMINATION OF HP UREA LINE FITTINGS**

Sr No.	Fitting Identif- No.	Line where Installed	Location		Size (OD)	Nom. Thick. (mm)	Meas. Thick. (mm)	RT Observations	Result/ Remarks
13	HPF to FICV-1204	Carbamate Pump Discharge to H-1203	3.5th	South/ West corner of floor	1" SCH 80	4.55	3.08-4.54	Thickness reduction observed.	Replacement recommended in 2-3 Years.
14	HPF to Seal Isoln. Valve	Liquid Outlet from V-1201	GF	Near P-1102C North-East side	2" SCH 80	5.54	5.19-5.69	Satisfactory	Satisfactory
15	HPF to Carbamate line to HPCC	Carbamate Pump Disch to HPCC	3.5th	West-South side near HPCC	1.5" Weld	-	15.67-16.41	Satisfactory	Satisfactory
16	HPF to Ammonia line to HPCC	Ammonia Pump Disch to HPCC	3.5th	West-North side near HPCC	1.5" Weld	-	15-16	Satisfactory	Satisfactory

ANNEXURE-7 (1/2)
GAUSS MEASUREMENT & DEMAGNETIZATION REPORT OF
K-1801 (HITACHI COMPRESSOR)

DESCRIPTION	POSITION	BEFORE (Gauss-max.)	AFTER (Gauss max.)
TURBINE (FREE ENDSIDE)			
Journal Bearing Pads	Governor side	Top-0.4 Bottom-0.6	
Journal Bearing Base Ring	Governor side	Top-0.3 Bottom-0.9	
Shaft Journal	Governor side	0.8	
Thrust Collar	Governor side	1.5	
Thrust Bearing	Governor side	1.1	
Thrust Base Ring	Governor side	0.5	
Thrust Bearing Pads	Governor side	0.9	
TURBINE (NORTH END)			
Journal Bearing Pads	Top Half	1.2	
	Bottom half	1.4	
Shaft Journal		0.9	
Journal Bearing Base Ring	Top Half	0.7	
	Bottom half	0.6	
L.P. CASE (TURBINE END)			
Shaft Journal		2.3	
Journal Bearing Pads		Top-0.9 Bottom-1.4	
Journal Bearing Base Ring	Top	1.0	
	Bottom	0.8	
L.P. CASE (G.B. END)			
Shaft Journal		1.6	
Journal Bearing Pads		Top-1.2 Bottom-0.7	
Journal Bearing Base Ring	Top	1.3	
	Bottom	2.2	
Thrust Base Ring	Active	1.6	
	Non active	2.0	
Thrust Bearing Pads	Active	0.9	
	Non active	1.2	
Thrust Collar		2.3	
GEAR BOX			
L.S. Shaft Journal Bearing L.P. Side	Top half	0.9	
	Bottom half	1.9	
L.S. Shaft Journal Bearing H.P. Side	Top half	0.8	
	Bottom half	0.8	
H.S. Shaft Journal Bearing L.P. Side	Top half	1.1	
	Bottom half	1.7	

ANNEXURE- 7 (2/2)

DESCRIPTION	POSITION	BEFORE (Gauss-max.)	AFTER (Gauss-max.)
H.S. Shaft Journal Bearing H.P. Side	Top half	1.3	
	Bottom half	1.6	
L.S. Shaft	Teeth	1.3	
	Journal portion	0.8	
H.S. Shaft	Teeth	2.5	
	Journal portion	2.2	
Thrust pads		1.9	
Thrust Base Ring	Inboard side	2.5	
	Outboard side		
Thrust Collar		1.2	
H.P. CASE (FREE END SIDE)			
Shaft Journal		1.5	
Journal Bearing Pads		Top-0.4 Bottom-0.3	
Journal Bearing Base Ring	Top	14.6	1.6
	Bottom	16.0	1.8
Thrust Base Ring	Inboard side	Top-1.3 Bottom-0.9	
	Outboard side	Top-1.1 Bottom-1.1	
Thrust Pads	Inboard side	2.0	
	Outboard side	2.5	
Thrust Collar		1.8	
Thrust Collar Journal		1.8	
H.P. CASE (G.B. SIDE)			
Shaft Journal		0.4	
Journal Bearing Pads		Top-0.9 Bottom-1.7	
Journal Bearing Base Ring	Top	9.3	1.2
	Bottom	9.1	1.1
Oil Rings (2 Nos.)	Top	1.9	
	Bottom	2.1	

ANNEXURE- 8 (1/1)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR.NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1.	Location: 41 (Parent Metal) HP CONDENSER H-1202 Stub end Gas outlet bottom side	SS	Microstructure shows fine-grained worked austenitic structure with twins. Weld metal microstructure shows dendritic structure of ferrite pools in austenite matrix. Presence of weld spot is observed at PM region.	Presence of weld spot is observed at PM. No significant degradation observed. Monitor after 1 year of service.
2.	Location:42 (Weld/HAZ) HP STRIPPER H-1201/A Stub end Liquid inlet top side	SS	Microstructure at weld shows dendritic structure of ferrite pools in austenite matrix, whereas at HAZ microstructure shows fine-grained worked austenitic structure. Microstructure at PM shows fine-grained worked austenitic structure with twins.	No significant degradation observed. Monitor after 1 year of service.

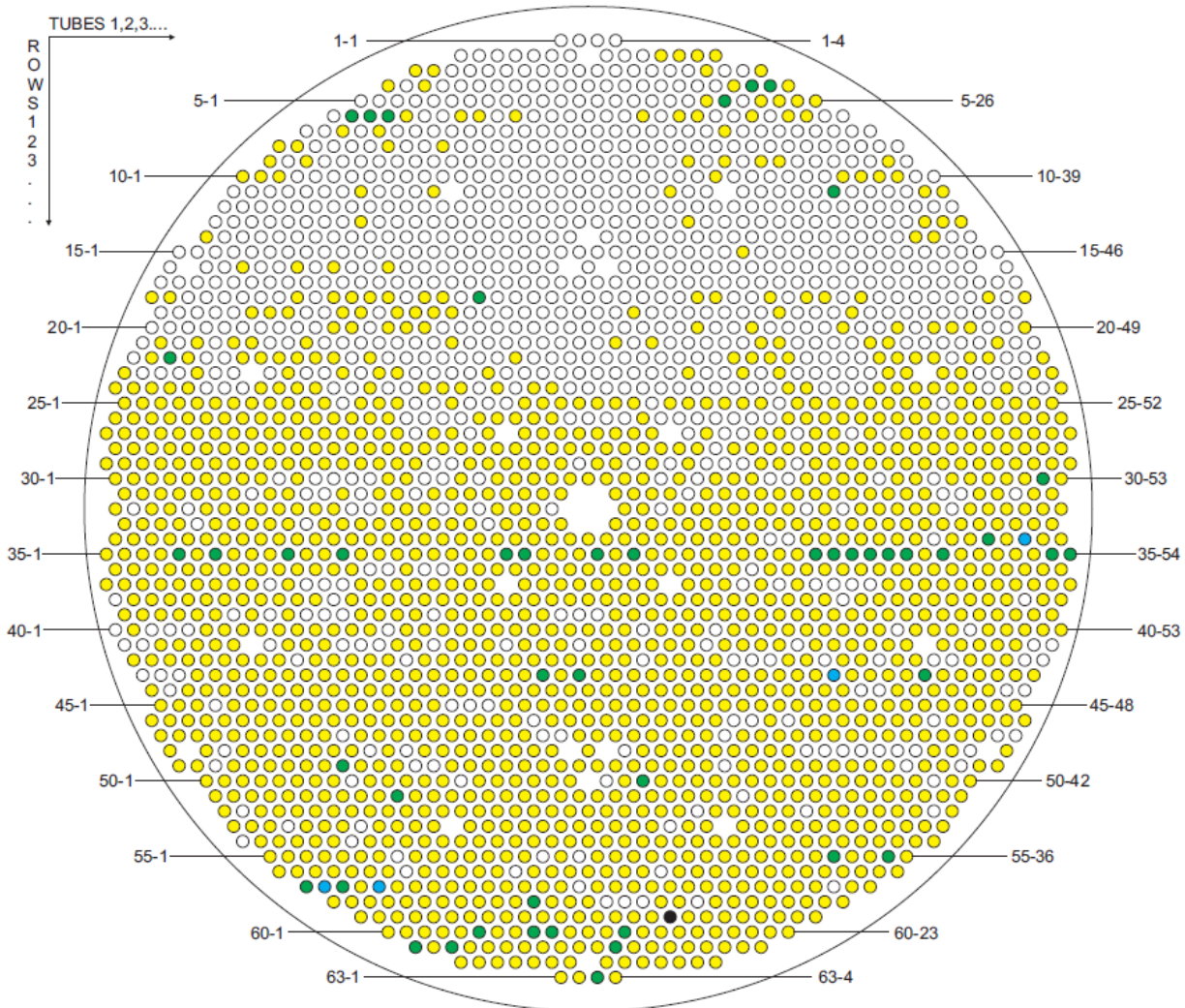
ANNEXURE- 9 (1/1)

TUBE SHEET LAY OUT OF H-1201/A (VIEWED FROM TOP)

IFFCO
Kalol, Gujarat.

UREA STRIPPER
H-1201/A

Viewed from Top Side



INSPECTION SUMMARY

Denotes:

- 0.3 mm to 0.50 mm ● 0.51 mm to 0.60 mm ● Plugged
- 0.61 mm to 0.64 mm ● 0.641 mm to 0.689 mm



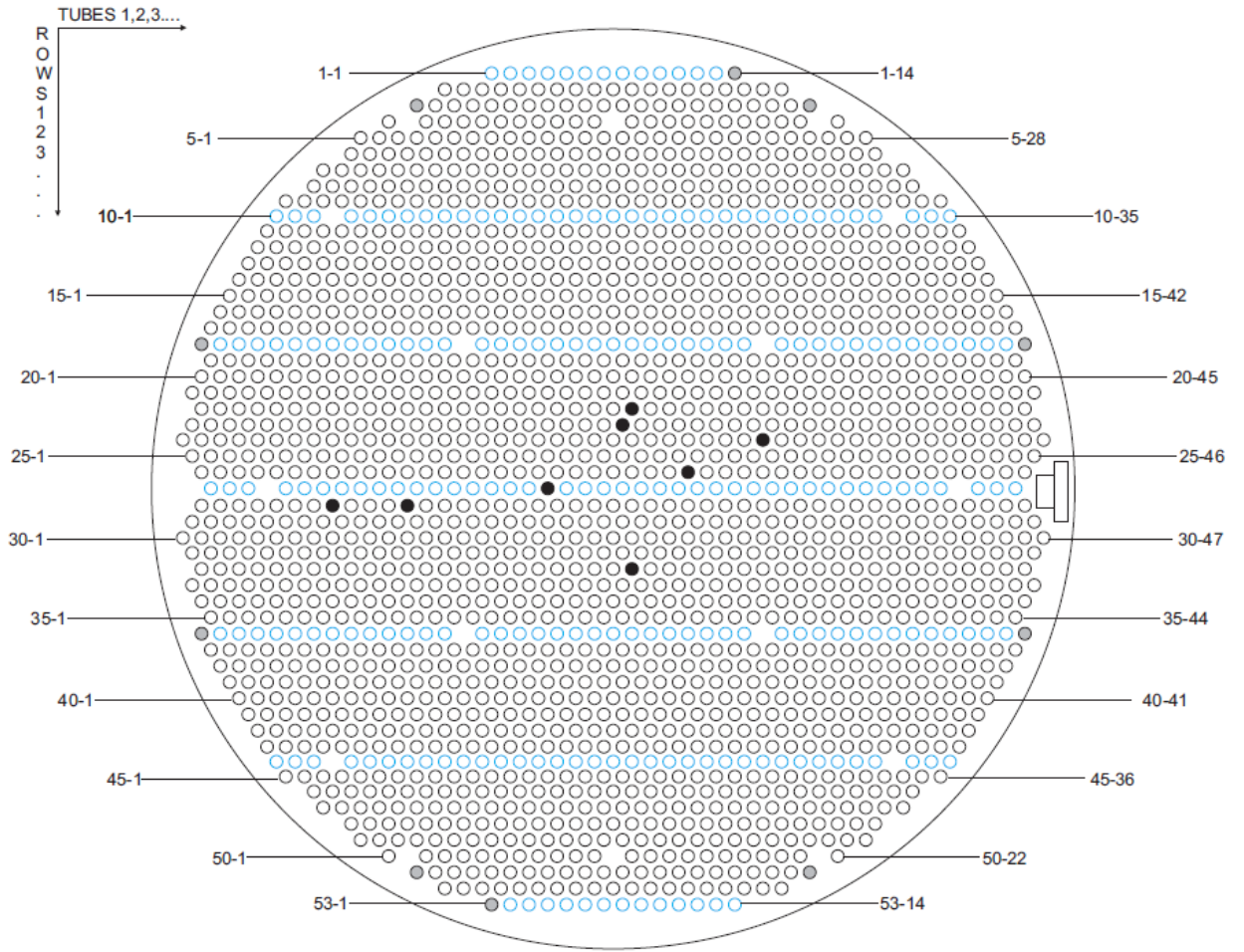
ANNEXURE- 10 (1/1)

TUBE SHEET LAY OUT OF H-1202 (VIEWED FROM TOP)

IFFCO
Kalol, Gujarat.

HP CONDENSER
H-1202

Viewed From Top Side



Tube Sheet Drawing

Denotes:

- Inspected up to 3000mm ● Not Inspected ● Plugged
- Inspected up to 12000mm



OFFSITE & UTILITY PLANT

- Inspection of BHEL boiler Primary & Secondary Super heater tubes.
- Inspection of Deaerator.
- 52”NB cooling water interconnection line between Ammonia & Urea cooling towers.
- In-situ Metallographic examination of steam outlet line from boiler.
- Thickness measurement of Air receiver Tanks..
- The detailed observations on individual equipment are given below. All the observations were recorded during inspection and were handed over to concerned Maintenance and Operation group for necessary corrective action.

BHEL BOILER (GT-2068):

Ultrasonic thickness measurement of all accessible super heater tubes was carried out. Minimum thickness of 5.79mm & maximum thickness of 7.09mm was observed against nominal thickness of 7.1mm for Primary Super heater tubes and Minimum thickness of 4.27mm & maximum thickness of 5.65mm was observed against nominal thickness of 5.6mm for Secondary Super heater tubes.

DEAERATOR:

Deaerator Head:

- One no. spring loaded distribution valve located on the top observed to have leakage from “O” ring.
- Angle supports provided below 2nd to 5th tray from top were found broken and damaged which needs to be repaired.
- All the three segments of the 2nd to 5th tray from top were found damaged and dislocated from its position needs repairing.
- Two nos. pin hole and leakage was observed in top hood to dome inside welding.
- Weld cavity observed in one no. nozzle (size-1/2”) from inner side of the Deaerator.
- Minimum thickness of shell and dished end found to be 8.87mm & 10.44mm against nominal thickness of 8.0mm & 10 mm respectively for shell and dished ends.

Deaerator Storage Shell:

- Brownish coloration was observed inside the shell and dish end.
- Condition of the weld joint was found satisfactory.
- Water is found accumulated in the bottom portion of the shell.
- Thickness measurement was carried out in deaerator head and storage shell and found satisfactory.
- Minimum thickness of shell and dished end was found to be 15.74mm & 14.50mm against nominal thickness of 14mm & 16 mm respectively for shell and dished ends.

52"NB COOLING WATER INTER CONNECTION LINE:

- Circumferential weld joints (15nos.) were found to have poor welding from inside.
- Epoxy paint was found peeled off at many locations resulting in oxide layer formation.
- Blisters of Epoxy paint also observed at many locations.
- Removal of oxide layers, blisters and application of epoxy paint at such locations is recommended to prevent corrosion.
- Ultrasonic thickness measurement was carried out at the locations where epoxy paint was peeled off and found to be in the range of 8.5 to 10.2 mm.

MISCELLANEOUS JOBS:

D.P. TEST:

Dye penetrant examination of weld joints of all the pipelines fabricated by contractors/departmentally, new pipeline fabrication / modifications job done by technical and maintenance groups etc. was carried out after root run welding and after final welding, as per requirement. Any defects observed during the tests were rectified in the presence of inspector followed by DP test for acceptance.

RADIOGRAPHIC EXAMINATION:

Radiographic examination of weld joints(10 nos.) of boiler furnace tube which were cut for sample for RLA and cooling water supply and return header (09 nos.) was carried out and found satisfactory.

METALLOGRAPHIC EXAMINATION:

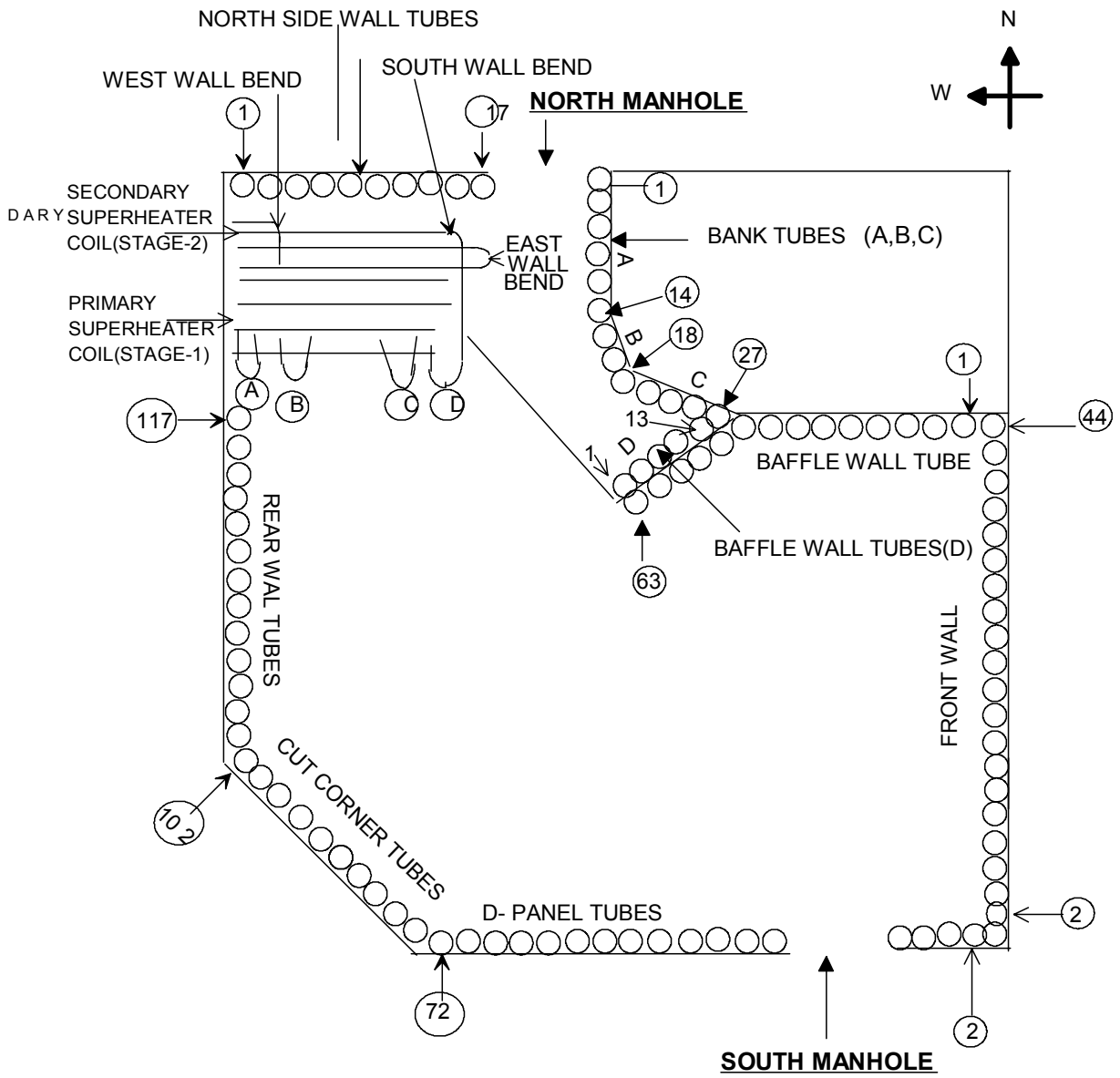
In-situ Metallographic examination of steam outlet line from boiler was carried out and observations are mentioned below.

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	Location: 36 (Parent Metal) Boiler steam outlet elbow-1	106 Gr.B	Microstructure shows fine-grained ferrite and pearlite structure. In situ spheroidization of pearlite is observed	IIInd stage of creep degradations. Monitor after 1 year of service.
2	Location: 37 (Parent Metal) Boiler steam outlet elbow-2	106 Gr.B	Microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure with presences of widmanstatten ferrites. In situ spheroidization of pearlite is observed.	IIInd stage of creep degradations. Monitor after 1 year of service.

THICKNESS MEASUREMENT SUMMARY OF AIR RECEIVERS:

Sr. No.	Eqipt. No.	Eqipt. Description	Shell			Dish End		
			Nom./ Design	Min. Measured	% Red.	Nom./ Design	Min. Measured	% Red
1	V-5301	Instrument Air Receiver Tank	16.0	16.1	-	16.0	16.99	-
2	V-5302	Plant Air Receiver Tank	16.0	16.2	-	14.0	13.22	5.7
3	V-5303	Bagging Air Receiver Tank	12.0	9.05	24.5	12.0	11.51	4.08
4	V-5304	Instrument Air Receiver Tank	18.0	16.7	7.22	16.0	16.2	-
5	V-5401	Inert Gas Receiver Tank	18.0	17.25	4.16	20.0	20.18	-

Note: All readings are in MM



**BHEL BOILER FURNACE LAYOUT
(GT-2068)**

INSTRUMENTATION

AMMONIA PLANT

CONTROL VALVE : MAINTENANCE JOBS

FRCV- 1: Actuator diaphragm was checked, found ok. General cleaning of positioner, Air filter regulator was carried out. Gland packing was replaced and checked the valve stroke.

FRCV-2: Control valve removed from bonnet, seat & plug were checked. Replaced the Plug/stem with repaired one . Machining was carried out on stem. All trim parts were cleaned and overhauled. Actuator diaphragm was checked, found ok. General cleaning of valve positioner was carried out. Replaced gland packing. Stroke was increased from 3.5 inch to 4.0 inch. as earlier valve opening was remaining at 95% of the scale at zero signal thus restricting the maximum flow capacity of the valve to about 82 T/Hr against designed capacity of 86T/Hr.

FRCV-3: Control valve removed from bonnet , seat & plug were checked. All parts were cleaned and overhauled. Also Actuator diaphragm was opened and checked, found ok. General cleaning of valve positioner was carried out. Replaced gland packing. Checked the stroke .

PRCV-18: Actuator diaphragm was inspected found ok. General cleaning of positioner, Air filter regulator was carried out. Replaced Gland packing, air/filter regulator .Checked the stroke.

PICV-14: C/V was opened from body for inspection. 2 no of Gaskets were replaced & new gland packing was provided, Hydro test was carried out to check seat leakage ,Installed in line & stroke checked.

PICV-24: Butterfly Valve was opened from body. Inspected trim parts. Provided cold welding material on disc and seating portion as pitting due to erosion / corrosion was observed. All parts were cleaned, overhauled and assembled. Gaskets were replaced & new gland packing was provided and stroke was checked.

FICV-485: C/V was removed from bonnet for Inspection The plug was in broken condition. Replaced plug, seat & cage by repaired one. General cleaning were carried out. Checked the valve for tight shut off ,reinstalled & checked the stroke.

LCV-480/1: C/V was removed from bonnet for inspection Checked and found OK. Checked the stroke.

LCV-21: Replaced the control valve with old valve removed from NGBC, Necessary line modification was done by General Engg. Section. Overhauling of valve was carried out, and checked the valve for tight shut off & stroke.

FRCV-5: Actuator diaphragm was opened and checked found ok . Provided new gland packing. Stroke was checked.

TRCV- 10, 11, 12: Actuator diaphragm was opened and replaced by new one. General cleaning in positioner was carried out. C/V stroke was checked.

PRCV- 25: C/V diaphragm was opened and checked, found ok. General cleaning in positioner was carried out. C/V stroke was checked.

PICV-13A: Gland packing was replaced. General cleaning & greasing was carried out . Finally C/V stroke was checked.

PICV-13B: Gland packing was replaced. General cleaning & greasing was carried out. Finally control valve operation was checked.

MICV-22: Actuator diaphragm was opened and checked found ok .Gland packing was replaced. General cleaning & greasing was carried out. Finally control valve operation was checked.

FICV-9, 10, 11: Preventive maintenance was carried out of both valves. Checked the stroke, found ok. Replaced the actuator diaphragm of FICV-9.

FICV-7, 8: Preventive maintenance was carried. Inspected the diaphragm of FICV-7 & 8. Finally checked the stroke.

PRCV-4 : General cleaning/greasing was carried out , provided new gland packing & checked stroke.

FICV-14: C/V was opened from bonnet. Plug, seat, cage were taken out for inspection. All parts were cleaned, overhauled, finally assembled & reinstalled and checked stroke.

MICV-003: Valve was removed from bonnet as passing problem was there. Replaced the plug & seat. General overhauling was carried out. After completion the maintenance, reinstalled the valve with new gaskets & operation was checked.

PRC-23: (Auxiliary Boiler damper draft control system) replaced the Air filter regulator & SS tubing job was done. General cleaning & checking was carried out. Finally checked the operation.

MICV-14: Plug/Stem connecting block was removed & provided new drilling /tapping for positioner feedback ever. Gland packing was replaced. General cleaning & greasing was carried out. Finally control valve operation was checked.

MICV-2, 8, 9 and MICV-28, 31, 32 (Reformer Pent house Valves) : Control valves were removed from line. Total overhauling were carried out & finally installed back.

PICV-005A & PICV-005B (FICV-1006): GAIL area Valves :Control valves were removed from line. Total overhauling were carried out & finally installed back.

101J/105J Lube oil PCV : PCV was removed from line. Total overhauling was carried out & finally installed back. Adjusted pressure as per requirement of production people.

PCV-27 A & B: (104E stripper): Both the control valves actuator were removed from body & maintenance was carried out & fixed back, finally checked the stroke.

HCV-70: Control valve was removed from line. Total overhauling was carried out & finally installed back.

THICV-60: Control valve was removed from line. Total overhauling was carried out & finally installed back.

TV-484: The valve actuator was removed from valve and changed its position from vertical to horizontal. Valve positioner was fixed opposite side from the original position because of pipeline insulation is fouling. The valve was calibrated and checked from control room and found satisfactory.

General Maintenance & stroke checking :

Following important control valves general /cleaning/ greasing were carried out. Provided new gland packings wherever required. Also valve positioner was cleaned and air header & regulator also flushed finally stroke was checked.

1	2	V-4, V-5, V-7	3	4	MICV 1 to 9	5	6	FICV-002
7	8	V-18	9	10	MICV 1A to 9A	11	12	PICV-002
13	14	LICV-134	15	16	MICV 24 to 32	17	18	PICV-006A
19	20	LCV-480/2	21	22	MICV-12	23	24	PICV-006B
25	26	LV-860A	27	28	MICV-13	29	30	PICV-16
31	32	LCV-3B	33	34	MICV-14	35	36	TRCV-142
37	38	LV-19	39	40	MICV-15	41	42	LCV-23
43	44	LV-21	45	46	MICV-16	47	48	

COMPRESSOR HOUSE JOBS:

Air Compressor (101J):

- Removed all Radial, Axial and key-phasor probes along with relevant junction boxes, speed pick-ups, T/C, and pressure gauges to facilitate mechanical maintenance jobs. All proximator Junction boxes were cleaned. Cleaning and Functional checking of all the removed instruments were carried out and same were fixed back after obtaining the mechanical clearance.
- Replaced Vibration probe with new Probe for Pt. No. 1V & 1H.
- Replaced broken flexible metal and plastic hose-conduit with new conduit.
- **HIC-101J:** General cleaning and overhauling of governor positioner/actuator was carried out, replaced its piston rod seal O ring and lip seal of actuator cylinder. Checked lock out relay and changed it with new. Assembled actuator set which includes loading pressure regulator, air lock relay, valve positioner and cylinder actuator. Performance was checked on test hook up. Checked calibration of I to P converter. Governor actuator was fixed back and stroke checking was performed.
- **TRIP-101J:** Mech. trip Limit switch was overhauled and checked operation.
- **VS-101J:** The Trip Solenoid valve was overhauled and checked its coil. Trip solenoid valve operation was checked.
- **101J/105J MOP:** Electronic governor actuator o/p signal cable & two nos of MPUs were removed to facilitate mech. maint. Jobs. After completion of jobs the same were fixed back.
- **101J(Trip logic):** Checked the setting for alarm and trip logic.
- **V-18:** Control valve operation was checked. Also overhauled and checked its Open /Close Feedback Limit switch ZSH-18.
- **Lube oil PCV:** Control valve was overhauled.
- **DP Tx for PI-92:** Mounting plate was changed.

Ammonia Refrigeration Compressor (105J):

- Removed all Radial, Axial and key phasor probes along with relevant junction boxes, speed pick-ups, T/C, pressure gauges and THIs to facilitate mechanical jobs. All Proximitor Junction Boxes were cleaned. After completion of Mech. Maint. jobs the same were fixed back after cleaning/functional checking. Gap voltage adjustments for radial and axial probes were carried out.
 - Replaced Vibration probe with new Probe for Pt. No. 3V, 3H & 8H.
 - Replaced broken flexible metal and plastic hose-conduit with new conduit.
- **PRC-9** – General cleaning and overhauling of governor Actuator/positioner was carried out, replaced lip seal & O ring of actuator cylinder. Air lock out relay was changed. Assembled actuator set which includes loading pressure regulator, air lock relay, valve positioner and cylinder actuator. Performance was checked on test hook up. Checked calibration of I to P convertor. Governor actuator was fixed back and stroke checking was performed.
- **TRIP-105J:** Mech. trip Limit switch was overhauled and operation was checked.
- **VS-105J:** The Trip Solenoid valve was overhauled and its operation was checked.
- **105J (Trip logic):** Checked the setting for alarm and trip logic.
- **DP Tx for PDSL-65:** Manifold was changed.

Synthesis Gas Compressor (103J):

- Removed all Radial, Axial and key phasor probes along with relevant junction boxes, speed pick-ups, T/C, pressure gauges and THIs to facilitate mechanical jobs. All Proximitor Junction Boxes were cleaned. After completion of Mech. Maint. jobs the same were fixed back after cleaning/functional checking. Gap voltage adjustments for radial and axial probes were carried out.
 - Replaced Vibration probe with new Probe for Pt. No. 2V & 2H of 103JBT.
 - Replaced Extension cable of 1V & 1H.
 - Replaced all Vibration probe 7V, 7H 8V, 8H, 9A & 9B of 103 HP case.
- Replaced broken flexible metal and plastic hose-conduit with new conduit.
- **PRCV-12(103JAT):** General cleaning and overhauling of governor actuator. Replaced the Piston/Cylinder & Positioner assembly with spare one. Its air regulator was replaced. Checked function of air lock relay. Checked calibration of I to P convertor. Air failure action and Stroke-checking was performed locally as well as from control room.
- **MIC-23(103JBT):** General cleaning and overhauling of governor actuator/positioner was carried out, replaced its loading regulator and lip seal of actuator cylinder. Checked lock out relay, cylinder leakage. Checked calibration of I to P convertor. Positioner was fixed and stroke checking was performed.
- **VS-103J & VS-103:** Trip solenoid valves VS-103J & VS-103 were overhauled. The coil of 103JAT Trip Solenoid Valve was changed with new coil.

- **103J (Trip logic):** Checked the setting for alarm and trip logic.
- **Beacon Speed Indicator.** Checked and mounted Speed pickup.
- **LP and HP case Bearing Temp. :** TI-103J-5A/5B to TI-103J-12A/12B were checked and fixed back properly. Also checked their connection in its junction Box.

FIELD JOBS:

- 115JA : Removed & reinstalled different instruments (RTD, MPU, SV etc.) at 115-JA and 115-JB to facilitate Mech. Maint. jobs. Checked both MPUs of Peak 150 Electronic controller for 115-JA. One bearing RTD was damaged during maint by mech. maint. The RTD was repaired, fixed and handed over to mechanical maint. checked after bearing assembly and found alright.
- 115JA AOP Trip pressure switches Manifold was replaced by new one.
- Removed all tunnel T/Cs with Thermowell for inspection and refixed after checking. Replaced thermocouple of TI-0071 & TI-0075.
- 104JAT & 107JAT : Various instruments were removed to facilitate Mech. Maint. jobs. After completion of Mech. jobs the instruments were reinstalled.
- Replaced Air/Filter regulator with new ones of I/P converters of the following control valves LICV-416, FICV-470, HICV-487.
- Provided low range Pressure Gauges at different locations syn gas converter & in plant as per requirement of production staff for purging & maint. clearance purpose.
- Mechanical DP measurement / Hydro testing machine tubing done. Provided high range pressure gauges for hydro test of vessels and lines.
 - Instrument air headers flushing were carried out at different locations.
- Boiler Inspection: Provided standard 10" dial size Pressure gauges on HP pump, steam drum, 112C and 107C. Pressure transmitter flushing and zero checking and other related work with Boiler inspection were carried out. After completion of inspection same were reverted to original.
- Steam Drum(101F): Following instruments of steam drum were checked.
 - Level monitoring system- Level State.
 - Level transmitters.
 - Pressure Transmitters.
 - Level switches.
- Main air header to NG/AG booster compressor side was isolated and provided isolation valve.
- PGR: Two no of PTs were installed, related cabling, wiring job carried out. Two nos of new Tags PI-PGRR1 & PI-PGRR2 were defined in DCS. To be lined up in next suitable opportunity.
- TI-102B: Replaced the RTD by new one.
- Removing and refixing of instruments at different locations to facilitate mech. Job.

- Old LCV-21 control valve was replaced by LCV-860A (800-J Hotwell Level Control Valve). All the fabrication job was carried out by Gen. engg. Section.
- TI-0098 : 105D Thermo-well removed from line , inspected & fixed back.
- TI-496 : Provided new thermowell in S-50 outlet line also provided seal welding. Same were inspected in inspection department. Provided new thermocouple.
- PDI 26,27,34,35 and 36 : Transmitters were to facilitate mech. Maint for 101 CA CB removal jobs.
- I D Fan's governor's pick up and feedback wiring removed along with the TI / PI and pressure switch to facilitate mech. Maint jobs & same were refixed .
- Two rotameters were provided near 105 D for nitrogen purging.
- GAIL Area:. Control valve PICV 004, PICV 005 A &B were removed along with the gauge near PICV 004 as the valves are removed for pipe line simplification job is carried out.
- PT-005 removed along with its power cable from field.
- LI-82: Parallel indication with LC-23, Provided new tapping of DP Tx. for of (101U) Deaerator. Level transmitter mounting, cabling and tubing job was carried out.
- New TI-0070 T/C with well was provided on transfer line107 D.
- 108 -C & 109 C : Removed & refixed instruments to facilitate mech. Jobs.
- TI-009 : Removed & refixed thermowell.
- General cleaning & Calibration were carried out for ISO 9001: 2008 & CDM related instruments.

- Following ISO 9001:2008 related instruments were calibrated:-

1	PT-7	9	PT-8	17	PT-10	25	PT-80
2	PT-150	10	PT-5	18	PT-4	26	FT-1
3	PT-62	11	PT-9	19	PT-36	27	TI-104E
4	FT-2	12	FT-3	20	FT-100	28	FT-1005
5	AR-1	13	PT-1027	21	FT-1006	29	TI-0011
6	PIC-1A	14	TI -0117	22	TRC-10	30	TIC-1025
7	TRC-12	15	TI-0039	23	TI-0036		
8	PT-501	16	PT-503	24	PT-28		

- following CDM related instruments were calibrated:-

1.	FR-33	4.	FI-65	7.	TI-0043	10	AR-5
2.	PI-82	5.	FQI-181	8.	TI-0023		
3	FR-6	6	PI-676	9	TI-0065		

ANNUAL MAINTENANCE OF UPSS, DCS, PLC & GAS ANALYSER:

FUJI UPSS:

- Voltage of each cell of the battery bank was measured & found between 1.40V to 1.44V DC.
- Electrolyte was poured into the cells wherever required. Finally voltage readings of battery bank as well as each batteries were taken (Total no of cells: 175). L
- Load testing for the battery bank was carried out at 56A load. Duration for that was 30 minutes. After 30 min. the battery bank voltage was found as 211V DC.
- Servicing of UPSS was carried out by service engineer. Cleaned all the cabinet.
- Air filter and checked the exhaust/cooling fan. Measured voltage on all the test.
- Points & settings. Software data was checked by UPS loader & found ok.
- Battery Float voltage was reduced from 251.9V to 249.5V as per the recommendation of Syn-Tech Power System Engg.
- Load was transferred from UPS to AVR & vice versa. Operation was found ok.

DCS:

- DCS shutdown maintenance activities were carried out as per the AMC procedure.
- Before starting preventive maintenance activities / AMC, Images of all control stations were saved by on-line option at EOPS. All EOPS parameters were saved on ENGS station. Saved tuning parameters of all control stations on ENGS. Total HDD back up was taken through boot loader & builder tools back up of ENGS were also taken. Saved tuning parameters of BCV and FCS0101 on CS3K ENGS. Project back up was taken.
- The system was dismantled as per plant clearance and operating conditions like dust, moisture and temperature were checked. All parameter were checked and found within limits. Interior of system cabinets (SCN and I/O cards), FCS, CTBC, ENGS and OPS were cleaned thoroughly. PCBs were inspected and inspection of data bus and connectors were done. No abnormality was observed.
- Printers and ECHU were cleaned/overhauled, wherever applicable. EFCD/ ENGS/ EOPS/ EFMS system and CPU back-up battery voltages and grounding was checked and the same were found within specified limits in all stations.
- Function of each component of the DCS was checked. YOKOGAWA diagnostic software was run on FCS and BCV, the results of the test Program indicated the healthiness of the system.
- Calibration of I/O cards of selected 2 cards in each nest was checked & found OK.
- Redundancy checks were performed on HF-BUS, Vent, CPU, PS, Bus converter,
- AAB841 and MAC-2 cards wherever applicable. As per redundancy feature, control transfer took place to the standby one properly.

- The following components were replaced which were identified faulty during Preventive maintenance. Replaced faulty Roof fan of marshalling cabinets & PDB cabinet of Centum-XL. Presently all fans are functioning ok.
- New loops were incorporated in Centum CS3000 & Centum XL. Related engineering jobs were also carried out.
- Latest backup of both total HDD and builder tools were taken for Centum-XL and CS3000. Latest project back up was taken on HDD and CD.

HIMA PLC:

- Cleaning of filters, fans, cabinets etc. was carried out for all the four PLC stations.
- The Faulty F-3237 card was replaced with spare card: Location: 2408 in PLC-2.
- Back up copy of all the programs (ELOP and Wizcon) were taken.
- New Logic for PICV-11A/B was incorporated in PLC-1 (IS-5 Block).
- TDR of 10sec were incorporated in logic of PDSL-63 & PDSL-66 (PLC-3, IS-105)

Gas Analysers:

ABB make CH₄ and CO₂ (AR-1 & AR-2) :

- Preventive maintenance of ABB make CO₂ and CH₄ analyzer was carried out. CO₂ and CH₄ Analyzer were checked. Condition of sample cells was good. Sensor CPU board, detector and cells were checked. Paper filters in sample system were replaced with spare ones. Sensors were cleaned.
- Manual Calibration of CO₂ and CH₄ analyser was performed & found ok.

O₂ and H₂ (AR-4 & ARC-3):

- Preventive maintenance of Oxygen analyzer AR-4 and Hydrogen analyzer ARC-3 was carried out. Cleaned sample path of AR-4 by flushing it with air jet. Cleaned sample conditioning system of ARC-3.
- Manual Calibration of O₂ and H₂ analyser was performed & found ok.

CONTROL ROOM JOBS:

- Monitor of HIS-0161 was replaced with a spare one.
- Monitor of HIS-0160 was repaired.
- GE-Fanuc PLC cabinet & P/I cabinet were removed from Marshalling Room.
- Vibration Monitoring Panels for 102-J & 800-J were removed from Control Room.
- New Graphic pages were designed in CS3K (for modified feed & fuel system).
- Faulty PC of HIS0163 was replaced with a spare one.
- Digging work for new cable trench was carried out in Marshalling as well as Control Room. The new cable trench will be used to accommodate additional Cables of integrated control system.
- 5.8 In HIMA PLC wires related to 102-J & 800-J were removed from TB.

EWR / SUGGESTION SCHEME / RECOMMENDATION COMMITTEE & TECHNICAL DEPT. RELATED JOBS:

- **New Control Valves in LTS Vent Line (EWR A-244 dated 28.07.2005):**
- PICV-11A/B: Installed two nos of new IL make control valves in LTS vent line. Related cabling, wiring, air header for I to P converter/Control Valves & Tubing work were carried out. Necessary engineering jobs were carried out in DCS & PLC.
- **Oil Filter in NG Line: (EWR No 259 dated 5/1/2010)**
- PDI-001 & PDI-002 : To provide indication of Diff Pressure across two oil filters in NG line two nos of DP Tx were installed. Necessary cabling, wiring, tubing job were carried out. The loops were defined in DCS.
- **Heating of fuel gas (AG + RIL gas) in 172-C & tail gas in 151-C with LP steam.**
- TI-601 & TI-602: Provided 2 nos. of new thermo wells & Thermocouples at 152-C O/L & 172-C O/L. Thermocouple cabling, wiring work was carried out & loops were defined in DCS.
- **New LT for Deaerator (EWR- A-257).**
- Tapping for new GWR LT was taken. A new (LI-82) DP Tx was installed in addition to existing leveltrol. A new loop for this DP tx was defined in DCS.
- **101-J/105-J L.O. Filter DP Indication (Suggestion no. SS/AMM/08/22)**
- Two nos of DP Tx were installed (for Filter A & B). Related cabling, wiring & tubing job carried out. Two new Tags PDI-601, PDI-602 were defined in DCS.
- **103-J L.O. Filter DP Indication (Suggestion no. SS/AMM/08/23)**
- One no of DP Tx was installed. Related cabling, wiring & tubing job carried out. A new Tag PDI-631 was defined in DCS.

CAPITAL JOBS:

- **ARCV-3 :** The old control valve was replaced by a new Koso make class IV control valve. For that necessary tubing, Cabling & wiring job was carried out. Finally checked the loop from DCS.
- **LCV-134 :** A new Koso make control valve was installed. For that necessary tubing, Cabling & wiring job was carried out. Stroke of that control valve was checked.
- **LT-13 (106-F Level):** Tapping for new GWR Level Tx was taken. Provided new DP transmitter for level measurement.
- **LT-101JLT(101J/105J LO Console Level):** A new GWR Level Tx was installed in LO Tank. The new tx was configured & taken in line.
- **104JA (Retrofitting of Turbine Governor):** New Electronic Governor (WWG 505) for 104-JAT was installed in Control Room. Necessary wiring for the same was carried out. Programming & successful commissioning of the same was carried out by the commissioning engg from Goodwill Governor/Woodward Governor.

101-JLJT FAILURE & 105-J TRIP: RECOMMENDATION OF COMMITTEE:

- 101J/105J MOP Disch. Pr. Indication: A new PT was installed in place of PSL-103 switch. One signal multiplier & a trip amplifier were mounted in HIMA Cabinet. A new Tag PI-610 was defined in DCS.
- 105-J: A new PT was installed to measure S.O. Pressure. A new Tag PI-611 was defined in DCS.
- Peak-150 101J/105J MOP : Gov. Valve opening indication was provided in DCS.
- Required configuration was carried out in Peak-150 controller & a new Tag 101J-GOV. was defined in DCS.
- DR of 10 sec was incorporated in logic of PDSL-63, PDSL-66 (IS-105) in PLC-3.
- 105-J Indication of S.O. Diff Pr. LP case & HP case : Two nos of signal multipliers were mounted in HIMA Cabinet, two new Tags PDI-611 & PDI-612 were defined in DCS.
- In HIS-162 Trend Block no 1 was defined in 1sec scan cycle. PI-610, PI-611 & SI-101JLT were defined in Trend Group of this block as per recommendation of committee report.

PREVENTIVE MAINTENANCE JOBS AS PER ISO 9001:2008:

- **Fuji UPSS** : The preventive maintenance of UPSS was carried by M/s I/L, Jaipur. The general cleaning, servicing and configuration and parameter checking were done as per AMC. The trip setting noted down using the hand held configurator. Battery back up test carried out. Redundancy test and smooth change over function for the UPS1 and 2 were checked.
- **YIL DCS** :The preventive maintenance of DCS was carried by M/s YIL as per the AMC. All EFCD, EOPS, EFMS and Engineering station cards were removed from cabinet / panel and cleaned. Faulty fans were replaced. Filters, panels & cabinets were cleaned. The redundancy for CPUs, MAC2 cards, power supply and HF buses were checked. Healthiness of Engineering station and EOPS was checked through software.
- **HIMA PLC** :The preventive maintenance of HIMA PLC was carried out. Filters, fans, cabinet were cleaned and physical inspection was carried out. Checked the redundancy for CPU, input and output cards, power supply cards and HI buses.
- **AMCO Batteries Bank**: The preventive maintenance of batteries was carried out by M/s syntech , AMCO battery bank supplier.
- **Control Valves** : Preventive maintenance of control valves were carried out by general cleaning, greasing, positioner & I/P checking, gland replacement / tightening, stroke checking.

Turbine Governor Controllers:

- HIC-101J for 101JT: Carried out general cleaning and overhauling. Changed air regulator of Governor positioner, stroke checked and overhauled.
- PRC-12 for 103JAT & MIC-23 for 103JBT: Carried out general cleaning and overhauling of Governor Positioner, stroke checked and completely overhauled.
- PRC-9 for 105JT: General cleaning, overhauling of governor positioner was carried out and checked stroke.

Continuous Improvement:

- Replaced old LCV-21 with spare valve LCV-860A (800-J hotwell level control valve) for better reliability & performance.
- Replaced the ARCV-3 & LCV-134 control valves for better reliability, performance & energy saving.
- Implemented new schemes as per suggestions scheme.
- **Calibration of Instruments:** Safety & Quality affecting instruments were checked and calibrated.

UREA PLANT

CONTROL VALVES:

- **LRCV-1201** –Control valve was dropped from the line. Diaphragm checked. Plug and seat were replaced by spare ones. Provided new Gland packing and sleeve .Control valve was boxed up in line and Valve stroking checked, found OK.
- **N/C Ratio meter Monoblock valve** was replaced by spare new one.
- **Prill Divert three-way valve:** Actuator was replaced by spare one (Repaired).
- **HICV-1207** - Control Valve was dropped from the line. Complete overhauling was carried out. Provided new diaphragm & gland -packing. Machining was done on plug and seat. Hydrotest was done. Found OK and re-fixed in the line.
- **PICV-1979A-** Control Valve was dropped from the line. Complete overhauling was carried out. Provided new diaphragm, gland -packing & bonnet-gasket .Machining was done on plug and seat. Finally re-fixed in the line and stroke checked. Found OK.
- **PICV-1979B** - Control Valve was dropped from the line. Complete overhauling was carried out. Diaphragm found OK. Provided new gland -packing & bonnet-gasket .Machining was done on plug and seat. Finally C/V re-fixed in the line and stroke checked. Found OK.
- **LICV-1235** - Control Valve was dropped from the line. Complete overhauling was carried out. Diaphragm checked and found OK. Provided new gland -packing & bonnet-gasket .Machining was done on plug and seat. Control valve was boxed-up and re-installed in the line. Stroke checked, found OK.
- **FICV-1385** - Control Valve was dropped from the line. Complete overhauling was carried out Provided new diaphragm, gland -packing & bonnet-gasket .Machining was done on plug and seat. Control valve was boxed-up and re-installed in the line. Stroke checked, found OK.
- **PICV-1202** - Control Valve was dropped from the line. Complete overhauling was carried out. Provided new actuator O-ring and gasket for top and bottom of bonnet. Machining was done on plug and seat. Finally C/V was boxed-up and re-installed in the line. Stroke checked, found OK.
- **PRCV-1202** - Control Valve was dropped from the line. Complete overhauling was carried out provided gasket for top and bottom of bonnet. Machining was done on plug and seat. Finally C/V was boxed-up and re-installed in the line. Stroke checked, found OK.
- **LRCV-1421** - Control Valve was dropped from the line. Complete overhauling was carried out. Diaphragm checked and found OK. Provided new gland -packing & bonnet-gasket. Machining was done on plug and seat. Control valve was boxed-up and re-installed in the line. Stroke checked, found OK.
- **LICV-1501** - Control valve was dropped from the line, dismantled and complete overhauling was carried out. Actuator-diaphragm was replaced by new -one. Machining was done on plug and seat. Control valve was boxed-up and re-installed in the line. Stroke checked, found OK.

- Following C/V was removed from bonnet, dismantled and partial overhauling was done. Finally re-fixed the valve and stroke checked.
- PICV-1810, HICV-1801, FICV-1281, HICV-1352, LICV-1201, LICV-1281, LICV-1502, HICV-1211, TICV-1101, TICV- 1352, TRCV-1202 & PICV-1181.
- For the following C/V Cleaning of valve positioned & actuator was done and stroke checked.
- FICV-1204, FRCV-1421 & PICV-1128 FICV-1128 ,PICV-1130 ,HICV-1802 , HICV-1803, PICV-1810, FICV-1302, FRCV-1102, FRCV-1201, HICV-1222A, LICV-1282 ,LICV-1420, FICV-1283, PICV-1481, TRCV-1421, TRCV-1422,PICV-1352A ,PICV-1352B , PICV-1131, LCV-1502A, LCV-1502B, FICV-1351, FICV-1352,PICV-1504, LRCV-1204, FICV-1284, MICV-1101, HICV-1422A,FICV-1435,PICV-1221,PICV-1221A, LICV-1504A, LICV-1504B, LICV-1425, PICV-1425,HICV-1422,PRCV-1201 & HICV-1202.

HITACHI (CO2) COMPRESSOR:

- All bearing RTDs were removed to facilitate Mech. Maintenance jobs.
- Checked and installed back after obtaining mechanical clearance.
- Two RTDs were found faulty ,same were replaced with new ones.
- Vibration probes and extension cables were removed to facilitate Mech. Maintenance jobs. They were checked and installed back.
- Followings Trip and Alarm Switches were cleaned, checked and calibrated:-
PSLL-1801A, PSLL-1801B, PSLL-1801C,PSHH-1843A, PSHH-1843B, PSHH-1843C, PSHH-1839A, PSHH-1839B,PSHH-1839C, PSHH-1812, PSL-1813, PSL-1844,PSLL-1818A,PSLL-1818B,PSLL-1818C ,PSL-1816, PSLL-1838A,PSLL-1838B, PSLL-1838C.
- Local Control Panel and turbine local control box were cleaned, all wiring connection were tightened. All junction boxes were cleaned, terminal tightened and changed PVC cover for all Instruments.
- Faulty Temperature indicators on Local control panel, TI-1801, TI-1806, and TI-1867 were replaced with new one.
- Following low level and high level switches of separators were calibrated.
- LAHH-1804, LAHH-1806, LAHH-1808, LAHH-1822 and LAL-1823.
- Following leveltrols were calibrated.
LICT-1803, LICT-1805, LICT-1807, LICT-1823, LICT-1195 and LICT-1821.
- Mock up test for Woodward governor 505E(HP & LP valve) was done.4 ata admission steam valve was also checked and found OK. Calibration of I/H converter was also done.

FIELD JOBS:

- LRC-1201 and LH-1201 detectors were removed to facilitate Mech. Maintenance jobs and installed back.
- Radio active sources of Autoclave and Stripper were removed to facilitate Mech. Maintenance jobs and installed back.
- Nine Nos. of HP Thermowells were removed, hydro tested, and checked by inspection deptt. Found OK. All Thermowells were re-fixed.
- Following type Pressure Transmitters were Calibrated:-
LT-1421,LT-1282,LT-1201, LT-1481 & LT-1202.
- Following ISO Quality affecting instruments were calibrated:-
PT-5303, PT-4405, PT-1121, PT-1145, PT-1201,PT-1421, PT-1105.
- FS-1101(Old FS) - Micro motion Ammonia mass flow meter was removed for calibration and it was re fixed in line after it was received from standard calibration lab. One of the wire found damaged so cut the wire up to the required length and re-fixed it.
- Level trols LIC-1235 & LIC-1203 were calibrated.
- Checked all the Hand Switches on operator console and provided two new Hand Switches.
- Following alarm and trip switches were calibrated-
PLCO-1201B, PL-1201B, PL-1102A, PL-1102B, PLCO-1102A, PAHH-1194, PAH-1193, PLCO-1201A, PALL-1195, PLCO-1102B, PSELL-1101, LSL-1357.
- Instrument main air header isolation valve was replaced with new one.
- Attended tube union leak of 4 ata conductivity transmitter sample tubing.
- Removed the extra instrument air line near P-1701A/B discharge filter as per MWR: 0905201387.
- Checked the well-thickness of LRC-1201 source holder. Found OK.
- All Plant J. B.'s terminal were tightened.
- All instruments PVC cover was replaced with new one.

CONTROL ROOM / MARSHALLING ROOM JOBS:

DCS:

- **Shutdown maintenance activities were carried out for DCS as per the Standard procedure.**
- The system was completely overhauled. Interior of system cabinets (I/O cards,R-I/O cards & Power supply cards), FCS, EWS and OPS/ICS were cleaned thoroughly. PCBs were inspected. One of the PCB of digital card was found faulty, so the card was replaced with new one.
- New loops were configured in EWS for CI-5,CI-6, FI-1814, & FI-1501.
- Back-up of DCS was taken.
- ICS -127 Monitor was replaced with new one.

- Function of each component of the DCS was checked. YOKOGAWA diagnostic software was run on FCS for checking the healthiness of the system.
- Redundancy for the FCS, V-net and R-I/O power supply card was checked and found OK.
- Battery voltages of FCS, ICS and R-I/O power supply card were taken.
- Additional I/O cards are provided in the DCS to accommodate new loops. Installed new cable duct and cable trays for wiring termination.
- AIMS PC for daily log sheet report and alarm recording system was checked. Spare PC was configured and taken in line.

OMRON PLC:

- Cleaned the PLC cabinet and terminal tightened.
- 4.2.2 Checked the redundancy of CPU.
- 4.2.3 Defined all the by-pass alarm in SCADA.
- 4.2.4 Back UP of the PLC program was taken.

Others:

- Cleaning of Woodward Governor and Antisurge controller consoles were carried out.
- Radiac Relay unit for LR- 1201 and its spare unit were calibrated.

CAPITAL JOBS:

- Replaced of old CS air header pipeline with SS in hydrolyser section.
- PICV-1129: Control valve was replaced with new one.
- HICV-1201: Control valve was replaced with new one. New cables were laid out for I/P converter & Valve position transmitter.
- Installed new I/P converter cabinet in prill bucket room.

TECHNICAL DEPARTMENT RELATED JOBS:

- Shifted 02 nos. of conductivity transmitters (CI-5 & CI-6) from boiler area to urea plant area and its associated installation, cabling and wiring jobs were carried out. Provided repeat analog signals for indication in Boiler DCS.
- Provided repeat analog signals for indication in boiler DCS for following flow indications of Urea Plant: FI-1814 & FI-1501.
- Provided flow indication of "DM water flow to urea Plant" in Urea plant DCS.
- Provided air-filter regulator and associated tubing for Vibro-Prill bucket.

OFFSITE PLANT & UTILITY

BOILER PLANT

CONTROL VALVES:

- Following control valves were removed from line for complete overhauling. (Inspection/maint. of Seat/Plug, valve positioner, I/P Converter, Actuator diaphragm, Gland packing, cleaning of Air supply regulator, replacement of gasket as required, c/v stroke checking etc.)
 - SGHTV- 41
 - Butterfly valve for Narmada water to CT make up flow (Overhauling of handjack assembly.)
- Following control valves were opened from Bonnet for partial maintenance.(Inspection of Seat/Plug, valve positioner, Actuator diaphragm, Gland packing, c/v stroke checking etc.)
- IGTV valve diaphragm was replaced with new one.
- BTV-1-4A/B, BTV-2-4A/B, GHTV, PCV-42, FCV-42,FCV-01,LCV-04.
- Following control valve's preventive maintenance was carried out. (General cleaning & c/v stroke checking.)LCV-5111,MICV-4401,LCV-01,LCV-02,HICV-5151,HICV-5153, HICV-5154.

FIELD JOBS:

- Syn. Gas SGHTV ball valve seal rings were replaced with new one in presence of service engr. from ELL-O-MATIC.
- PSH-11 & 12 Pressure switches were relocated as required by process people.
- Following field switch set value were checked.
 - LSL-1, LSL-2, LSL-3 of steam drum level .
 - LLCO-5111, LAL-5111 and LAH-5111 of Deareator.
 - PSL-1 F.D. Fan lube oil pressure low AOP START.
 - PSL-11(set at 300mmwc - Alarm), PSH-12 (set at 400mmwc –Trip)
 - PSL-24, PSL-25, PSN-26 & PSL-27 of Ignition and fuel gas line.
- Checked set value of following lube oil system switches of motor and turbine driven BFW pump.
 - PAL-5114, PLCI-5113, PLCO-5112 for P-5111
 - PAL-5113, PLCI-5112, PLCO-5111 for Q-5111
 - PAL-5115, PLCI-5114, PLCO-5113 for P-5112
 - PLCI-5115 M-5112 AOP

- O2 Analyser sample filter assy. was cleaned with air TR-13 Furnace Temp. T/C was replaced with a new one.
- Following Damper's limit switches, solenoids valves, air regulators etc. were overhauled and checked its operation.
- F.D. fan inlet damper and F.D. fan outlet damper.
- Air heater inlet damper and Air heater outlet damper.

Steam drums jobs:

- EYE-HYE Electrodes were checked and tightened the entire terminal.
- High tech make steam drum level indicator electrodes were checked and tighten the entire terminal.
- Pressure gauges PI-2, PI-3, PI-4 & PI-5 were calibrated w.r.t. Boiler inspection. Carried out all instrument jobs as per mech. requirement. BFW pump (Motor/Turbine driven) pressure switches, Tacho-generator, TI & PI were removed and installed back.
- Checked instruments as per ISO calibration schedule.
- .FI-1814, FI-1501, CI-5 & CI-6. related new tags/Face plates were assigned in DCS. These instruments are located in Urea plant and only monitoring is provided in Boiler DCS.
- BTV-1-4A/B & BTV-2-4A/B: (Burner no 1&2 Block and bleed assembly), Solenoid & Limit Switch Junction box. was replaced with new one. Replaced solenoid valves of BTV-1-4A/B & BTV-2-4A/B with new one.(Class-II C).
- New orifice was installed as per suggestion SS/UTI/08/39 in D.M. Water to Urea & Boiler line. New tag FT- 4203 was assigned along with Face plate and trend recording in Urea and Boiler. Installed multiplier for parallel indication in Urea and Boiler DCS.

DCS AND STARDOM PLC

- DCS shutdown maintenance activities were carried out as per the AMC procedure. The following activities were carried out in Boiler and DM plant.
- Before starting preventive maintenance activities / AMC, Project back up was taken for Boiler & DM Plant DCS and BMS Stardom PLC of boiler plant.
- The system was dismantled as per plant clearance. Operating conditions like dust, moisture and temperature were checked. All parameter were checked and found within limits. Interior of system cabinets (SCN and I/O cards), FCS, ENGS and HIS were cleaned thoroughly. PCBs were inspected and Inspection of data bus and connectors were done. No abnormality was observed.
- Function of each component of the DCS/ STARDOM PLC was checked. YOKOGAWA diagnostic software was run on FCS the results of the test Program indicated the healthiness of the system.
- Calibration of I/O cards of selected 2 cards in each nest was checked and found OK.

- Redundancy checks were performed on Vnet, CPU, PS and AAB841 cards wherever applicable. As per redundancy feature, control transfer took place to the standby one properly.
- Replaced faulty roof fan of marshalling cabinets / HIS and system cabinet of FCS/ STARDOM. Presently all fans are functioning ok.
- One Node was added and configured to the existing Boiler DCS System. UPS tags for UPS reading and alarms were configured and simulated through MODBUS.
- Latest backup of CS3000 /STARDOM PLC was taken.
- Provided Graphics of HIS-62 & HIS-63 in HIS-61.
- Fixed new node in system cabinet.
- Syn. Gas burner related PLC logic modified as per the requirement.

IGNITORS:

- Both Burner's ignitor gun, spark plug, gas flame scanners were cleaned and checked.
- All furnace draft PI impulse lines were flushed with 7.0 kg/cm² air. Replaced Flame Scanner Unit 25SU3-2100 with spare one in BNR-1. Checked and set the parameters, and also adjusted the scanner output of both the unit (0-2000 counts) and connected with DCS.

D.M. WATER PLANT:

CONTROL ROOM JOBS:

- Cleaning of DCS panels & checking of hardware functionality were done. Redundency check of DCS was done. Found o.k.
- Replaced old solenoid valves with new Rotex make Gang solenoid valves. (Total 30 nos. of solenoid valves)

2 x 60 KVA UPSS : (EMERSON Make)

- One no. battery was changed from battery bank .Cleaned and tightened all the battery terminals.
- Electrolyte was poured into the cells wherever required. Finally voltage readings of battery bank as well as each battery were taken (Total no of cells: 302).
- Kept the battery bank in boost mode for 8 hours. After that load testing for the battery bank was carried out. Duration for that was 4 hours. After 4 hours the battery bank voltage was found normal .
- Servicing of UPSS was carried out by service engineer. Cleaned all the cabinet air filter and checked the exhaust/cooling fan. Measured voltage on all the test points & settings.
- MODBUS communication was established between UPS and Boiler DCS. Tags for UPS readings and alarm were configured in Boiler DCS.

NH3 STORAGE:

- Cleaning of Tata Honeywel PLC was carried out. Checked PLC programme by connecting PLC with PC
- 'IL' make UPS battery was checked for performance. Load was transferred on battery for about 15 minutes. It was found alright.
- General cleaning of following field switches of compressor K- 3001-A area was done.
- PSH-3065A,PSH-3060A,PSL-3057A,PSL-3063A, PSL- 3053A & FSL-3051A

COOLING TOWER:

- 1 Q- 4411 (Elliott Turb.) Turbine side radial vibration probes , speed pick-up probe, local THI & PI were removed & reinstalled to facilitate mech. maint.
- LT-01, Hotwell leveltrol of H-4411(Surface condenser) was cleaned and checked it's calibration.
- All the three level switches (LSAL-01, LSAH-01 & LSHH-01) of H-4411 (Surface condenser) were cleaned & calibrated.
- Techogenerator. of Q-4402 & Q-4403 were cleaned, checked and fixed back.
- C.T. Basin level trans. (Electronic) was checked.
- Carried out general cleaning and stroke checking of LCV-01, LCV-02, MICV-4401B, FCV-01, HICV-5153 & HICV-5154.
- Cleaning of control panel & tightening of all terminals inside panel was carried out.
- FI-91 (C.W. flow to Ammonia plant) Rockwin Turbine flow meter was overhauled & fixed back.

I.G. PLANT:

Servicing and calibration of ABB make H2 analyzer of new I. G. Plant was carried out by Service engineer from M/s ABB in our presence.

- Overhauling of three way valve & 2 nos. of Changeover valves of Indcon Air Drier (J-5302) was done.
- Attended all running jobs.

WEIGH BRIDGES:

ASHBEE MAKE - 40 T:

- Ashbee make Weigh bridge cleaning & painting of platform was done.
- Laid new PVC conduit pipes inside weigh bridge pit for Load cell cables.
- Replaced all the six load cells(Cap. 25T each) with new 'Flintek" make (Capacity-40T).
- Replaced all the platform plate mtg. bolts with new SS bolts. Calibration of weigh bridge was carried out with standard weights by service engr. from Ashbee in our presence. Stamping of weigh bridge got done.

METTLER TOLEDO MAKE - 30 T:

- Checked calibration of 30 MT Mettler weighbridge with std. weights (Up to 14 (Tone)

B&MH PLANT

POWER BUILD MAKE AUTOMATIC BAG FILLING & WEIGHING M/C. (P/S No. 1,2,3,4,7, 8, 9A, 10A & 10B)

- Checked wiring terminals in the main panel, local panel, Solenoid oxes, and loadcell boxes.
- Cleaned and checked CSC-25, relay board, fuses, and all sensors.
- Checked functioning and calibration of all Packer Scales.
- All solenoid valves were overhauled.

PBL MAKE AUTOMATIC BAGGING M/C No: 9-B:

Installation and commissioning of new M/C was carried out by service Engr. from Prayas Engg. in our presence.

WEIGH SCALES (Mettler-Toledo make):

- Cleaned the weighing scales and Digital Indicators.
- Calibrated all weighing scales.
- Weigh scale platforms were cleaned & painted.
- Replaced power supply board of all Weighing scales with new one.

BELT WEIGHER SYSTEM:

Following activities were carried out by service engr. from EMTIC in our presence.

- Cleaned / Overhauled the tacho-meter assembly.
- Checked the healthiness of loadcells, tacho-meter.
- Checked the load cell performance by actually putting weights and checking milli volts, the performance was found satisfactory.

DUST EXTRACTION SYSTEM:

- Cleaned the Dust Extraction Panel.
- Cleaned all field instruments (C/V,FlowTx,LevelTx etc.) related to DES.

EFFLUENT TREATMENT PLANT:

- Overhauling of SBA control valve and its valve positioned.
- Cleaning of sampling system and calibration of Ammonia analyzer.

NARMADA WATER OFF-TAKE POINT (JASPUR):

- Replaced all the 22 Nos.of UPS batteries with the batteries having higher current capacity (12V/100Ahr.) & also replaced current limiter card of both the Chargers. Performed Load test of batteries for about 4 hrs.
- Cleaning & checking of DCS/PLC hardware was carried out.

NARMADA WATER TREATMENT PLANT:

- Cleaning & checking of DCS/PLC hardware was carried out.
- Ferruling/lugging of some of the cables related with pump indication was completed.
- Cleaning of UPS panel & battery bank was carried out.

ELECTRICAL

AMMONIA PLANT

- Preventive maintenance of transformers TR-21, TR-6, TR-22 and TR-Start-up heater was carried out and the job details are as under:
 - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
 - Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
 - Alarm & tripping contacts of Buchholz relay and MOG were checked
 - Condition of silica gel was checked. Accordingly discharged silica gel was recharged.
 - Oil leakages from the transformers were attended and damaged gaskets were replaced.
- Preventive maintenance carried out on all the feeder compartments in MCC-5, MCC-5A, MCC-5B & MCC-16 and the job details are as under:
 - Checked the tightness of cable, wiring terminals, power & control circuit connections in the feeders.
 - Thoroughly cleaned the feeder compartments.
 - Replaced damaged/ worn out contacts etc.
- Overhauling of following motors was carried out:
 - 104J,104JA,104JT,104JTA,107JT,101-BJ and 116-JB,2004/J 103J, 121J/A, 121J/B, 101/105J.
- Preventive maintenance of actuators carried out for the following MOVs and tested with their interlocks (If any):
 - SP1, SP2, SP3, SP4, SP5, SP70, SP71 SP152, SP158 & SP159.
- Testing and calibration of power analyzer installed in MCC-16 for 117J syn-gas compressor has been carried out.
- Servicing of L&T make LT Air Circuit breakers were done in respective MCCs.

UREA PLANT

Modification and New Installations

- Rerouting of Electrical cables connecting to loads of Hitachi compressor section in Urea plant on newly installed cable tray and removed corroded old cable tray.
- Installation & testing of new motor in M-1403/1 conveyor.

Scheduled Preventive Maintenance

- Preventive maintenance of transformers TR-7A, TR-7B, TR-17, TR-18 and TR-20 was carried out and the job details are as under:
- Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
- Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
- Alarm & tripping contacts of Buchholz relay and MOG were checked.
- Alarm & tripping contacts of Buchholz relay and MOG were checked.
- Condition of silica gel was checked. Discharged silica gel was recharged.
- Oil leakages from the transformers were attended and damaged gaskets were replaced.
- Preventive maintenance of the all feeder compartment in MCC 6, MCC 14, and MCC 15 were carried out and the job details are as under:
 - Checked the tightness of cable, wiring terminals, power & control circuit connections in the feeders.
 - Thoroughly cleaned the feeder compartments.
 - Replaced damaged/ worn out contacts, etc.
- Complete overhauling of following LT motors
- P-1408, P-1506, M-1402/1&2, M-1419, M-1421, M-1401/A&B, K-1401/1, 2, 3 & 4 M-1403/1, 2 & 3 ,P-1815A&B, P-1817,P-1505A&B, P-1401A&B, P-1814.
- Preventive maintenance of actuators of following MOVs was carried out:
- MOV 1501, MOV 1203, MOV 1202, MOV 1801 & MOV 1102
- Preventive maintenance of LT Air circuit Breakers of Siemens & L&T make, installed in MCC 14 & 15 was carried out.
- Preventive maintenance of rope switches installed on following conveyors M-1419, M-1421 & M-1403 train.
- Replacement of indication lamps of local control panel of P-1102 A, B & C and P-1201 A, B & C with LED lamps.

OFFSITES & UTILITY PLANT

Scheduled Preventive Maintenance

- Preventive maintenance of transformers TR-1A, TR-1B, TR-15 and TR-DG set was carried out and the job details are as under:
 - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
 - Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
 - Alarm & tripping contacts of Buchholz relay and MOG were checked.
 - Condition of silica gel was checked. Discharged silica gel was recharged.
 - Oil leakages from on the transformers were attended and damaged gaskets was replaced.
- Overhauling of transformer TR-4A & TR-4B was carried out by lifting the core. Inspection cleaning and testing of winding was done. The transformer oil was replaced with new oil.
- Preventive maintenance jobs were carried out in 66 KV switchyard:
 - Cleaning of insulators of all the CT & PT units, bus bar support, lightning arrester, breakers, etc.
 - Insulation Resistance was measured of all the CTs & PTs.
 - All the moving parts of isolators were cleaned and lubricated.
 - 11 KV VCB panels were cleaned and outgoing cable terminals were checked for its tightness or hot spot.
 - Maintenance of SABARMATI feeder's isolator was carried out.
- Preventive maintenance jobs were carried out in 11 KV MPSS:
 - Checked the tightness of outgoing terminals.
 - Thoroughly Cleaned the feeder compartment of both Jyoti and Siemens panel
 - Replaced damaged /worn out contacts, etc.
 - Checked power & control circuit connections in the feeders.
- Preventive maintenance of the all feeder compartment in MCC-3, DG MCC, MCC-10, MCC-10A and Jaspur MCC was carried out and the job details are as under:
 - Checked the tightness of cable, wiring terminals, power & control circuit connections in the feeders.
 - Thoroughly cleaned the feeder compartments.
 - Replaced damaged/ worn out contacts, etc.

- Overhauling of following LT motors was carried out:
P-2161, P-6117B, K-5201, P-3102C
- Preventive maintenance and servicing of HT siemens Breakers installed in 11KV MPSS were carried out.
- Preventive maintenance and overhauling of HT BHEL make MOCB Breakers 52A, 52B, 52F, 52G, 52L installed in 66KV substation was carried out.
- Replacement of defective Indication lamps of 11 KV MPSS and 66 KV substations was carried out.

Modification and New Installations:

- Revamping of MCC-2B/2E, with new Motor Control Center.
 - Removed and shifted old panel from existing location and all power and control cables disconnected from old MCC panel.
 - Testing, commissioning and installation of new panel and relocated all power and control cables connected from old MCC panel to new panel.
 - Checking of all motors for their direction of rotation.

Scheduled Preventive Maintenance:

- Preventive maintenance of transformers TR-2A, TR-2B, TR-3A, TR-3B, TR-11, TR-12, TR-13 TR-14, TR-16 and TR-23 was carried out and the job details are as under:
 - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
 - Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
 - Alarm & tripping contacts of Buchholz relay and MOG were checked.
 - Condition of silica gel was checked. Discharged silica gel was accordingly recharged.
 - Oil leakages from the transformers were attended and damaged gaskets were replaced.
 - Oil leakages from the transformers were attended and damaged gaskets were replaced.
 - Radiators of TR. 2A were replaced by new one.
- Preventive maintenance of the all feeder compartment in MCC-1, MCC-2, MCC-2F and MCC-13 was carried out and the job details are as under:
 - Checked the tightness of cable, wiring terminals, power & control circuit connections in the feeders.
 - Thoroughly cleaned the feeder compartments.
 - Replaced damaged/ worn out contacts, etc.

- Overhauling of the following LT motors was carried out:
 - M-5120, P-5113, P-4406, P-4401/B, P-4412, P-4411/B, P-5118B, P-5118A, P-5119, P-5117, P-5111/A, P-5111/B, P-5112/B, P5112/A, P-4405/1A,P-5112/A,E-5118/C,E-5116,E-5111,E-5118/C.
- Existing Siemens make actuators of P-4403-700mm, P-4403-900mm,RAH drain valve and main soot blower valve were replaced with new Rotork make actuator and modified control wiring accordingly and servicing of all Rotork make actuators installed in utility plant were carried out.
- Preventive maintenance of LT Air circuit Breakers of Siemens make installed in MCC 1, 2, 2F &13 was carried out.
- Overhauling of following HT motors was carried out :
- P-4402, P-4401/C, P-4401/D & P-4404/E.
- Cooling tower area indication lamps were replaced with LED type lamps.

B&MH PLANT

Scheduled Preventive Maintenance

- Preventive maintenance of transformers TR-5A was carried out and the job details are as under:
 - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
 - Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
 - Alarm & tripping contacts of Buchholz relay and MOG were checked. Servicing of Buchholz Relay of transformers was carried out.
 - Condition of silica gel was checked. Discharged silica gel was recharged.
 - Oil leakages from on the transformers were attended and damaged gaskets was replaced.

- Overhauling of transformer TR-5B was carried out by lifting the core. Inspection cleaning and testing of winding was done. The transformer oil was replaced with new oil.

- Preventive maintenance of the all feeder compartment in MCC-4 and MCC 4A (New &Old) was carried out and the job details are as under:
 - Checked the tightness of cable, wiring terminals, power & control circuit connections in the feeders.
 - Thoroughly cleaned the feeder compartments.
 - Replaced damaged/ worn out contacts, etc.

- Overhauling of following LT motors was carried out:
P-2163, P-2704/3, M-2137, M-2122/A2, M-2122/A1, M-2110, M-2117, M-2116/1, M-2112, M-2121, K1216.

- Preventive maintenance carried out on all rope switches installed on Conveyors: M2110, M2112, M2117, M2121, M2122 & M2123 and replaced defective one with new one.

Non plant

Scheduled Preventive Maintenance

- Preventive maintenance of transformers TR-10A and TR-10B was carried out and the job details are as under:
 - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
 - Recommended Testing & Measurement of parameters like Insulation resistance, BDV of transformer oil was carried out on each transformer.
 - Alarm & tripping contacts of Buchholz relay and MOG were checked. Servicing of Buchholz Relay of transformers was carried out.
 - Condition of silica gel was checked. Discharged silica gel was recharged.
 - Oil leakages from on the transformers were attended and damaged gaskets was replaced.
- Preventive maintenance of LT Air circuit Breakers of L & T make installed in MCC was carried out.

CIVIL

AMMONIA PLANT

AUXILIARY BOILER

- Repairing of damaged insulation bricks (ACF make – “POROSINT 500 SPL” – 228x 114x 63 mm tk.) and high temp. Fire bricks (228 x 162 x 63 mm tk.).
- Repairing work at the adjutant portion of existing burners with high tech castable material whyheat
- Repairing of damaged refractories lining of header with Whyheat high temp castable material
- Repairing of damaged Burner block Fan No 1,3,4

PRIMARY REFORMER

- Repairing of Refractory lining work and removal of old damaged refractory.
- Repair of insulation bricks (ACF NAKE – “POROSINT 500 SPL” – 228x 114x 63 mm tk.) along with back-up insulation after the removing / reconstruction of tunnel walls in primary reformer including bottom floor, tunnel slabs etc.
- Replacement of AC sheets roofing
- Repairing of Refractory lining work HT heat zone area ceiling bottom 2 side insulated 11 castable Materials.

UREA PLANT

PRILL TOWER SCRAP FLOOR

- Dismantling of old epoxy coating and providing new epoxy coats
- Damaged acid proof brick repairing.
- Repair of Damage bitumastic lining at G.F floor area

BUCKET ROOM

- Epoxy paint inside the bucket room.

TOP FLOOR

- Bitumastic lining work at top floor of Pill tower.

CONVEYOR GALLERY

- Bitumastic lining work at belt conveyor, and strengthening of all the 25 numbers of R.C.C foundacation in G.F Floor ,1 rd Floor ,2 rd Floor , 3 rd Floor

Making of New R.C.C Drain in G.F area

OFFSITES & UTILITY PLANT

BHEL BOILER AREA

- Flooring of primary coil area by whyheat car high temp. castable material.
- Repairing of super heater drum refractory.
- Repairing of damage hot insulating brick.
- Repairing of boiler top drum refractory by Whyheat car high temp. castable material.
- Replacement of AC sheet by New G.I pre coated sheet at BHEL boiler house

COOLING TOWER AREA

- Repairing of damaged plywood sheets for urea cooling tower sell no. 1 & 2 as well as at ammonia cooling tower sell no. 3, 5 & 6.
- Construction of open channel for urea cooling tower.
- Construction of brick wall work inside the urea cooling tower.
- 11 No Cut out grouting of Ammonia cooling tower open channel
- Grouting & Excavation work for damage cooling tower pipe line risers..

B&MH PLANT

TOP SUSPENDERS AT SILO BELT GALLERY

- Belt conveyor gallery for M -2112 and M-2117 suspenders with epoxy plaster
- IPNET coating for both top side suspenders units inside the silo.
- Epoxy paint work in two rooms at top floor, and two rooms in ground floor & outside portion of the building for transformer tower
- Epoxy paint work at out side portion of M.C.C building.
- Repairing of damage bitumastic lining work over top of silo from outside portion

BAGGING PLATFORM

- Epoxy paint in bagging plant railway platform column.
- I.P Net coating in hopper floor area
- Ceramic tiles fixing at top floor in side wall in B& MH plant
- Repairing of Damage Plaster in B & MH Plant.

TECHNICAL

AMMONIA PLANT

Automatic Vent valves at the outlet of LTS Exit process line:

Ref: EWR A-244, Dated 28-Jul-2005:

As per approved EWR it was requested to install the automatic vent valves at the outlet of LT shift converter to have more stable plant operation in case of tripping / stoppage of MDEA system. Therefore, to achieve 100% venting capacity, as per HTAS recommendations tapping at upstream of 143-C taken to provide vent valves PICV-11 A/B .

Two Nos. 8 Inch NB size tapplings have been taken from the line PG-1207.01-20" with weldolet and control valves installed with isolation valves of size 8"x300#. The downstream side of Control valve line was kept as 12 Inch NB size and has been connected to SP-73 vent header with 12"x150 # isolation valves. The pipe material is ASTM A 106Gr.B . Existing platform also extended for the ease of day to day operation and better maintainability in the area.

With installation of vent valves, Ammonia plant reliability improved and start up time saved by having these Vent valves at the outlet of LT shift converter.

The job was carried out by M/s SKYWIN vide W.O. no. 20091267 Dated 05/03/2010.

Heating of fuel gas (AG + RIL gas) in 172-C & tail gas in 151-C with LP steam & Use of 151-C for pre-heating of tail gas from PGR unit:

Ref : TM/02/1200 Dated : 02/02/2010:

With reference to above scheme, It was proposed to use the redundant 172-C, for fuel gas (RIL gas & AG) heating from about 22⁰ C to 100⁰ C with LP steam. 172-C have about 128 m² area compared to 22 m² area in existing Heat Exchanger 151-C.

For this 10" tapping with isolation valve taken from existing 151-C inlet line for 172-C tube side inlet and 10" tapping for fuel gas outlet with isolation valve taken from 172-C to PRCV-2 .

Existing 10" gas bypass line of 151-C kept as it is and used for 172-C gas bypass. 2" LP steam tapping from Urea side LP steam header with double isolation valve (one Globe valve) provided for 172-C shell side for heating of fuel gases. Pressure gauge will be provided on shell side of 172-C.

2" Condensate line from 172-C steam trap unit with u/s and d/s isolation valves and trap bypass joined to the existing 8" condensate line near HTS to deaerator. One condensate drain to atmosphere also provided for use during start-up.

It was also proposed to use existing 151-C for pre-heating tail gas of PGR plant from ~ 17⁰ C to ~ 100⁰ C. For tail gas heating, 6" tapping with isolation valve for 151-C tube side inlet taken from existing tail gas line at upstream of main isolation valve (above FRCV-3). 6" tapping with isolation valve from 151-C tube outlet connected to existing tail gas line at downstream of main isolation valve . Existing LP steam and condensate connections on shell side of 151-C used for heating of tail gas. TI in DCS shall be provided.

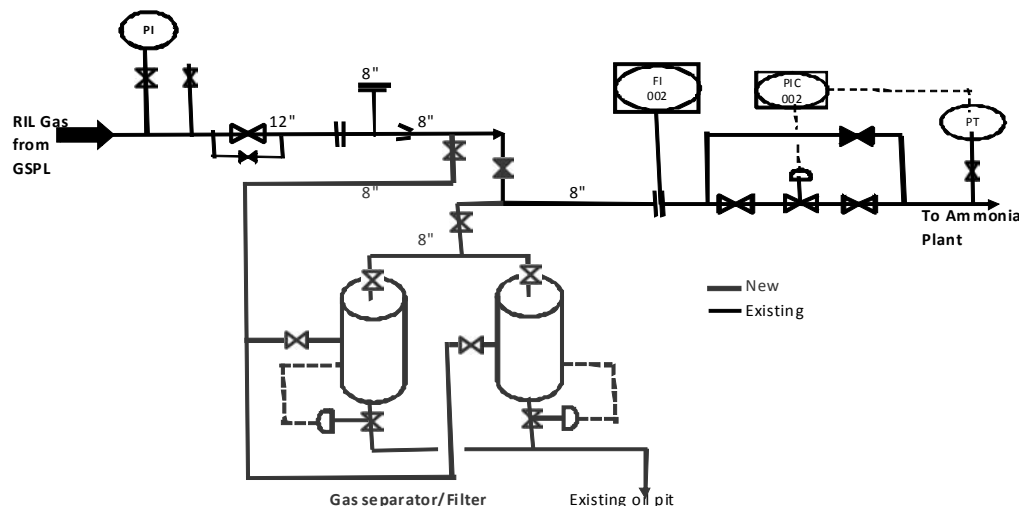
Following benefits achieved with the implementation of above scheme:

- Fuel gas (RIL gas + AG) heating will be possible upto 100°C instead of $\sim 75^{\circ}\text{C}$.
- This is equivalent to 0.13 Gcal/h additional heat duty.
- Tail gas from $\sim 17^{\circ}\text{C}$ to $\sim 100^{\circ}\text{C}$. This is equivalent to 0.1 Gcal/h heat duty. Total additional heat duty in fuel gas heating will be 0.23 Gcal/h.
- This has reduce $\sim 29\text{ Sm}^3/\text{h}$ Gas firing in ammonia plant and increase $\sim 13\text{ Sm}^3/\text{h}$ gas firing in boiler. There is net saving of 0.14 Gcal/h equivalent to monetary saving of Rs. 14 lakhs/year at Rs. 11.13 / Sm^3 RIL gas cost.
- In addition to energy saving, there is little bit reduction in GHG emission ($\sim 0.8\text{ t/d CO}_2$).

Filter at Main RIL gas supply line at GMS-Ammonia Plant:

RIL gas at Ammonia plant battery limit is received by 12" GSPL line at Gas Metering Station (GMS) at IFFCO Kalol plant premise. After battery limit valve, line size is reduced to 8" before flow orifice FI-002.

Existing filter procured vide P.O. No. E5355/D Dated 31/03/1995 and installed in GAIL supply line removed and installed in RIL supply line.



The job was carried out by M/s SKYWIN vide W.O. no. 20091267 Dated 05/03/2010.

Simplification of gas pipe lines at GAIL metering station:

Following jobs have been carried out for the simplification of gas pipe lines:

- FICV-002, 2 No isolation valves and its bypass to be removed and pipe provided at GMS. **(Feed gas Line Modification)**
- 1st Vent Valve -PIC-1A removal, feed line isolation valve removed and gas feed pipe line modified at pipe rake. Removal of PIC-1 A downstream pipeline connection to vent header. **(Feed gas Line Modification)**
- Removal of PIC-004 loop. Direct connection of PIC-006 downstream line to Separator 178-F inlet. Fuel gas connection to Pre-reformer (3") modified from 178-F inlet line. Removal of redundant pipelines. **(Fuel gas Line Modification)**

- New fuel gas line for primary reformer tapping (8") from 178-F separator d/s pipe Line near 178-F. Connection of 8" tapping with 12" gas header near PIC-004 with Elbow. Removal of 12" fuel line. **(Fuel gas Line Modification)**
- Interconnection piping for Gas firing in Naphtha tip of arch burners (DBA-16) in Ammonia Plant. About 10% of total fuel is being at central naphtha tip and corresponding firing at gas tips has been reduced. Primary and secondary air register are adjusted accordingly.
- 4" Interconnection from Tail Gas to Syn gas Line to BHEL BOILER.
Above piping simplification jobs resulted in ease in operation and control and good housekeeping in the relevant areas.

LP steam instead of MP steam in Steam Stripper (C-2) in Amm. Recovery Unit:

Ref: TM/02/1200 Dated : 02/02/2010:

As an energy saving measure, it was suggested to use LP steam from Urea Plant LP steam header (near ID Fan) for stripping of ammonia from ammoniac water in steam stripper (C-2) of ARU unit.

4" tapping taken from Urea Plant LP steam Header (near ID Fan) to connect with existing steam line at d/s of FICV-505 d/s isolation valve. New flow orifice for LP steam will be provided in next turnaround.

LP steam tapping isolation valve & downstream line joining MP steam line to C-2 shall have 300 pond rating as for MP steam line. Fig. 8 blinds provided on LP steam and 20 ata steam supply lines to C2.

Replacement of LCV-21 of 156-F:

The above control valve was old and obsolete. One control valve from NGBC is used for the same. Full port valve (2") in place of smaller (1.5") provided with main Line and Bypass line Modification.

With replacement of this CV better operation flexibility and ease of Maintenance have been obtained.

Interconnection piping for Gas firing in Naphtha tip of arch burners (DBA-16):

It was proposed to carry out the trial of fuel gas firing in naphtha gun at central location of all the arch burners during normal operation of Ammonia Plant. On trial, from the gas pressure on naphtha header, it was evident that approximately 20 % of total heat liberation by burner assembly was through the central naphtha gun. Though it may not be quantified, it has been apparent that there has been reduction in tube skin temperature.

To implement this Interconnection piping for Gas firing in Naphtha tip of arch burners (DBA-16) has been carried out. Accordingly tapping of 1.5 Inch NB from gas header of 4 Inch NB have been taken through swage nipples from north and south side at 18 points and connected to naphtha header with isolation valves. Drain arrangement at all the 18 points also provided.

With the implementation of above modification about 10% of total fuel is fired at central naphtha tip and corresponding firing at gas tips has been reduced which resulted in lower skin temperature of catalyst tubes.

UREA PLANT

Shifting of vent line connection of ammonia water tank/urea solution tank to vent stack in urea plant (EWR No.U-230):

It was suggested in the above EWR to shift 12" common vent line of ammonia water tank & urea solution tanks to vent stack at higher elevation in vent stack, just above the connection of HPCC (H-1202) shell side rupture disc outlet to vent stack (near 4 ata steam drum).

Accordingly, above modification has been carried out by laying 14 /12" size SS 304 pipe line of approx. 30 mtr.

The above modification has helped in stopping Ammonia vapour release from Ammonia Water tank & Urea solution tanks to environment.

Installation of PICV-1129:

New higher size Control valve PICV-1129 (Size : 8" NB) has been installed in Urea Plant in place of existing control valve (Size : 3" NB) in 23 to 4 ata steam line to give more operational flexibility.

Air Blower Discharge piping modification:

Air blowing piping modification has been done to make piping simpler after the removal of one Blower earlier.

UTILITY PLANT

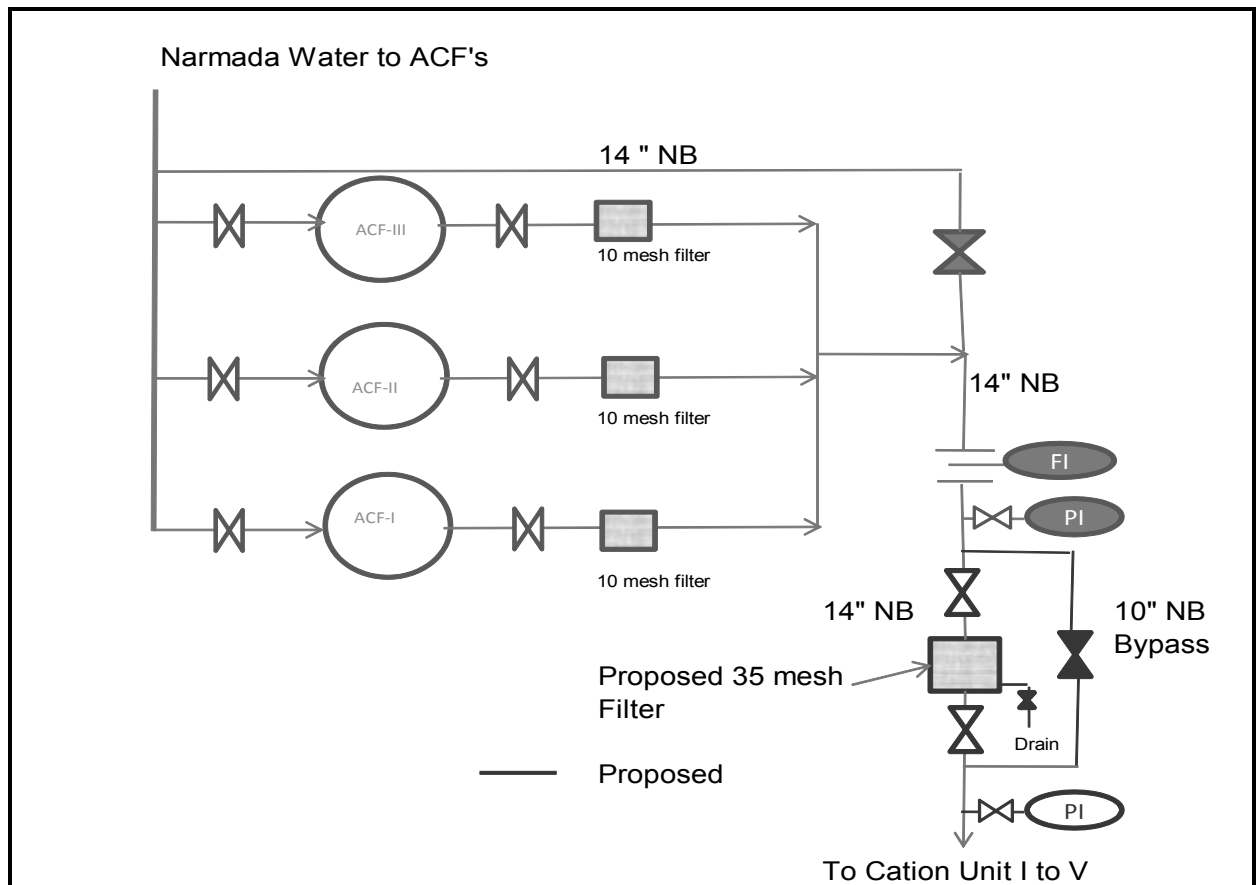
Provision of filter in common outlet header of ACF's in DM plant:

Ref.: (EWR no: WT-93)

It was requested in above EWR to provide suitable mesh size filter in common outlet header of ACF units to retain small activated carbon particles which are damaging cation resins.

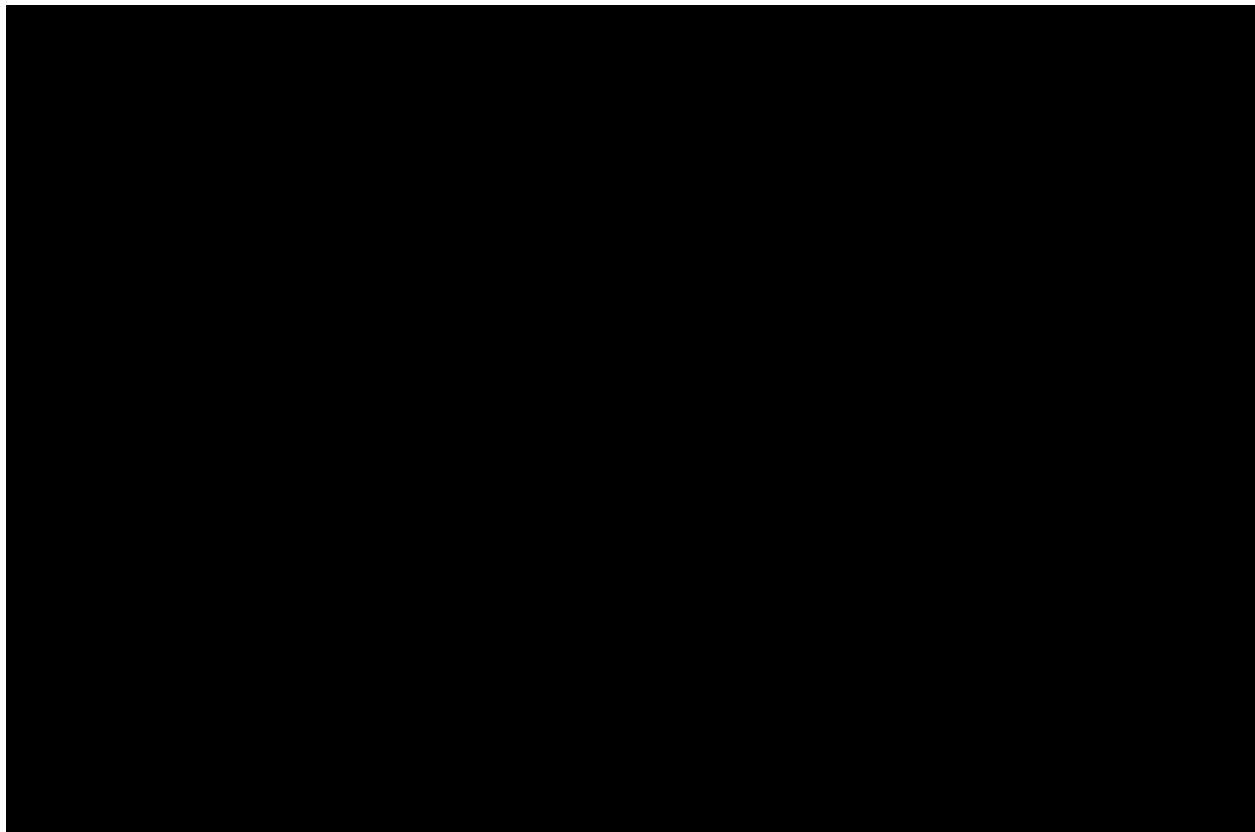
Accordingly to avoid any possibility of even small size carbon particle slippage to cation units resin bed, one filter with 35 mesh size SS wire mesh has been installed on 14" common outlet line of ACF units. The filter installed in available space along water line near cation-IV unit. Filter has been provided with 10" bypass line to facilitate cleaning as per attached PFD.

The Filter Vessel used was fabricated in-house with available 30" CS Pipe and Flanges.



The installed filter fabricated in-house as per details given below:

Outer shell	:	30" CS pipe.
Filter Basket	:	24" SS pipe.
Holes in filter basket	:	10 mm dia. Holes at 15 mm triangular pitch.
No. of holes	:	7700 nos. 10 mm dia. Holes at 15 mm triangular pitch.
SS Wire mesh	:	35 mesh to be welded on filter basket.



Installation of Restriction orifices in burner gas inlet lines:

Restriction Orifice plates received from M/s Thermex has been installed at d/s flange of last isolation Valve in both Burner inlet lines.