MTC / REPORT / 01
REPORT NO. 29 / 2009

IFFCO

KALOL UNIT

PLANT TURNAROUND REPORT

(MARCH - APRIL - 2009)

INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

I N D E X

PREFACE

The Annual Plant Turnaround for the year 2009 was taken from 16th of March, 2009, 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 16th March, 2009. This shutdown report contains Plant wise and section wise details of the jobs carried out. Ammonia plant was restarted on 8th of April, 2009 and regular production resumed on 10th April, 2009. Similarly, Urea plant restarted on 8th April,2009 and production resumed on 9th April, 2009.

Critical jobs like, replacement of Steam super heat coils in BHEL boiler, Major Overhauling of Prill Tower Scrapper (M-1402-1/2) and drive Gear Box and replacement of existing diaphragms in 105-JT & 101-JT Turbines with indigenously reconditioned one also were carried out.

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 25 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:

- The insulation of wall No. 3 & 4 of Primary Reformer was upgraded from refractory bricks to ceramic fiber Z section modules. After up gradation, during operation the outside wall temperature of Primary Reformer was measured and found to be 85 – 90^{0}C whereas it was 105 - 148^{0}C before up gradation.
- Replaced damaged diaphragms in Refrigeration Compressor drive Turbine (105-JT) & Air compressor drive turbine (101 JT).
- Lean aMDEA solution pump drive turbine (107-JT) Murray make and CO2 gas recycle compressor (107-J) were overhauled.
- Replaced existing Lubricated gear coupling by New Euroflex make Shim-pack type coupling between 105-JT to JLP & 105-JLP to Gearbox.
- High bearing temperature in 103-JHP NDE was attended and rectified.

- PRC-12 was attended, as same was malfunctioning before plant stoppage.
- NRV-ARVs of 115-JA, 115-JB & 104-J, 104-JA, P-110 A/B were overhauled.
- RLA study of 101-F HP boiler was carried out by M/S Thermax, Pune with the approval of CIB Gujarat.
- Routine preventive maintenance jobs of all rotary machines were carried out.
- 129-JC Tube bundle was replaced with new bundles manufactured by M/s PATEL AIRTEMP, A'bad.
- 131-JC leaky tubes were plugged and modified to single pass CW flow from two pass and provided additional jacketing at outside the shell for sufficient cooling effect, as more than 50% tubes plugged. Both the exchangers found working satisfactorily after the restart up.
- Boilers 101-F, 112-C & 107-C were inspected by Boiler Inspector and got approval of CIB Gujarat.
- Catalyst was replaced in Primary reformer, Secondary reformer, HTS, LTS guard & De-Sulpheriser.
- Alluminising was done on external surface of Primary reformer stack to prevent corrosion

UREA:

- Major Overhauling of LP case for Hitachi CO2 Compressor (K-1801-1) and Gear Box (M-1801) was carried out.
- Overhauling of Prill Tower Scrapper (M-1402-1/2) and drive Gear Box was carried out. Overhauling of Gear box was carried out for the first time after inception of the Plant.
- Modification jobs to stop Urea spillage in Prill tower belt conveyors (M-1403-1/2) was carried out.
- Routine inspection of Autoclave (V-1201), HP Condenser (H-1202) & HP Stripper (H-1201) was carried out.
- Liner repair in V-1201 was carried out as per inspection report. Flush grinding and re-welding of liner welds was performed in compartment no. 1 & 3.
- Top dome of HP Scrubber (H-1203) was opened for checking of suspected choking of gas outlet line.
- Minor Overhauling of HP case of Hitachi CO2 compressor & Siemens turbine was carried out.
- Top half tubes (92 nos.) of 3rd inter stage cooler (H-1813) of Hitachi compressor train were replaced.
- In HP condenser (H-1202), 5 nos. of tubes were plugged on the basis of Eddy current testing results.
- One tube of LP Carbamate condenser (H-1205A) was plugged based on leakage detected during hydrotest.

OFFSITES:

- Replacement of Super heater coils along with associated headers of BHEL Boiler F-5111.
- All cooling water pumps, BFW pumps and turbines were taken for Preventive maintenance.
- IBR inspection of BHEL Boiler (GT-2068) was carried out.
- The wooden structure of all Cooling tower cells was inspected by M/s Paharpur Cooling Tower Pvt Ltd,
- Complete revamping of Ammonia Cooling Tower cells (H-4401/1 to 3) was carried out.
- Brick wall open channel and 2 nos. of partition walls were made to facilitate the complete revamping of ammonia cooling tower cells (A4 to A6) in future.
- All 28 Nos. of distribution valves of CW return headers were overhauled.
- In-situ refurbishing of Discharge valve of Cooling water Pump (P-4402 A/B) Size & rating 1100 mm x 150 #, P-4403 size & rating 900mm x 150#, 700mm x 150 # and P-4401-C , 900 mm x 150 # were carried out.

B & MH:

- Overhauling of Reclaim machine was carried out.
- All Conveyors and drive Gearbox were taken for preventive maintenance. Replaced the damaged conveyor belts of M 2110, M 2122 / A1.
- Preventive maintenance of all packer scales and stitching.

ELECTRICAL:

Annual plant turnaround-2009 was carried out during March-April 2009. 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 feeders were replaced. All Connections were checked for tightness.
- Replacement of MCC-1, Section – B was carried out.
- Preventive maintenance of all the transformers were 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-6 & TR-8 was done by lifting the core. Radiators and radiators valve were replaced in TR-7A.
- Servicing of all the Jyoti make HT VCBs and LT ACBs of TMG make were carried out. Closing and tripping time of all the VCBs were checked and adjusted wherever necessary.
- All critical motors installed at various locations in plants were overhauled. Terminal boxes of all HT motors were checked and tightened connections.

- All the MOVs in various plants were thoroughly checked for its operations and indication in control rooms.
- 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.
- Testing and calibration of protective relays installed in MCCs, DG set and 66KV yard / MPSS were carried out.

INSTRUMENTATION:

AMMONIA:

- Replaced the existing obsolete control valve PRCV-6 with new KOSO make control valve. The new valve was taken in line and is functioning well.
- Replaced the old thermocouple cables with new extension cables. The 34 year old junction boxes were also replaced with new ones. This has reduced the transmission error in temperature measurement.
- Successfully completed the jobs related to the scheme Syn.Gas firing in BHEL boiler.
- 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.
- Calibrations of all quality affecting instruments were carried out.

UREA:

- Replaced the radioactive source of LR-1201 (autoclave level measurement) with fresh one. Both the detectors of LR-1201 were calibrated and taken in line.
- Preventive maintenance of Nucleonic gauge LRC-1201 was carried out.
- FS-1101(Old FS)- Micro motion Ammonia mass flow meter was removed and sent to FCRI, Palakkad for calibration. The instrument was installed back after calibration and put in line.
- Internal modifications were carried out in control valves PRCV-1504 and PICV-1130 to reduce the passing.
- All the very old and corroded MS Instrument air headers were replaced by SS headers for maintaining good air quality and for better reliability and to Servicing of DCS/Omron PLC system for Hitachi compressor was carried out by suppliers' engineers.
- Servicing and overhauling of the control valves was done . Body of HICV-1201 was replaced with repaired ones.

UTILITY AND OFFSITE:

- Carried out installation and commissioning of new 2x60 KVA UPSS to cater power to Offsites, Utilities and Urea plant Instrumentation for better reliability.
- Carried out all instrument jobs related to the scheme ' Syn.Gas firing in BHEL Boiler'.
- Provided new thermocouples for the measurement of skin temperatures of new super heater coils in boiler plant.
- 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.

CIVIL:

Following jobs were executed during annual turn around.

1. Replacement of damaged waterproof plywood sheets for Cooling towers deck slab.
2. Repairs & Maintenance of bitumastic linings and acid alkalis proof brick lining for B & MH, scrapper floor, transfer tower floor etc.
3. Providing and applying epoxy monolithic plaster for B& M H Plant, Urea Plant, Prill cooling system etc.
4. Providing and applying IP-Net protective coating for silo conveyor no.-2112, B& M H Plant, Urea Plant etc.
5. Providing & applying epoxy painting to RCC Structure of bagging plant transfer tower, prill cooling systems, urea plant area.
6. Shifting of debris etc from various locations at plant site.
7. Repairs of refractory lining work for Primary, Auxiliary Reformer and BHEL boiler.
8. Replacement of damaged AC sheet for various areas at plant site.
9. Providing and applying Tar plastic to damaged wooden membrane of cooling tower.
10. Replacement and maintenance of burner blocks in Auxiliary boiler.
11. Castable refractory repairing works in LT and HT zone.

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 - 2009 These included major jobs of replacement of Boiler Burners and HTS bottom Grid Modification.

AMMONIA:

- Provision of Cold Ammonia from storage to 107- F instead of 109- F
- Improvement in gas outlet System for HTS Converter (Modification in HTS Converter Outlet Grid)
- Diversion of 104-E overhead vapours to 101-B stack and syn gas first stage separator (105-F) Ammonical water to new tank/ separator.

UREA:

- Increased water seal height of CO2 knock out drum (V-1101)
- Provision of inlet and outlet isolation valves for urea recovery cooler (H-1427) on process side (Tube side) and cooling water supply isolation valve
- Installation of welded Plate Heat Exchangers (H-1301 & H-1301 A) in series
- Steam Condensate Pump (P-1505 A/B) discharge piping loop height increase in Urea Plant
- Ammonia recovery from vent gases of urea solution tank & ammonia water tank
- Higher size condensate line for HP ammonia Pumps (P-1102 A/B/C) plunger packing

OFFSITE:

- Replacement of old duel fuel (RLNG + LSHS) burners with new duel fuel (RLNG + SYNTHESIS GAS) burners in BHEL boiler.
- Relocation of Instrument Tappings (for relocation of Pressure Switches) from upstream of R-LNG Heater to Downstream of R-LNG Heater in R-LNG Line to Burners of BHEL Boiler
- Provision of Flow Indicator and Recorder for 4% NaOH to MB / SMB Stream Regeneration
- Provision of bypass to control valve (LCV-17) at the inlet of DM water storage tank

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 Boiler Burner Replacement Job.

As lots of rigging work was involved during execution of above jobs, safety was given top most priority like full time deployment of safety personnel near Boiler for Burner replacement Job. F&S section kept strict vigil during execution of all the above jobs.

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, even by selecting one higher size or thicknesses to meet the requirements with in-house availability. Efforts were also made to recondition Valves and retrieve Pipes, Fittings and Flanges from lines which were removed in earlier years due to modifications.

PLANT TURNAROUND MARCH - APRIL - 2009

GENERAL - DETAILS

EQUIPMENT UTILISED (IFFCO) :

- 135 T Kobelco Crane 01 No
- 55 T HM Crane 01 No
- 55 T TIL RT-760 Tyre mounted mobile Crane 01 No
- 15 T Coles Crane 01 No
- 18 T Tata Crane 01 No
- 10 T Escort Lift-N-Shift 01 No
- 14 T Escort Lift-N-Shift 01 No
- 03 T Forklift 03 Nos.
- 05 T Forklift 01 Nos.
- 10 T Truck 01 No
- 909 Tata (Mini Truck) 01 No

MANPOWER UTILIZED:

IFFCO MANPOWER:

- Mechanical }
- Mechanical Services } Existing
- Electrical } strength
- Instrument }

HIRED - CONTRACT MANPOWER:

Sr. No.	Category	Man days
1	General Fitter	1039
2	Rigger	1028
3	S.S. Rigger	2951
4	Fabricator	157
5	Grinder	213
6	Gas Cutter	94
7	Welder (HP)	53
8	Welder (ARC)	118
9	Carpenter	78
10	Mason	72
11	Machinist	42
12	Draftsman	12
13	Forklift Operator	36

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

SHUT DOWN RELATED CONTRACT

SR. NO.	PLANT	WO NO.	JOB DESCRIPTION	VENDOR'S NAME
1	--DO--	20081375	RLA STUDY OF WASTE HEAT BOILER	M/S. THERMAX PUNE
2	--DO--	20081140	CF MODULE INSULATION OF PRIMARY REFORMER	M/S.LLYOD INSULATIONS, MUMBAI
3	--DO—	20081261	MAJOR OVERHAULING OF ROTARY MACHINES OF AMMONIA PLANT	M/S.JYOTHI, HYDERABAD
4	--DO--	20081262	MAJOR OVERHAULING OF ROTARY MACHINES OF UREA & UTILITY PLANT	M/S.TURBO ENGINEERING
5	--DO--	20081200	OVERHAULING OF RELIEF VALVES	M/S.TYCO VALVES & CONTROLS, MUMBAI
6	--DO--	20081303	IN-SITU OF RETUBING OF HE-2	M/S.S.R.ENGINEERING
7	--DO--	20081288	OVERHAULING OF 117-J	M/S.MARUTI ENGG., AHMEDABAD
8	**UREA (MECH.)**	9920376 30-03-07	M-1403 BELT CONVEYOR JOBS	M/S.ELECON ENGG., V.V.NAGAR
9	**OFFSITE (MECH.)**	20081026	EXPERT SERVICES OF BHEL ENGINEERS FOR REPLACEMENT OF PRIMARY & SECONDARY SUPER HEATER COILS ALONG WITH HEADERS OF BHEL BOILER 27 VP 20 W	BHEL
10	--DO--	20070106	REPLACEMENT OF PRIMARY & SECONDARY SUPERHEATER COILS ALONG WITH HEADERS OF BHEL BOILER 27 VP 20 W	SHREE GANESH ENGINEERING COMPANY
11	--DO--	20081327	EXPERT SERVICES OF M/S. ACE CALDERYS LIMITED FOR REFRACTORY WORK IN THE BHEL BOILER	ACE CALDERYS LIMITED
12	--DO--	20080860	SERVICES FOR IN-SITU GLAND RE-PACKING OF VALVES	AMRUTHA ENGINEERING
13	--DO--	20080872	SERVICES FOR IN-SITU MACHINING , OVERHAULING AND TESTING OF HP/MP STEAM / GAS / LIQUID SERVICES SAFETY VALVES / RELIEF VALVES / PILOT OPERATED VALVES	FLOTEC ENGINEERING SERVICES
14	--DO--	20080886	IN-SITU REPAIR OF GATE VALVES	EFCO MASCHINENBAU INDIA P. LTD
15	**B&MH (MECH.)**	20080878	CONTRACT FOR OVERHAULING OF RECLAIM MACHINE	M/S EMTICI, VV NAGAR
16	--DO--	9920457	CONTRACT FOR OVERHAULING OF TRACKING ROLLER	M/S HOSCH EQTS., KOLKOTA
17	--DO--	9920534	SERVICING OF ARMSTRONG STITCHING MACHINE	M/S GABBAR ENGG. CO., AHMEDABAD
18	--DO--	9919985	ARC FOR SPLICING & VULCANISING	M/S J.K. RUBBER

19	**CIVIL**	20081047	MODIFICATION OF 52" DIA UNDERGROUND PIPE LINE FROM SUMP PUMP P-4404 TO SUMP OF PUMP-4401-D.	SADGURU CONST. CO.
20	--DO--	20080956	PROVIDING AND APPLYING IP NET PROTECTIVE COATING ON RCC STRUCTURES OF SILO, B & MH PLANT AREA, CONVEYOR GALLERY, PRILL TOWER.	KRISHNA CONCHEM PRODUCTS.
21	--DO--	20080867	PROVIDING AND APPLYING EPOXY MONOLITHIC PLASTER AT B&MH BUILDING AND UREA PLANT.	GYATRI CONST.
22	--DO--	20081099	REPAIR OF REFRACTORY LINING WORK FOR PRIMARY REFORMER, AUXILIARY AND BHEL BOILER AREA.	M H DETRIC (INIA) LTD.
23	--DO--	20080852	PROVIDING AND APPLYING EPOXY PAINTING TO RCC STRUCTURE OF BAGGING PLANT AND UREA PLANT.	VAIDEHI & COMPANY
24	--DO--	20080866	REPAIR AND MAINTENANCE OF BITUMASTIC LINING, ACID AND ALKALIES PROOF BRICK LINING IN STRONG / WEEK EFFLUENT PIT, WATER TREATMENT PLANT , PRILL TOWER-TOP FLOOR, BAGGING PLANT AND OTHER PLANT AREAS.	INDOCHEM ENGRS. CO.
25	--DO--	20081043	REPAIRING OF DAMAGED AC SHEETS INSTALLED AT REFORMER AND COMPRESSOR HOUSE ETC.	SADGURU CONST. CO.
26	--DO--	20081059	SHIFTING OF DEBRIS, MALBA ETC FROM VARIOUS LOCATIONS IN PLANT SITE.	I.M.NAIK
27	--DO--	20080934	MAINTENANCE OF DAMAGED COOLING TOWER DECK COVERING BY PLYWOOD SHEET.	SUDAMA FURNITURE.
28	**INSPECTION**	20080971	NDT TEAMS FOR CARRYING OUT DYE PENETRANT TESTING	INDUSTRIAL X-RAY & ALLIED RADIOGRAPHERS (I) P VT. LTD.,MUMBAI
29	--DO--	9921392	NDT TEAMS FOR CARRYING OUT ULTRASONIC FLAW DETECTION	NDT SERVICES, AHMEDABAD
30	--DO--	9921368	NDT TEAMS FOR CARRYING OUT RADIOGRAPHY JOB	NDT SERVICES, AHMEDABAD
31	--DO--	9921370	NDT TEAMS FOR CARRYING OUT IN-SITU METALLOGRAPHY JOB	TCR ADVANCED ENGG, VADODARA
32	--DO--	20081226	AUS OF PRIMARY REFORMER CATALYST & RISER TUBES.	PDIL, SINDARI,DHANBAD,BIHAR
33	--DO--	20081276	NDT TEAMS FOR CARRYING OUT MAGNETIC PARTICLE TESTING.	NDT SERVICES, AHMEDABAD
34	--DO--	20081362	EDDY CURRENT TESTING OF HP STRIPPER AND HP CONDENSER	TESTEX NDT ,MUMBAI

35	**ELECTRICAL**	20081388	MISCELLANEOUS ELECTRICAL JOBS DURING ANNUAL TURN ARROUND-2009	A.N. ELECTRICALS
36	--DO--	20081367	PROTECTIVE RELAY TESTING AND CALIBRATION INSTALLED AT PLANT AND TOWNSHIP.	ELECON ENGINEERING
37	--DO--	20081280	CONTRACT FOR SERVICES OF ELECTRICIANS FOR SHUTDOWN JOBS	A.N. ELECTRICALS
38	--DO--	20081130	SERVICING OF ROTORK MAKE VALVE ACTUATORS	ROTORK CONTROLS (INDIA) PRIVATE LIMITED
39	--DO--	20081231	SERVICING OF TMG MAKE LT AIR CIRCUIT BREAKERS	HEATEX INDUSTRIES
40	--DO--	20081131	SERVICING OF JYOTI MAKE 11KV VACUUM CIRCUIT BREAKERS	POWER SWITCHGEAR SERVICES
41	--DO--	20081434	MAINTENANCE OF TRANSFORMERS AT PLANT AND TOWNSHIP.	VOLTAMP TRANSFORMER LTD.
42	--DO--	9921396	SUPPLY AND REPLACEMENT OF MOTOR CONTROL CENTER-01, SECTION-B	SIEMENS LTD.
43	--DO--	20080394	REPLACEMENT OF ROTORK MAKE VALVE ACTUATORS	ROTORK CONTROLS (INDIA) PRIVATE LIMITED
44	--DO--	20080261	OVERHAULING OF MOTORS	INDIAN HEAVY ELECTRIC CO
45	**INSTRUMENT**	20080664	PREVENTIVE MAINT. OF AMMONIA PLANT HIMA PLC	L & T,
46	--DO--	9921526	PREVENTIVE MAINT. CHECKING OF AMMONIA PLANT UPSS	INSTRUMENTATION LTD.,
47	--DO--	9921265	UPS BATTERIES	SYN-TECH POWER SYSTEM,
48	--DO--	9919529	AMC FOR SERVICING OF ANALYZERS	ABB ANALYTICAL,
49	--DO--	9921158	RETROFITTING JOB OF PNEUMATIC LEVELTROLS	DRESSER VALVES,
50	--DO--	20081068	PREVENTIVE MAINTENANCE	YOKOGAWA INDIA LTD.,
51	--DO--	20080984	MAINTENANCE OF CONTROL VALVES	HI-TECH CONTROLS,
52	--DO--	9921476	OCCASIONAL TEMPORARY JOBS	SAIYAD & CO.,
53	--DO--	20070435	ASSISTING IFFCO DURING ANNUAL TURNAROUND	A - Z INSTRUMENTS SERVICES,
54	--DO--	20081094	AMC FOR RADIOACTIVE TYPE LEVEL MEASURING SYSTEM IN UREA PLANT	BERTHOLD TECHNOLOGIES (INDIA) PVT. LTD. CHENNAI
55	--DO--	20070238	AMC FOR M/S OMRON, JAPAN MAKE PLC	MASIBUS AUTOMATION AND INSTRU. (P) LTD. AHMEDABAD
56	--DO--	20081044	WORK CONTRACT FOR INCIDENTAL INSTRUMENTATION MAINT. JOBS	SANTECH SYSTEMS
57	--DO--	9920198	SERVICING OF BELTWEIGHER SYSTEM	EMTICI ENGG.LTD.
58	--DO--	9921183	REPAIRING AND VERIFICATION OF 40 TON WEIGHBRIDGE	ASHBEE SYSTEMS PVT LTD

59	**PLANNING**	20080669	ANNUAL RATE CONTRACTOR FOR SUPPLYING & APPLICATION OF ANTI-CORROSIVE PAINTS IN UREA & B&MH PLANT	M/S.B.CHAUHAN & CO,SAIJ
60	--DO--	20080702	ANNUAL RATE CONTRACT FOR FABRICATION & ERECTION OF PIPING & STEEL STRUCTURE.	M/S.J & J ENGINEERS – KALOL
61	--DO--	20080707	ANNUAL RATE CONTRACT FOR FABRICATION & ERECTION OF PIPING & STEEL STRUCTURE.	M/S.SMITHA ENGINEERS– KALOL
62	--DO--	20081530 .	ALUMINIZING OF PRIMARY REFORMER STACK	MYTHRI METTALIZING. BANGLORE
63	--DO--	20081329	OPENING & BOX-UP OF HEAT EXCHANGERS IN AMMONIA, UREA AND OFFSITES PLANTS.	M/S. RAM BAHADUR & CO ALLAHABAD
64	--DO--	20081435	ASSISTING IFFCO DURING BREAKDOWN / PLANT TURNAROUND JOBS.	M/S. RAM BAHADUR.
65	--DO--	20081436	ASSISTING IFFCO DURING BREAKDOWN / PLANT TURNAROUND JOBS.	M/S. GEN ENGG WORKS.
66	--DO--	9921620	ANNUAL RATE CONTRACT FOR HYDROJET CLEANING OF HEAT EXCHANGERS.	M/S.DELUXE HYDROBLASTING SERVICES,MUMBAI
67	--DO--	20070378	RATE CONTRACT FOR CARRYING OUT VARIOUS INSULATION JOBS.	M/S. BALAJI INSULATION
68	--DO--	20070380	RATE CONTRACT FOR CARRYING OUT VARIOUS INSULATION JOBS.	M/S. KHANDELWAL INSULATION

MECHENICAL

AMMONIA PLANT

AIR COMPRESSOR TRAIN (101-J)

101-JT Air Compressor Drive Turbine Major Overhauling

Following activities were carried out during the turbine overhauling:

Exhaust piping removed after locking the bellow in the exhaust piping. After de-coupling, it was recorded like clearances of Journal Bearing, Thrust Bearing, Axial float and coupling alignment readings. Floating front end bearing pedestal was locked by providing washers in the holding bolts before opening the casing bolts. Turbine casing bolts were loosened and removed the top cover. Recorded all internal clearances and Rotor was lifted by Kobelco crane. Removed all Diaphragms and observed severe erosion in the casing grooves at stage 3, 5 & 6 which lead to steam leak at the back of diaphragm seating surface of casing. It was repaired by weld built up. Repair methodology followed for weld repair is as below:

101-JT Casing Repair

Pre Heat the repair area approx up to 150 deg. C by Gas Torch. Followed by weld built up by TIG process and slow cooling the welded area by covering under insulation cloth. Metal built up was done with ER-70 S filler wire. Final finishing of built metal surface by hand grinding and cleared by dye penetrator test.

During installation, the first diaphragm i.e. Stage 2 diaphragm was installed back since it's condition is good. Rests of the diaphragms were replaced with reconditioned one. All reconditioned diaphragms were fitted without any rework. These diaphragms are earlier removed from 101-JT and got reconditioned at M/s Man Turbo India Private limited, Vadodara vide Work order No 20081081 dtd 02.01.2009 @ cost of Rs 12.35 Lacs.

101-JT Rotor on Bottom Casing

The parting plane level readings of reconditioned diaphragms with respective casing grooves were measured. A minimum clearance 0.2 mm as required, is observed in all reconditioned diaphragms. Existing interstage labyrinth seal were found in good condition and installed the same back. Rotor was cleaned and found in condition. Small deformation was noticed in the rib of coupling hub (turbine). As Turbine was running normal before stopping the machine for overhauling, and any such rectification may change dynamic balancing of the coupling, hence it was left as it is.

101-JT Repaired Bottom Casing

After placement of Rotor, Diaphragm to Rotor Disc axial clearance was recorded and found within design values. The rotor run out was checked and found within the limit, readings were recorded. The governor drive assembly was completely overhauled. The condition of worm & worm wheel was found good, blue match was checked and assembled back. The fulcrum Pins of steam chest valve was found worn out. New pin manufactured in work shop and installed in the chest linkage fulcrum. Also the universal bearing was replaced. The Valve clearances of all five valves were recorded and Steam chest valve was assembled. Old copper gasket was used during assembly with graphoil tape. After complete assembly the Top casing was lifted for placement and assembled. The Axial float, Nozzle clearance, Bearing clearance, Thrust float were recorded and casing was boxed-up. No activity was carried out on governor and same was assembled as such. Then alignment of complete train was checked and found o.k. During start-up the turbine was put on slow roll @ 2000 RPM for 3 hrs, then speed was raised to minimum governing speed. Speed was brought upto 4595 / 4600 RPM. While raising the speed steam chest joint gasket (copper) leaked and Turbine was to be stopped for attending the leakage. New gasket, cut from 1.6 mm thk cooper sheet assembled after annealing. After attending the leak again the Turbine was put on slow roll for five hrs for uniform heating and thermal expansion of the turbine. Speeded the turbine to its minimum governor speed of 4800 RPM by the Gimble valve and further speeding was done by governor. OST of the turbine at 7250 RPM achieved in 2-3 trails by adjusting the shim under the spring of OST assembly. 1st & 2nd trial the turbine does not trip and even at crossing 7300 RPM. The spring tension was reduced by putting thinner shims under the spring and tripped at 7250 RPM.

101-JLP Air Compressor Preventive Maintenance.

Decoupled 101-JLP and gear box. Journal bearings and Thrust bearings were inspected and found in good condition. Checked coupling alignment and compare with protocol reading and found OK. Gauss measurement was carried out and found within acceptable limits (3guass). Oil guard at the thrust end (CF 588 K, New part No AF 587BC) was found damaged and the same was replaced by new one. The entire bag filters as well as Roll-O-Matic filters were replaced at suction end.

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 recorded and found within the design range.

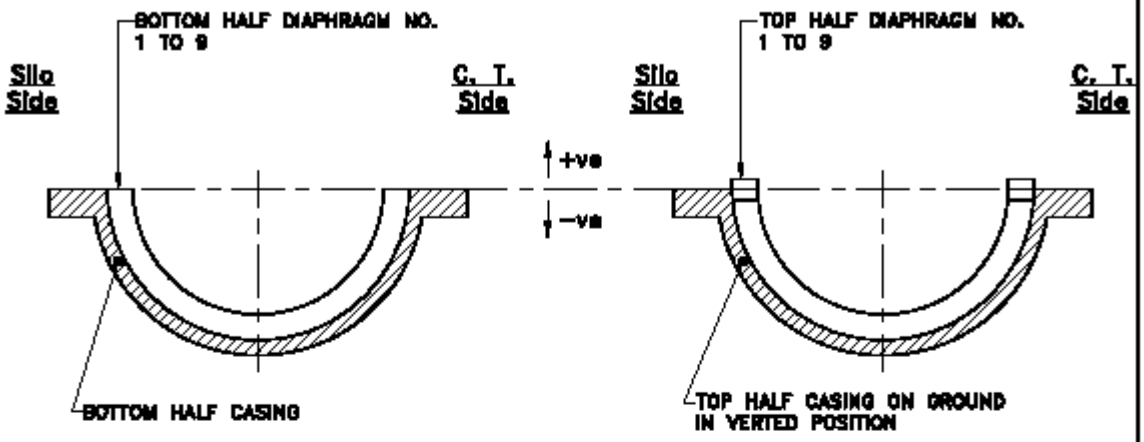
101-JHP Air Compressor Preventive Maintenance.

Drive end & Non Drive end journal bearing as well as thrust bearings were inspected and found in good condition. Gauss readings of journal and thrust bearing pads and base ring, shaft journal, thrust collar were measured and found within limit.

Couplings Inspection

The coupling between 101-JT to 101-JLP and 101-JHP to gear box were inspected and found to be O.K. The DBSE and coupling overhang/override were measured and found to be acceptable.

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL



ALL DIMENSIONS ARE IN MM.

DIAPHRAGM NO. FROM GOVERNOR END	NO.:1	NO.:2	NO.:3	NO.:4	NO.:5	NO.:6	NO.:7	NO.:8	NO.:9
	BOTTOM CASING WITH BOTTOM HALF DIAPHRAGM								
SILO SIDE (X1)	+0.10	−0.45	+1.00	+1.80	+1.20	+0.05	+0.20	+0.60	−0.20
C.T. SIDE (X2)	−0.35	+0.35	−1.20	−1.95	−1.30	−0.65	−0.30	−0.85	−0.15
	TOP CASING WITH TOP HALF DIAPHRAGM								
SILO SIDE (X3)	−0.50	−0.85	−0.50	+1.10	−0.10	−0.25	+0.55	+1.25	−0.30
C.T. SIDE (X4)	+0.55	+0.70	+0.55	−1.15	−0.10	+0.20	−0.65	−1.60	−0.30
NET CLEARANCE (SUM OF ALL FOUR i.e. (X1 + X2) + (X3 + X4) with reference to parting plane)	−0.20	−0.25	−0.15	−0.20	−0.30	−0.65	−0.20	−0.60	−0.95

DRN	N.V. PANCHAL	TITLE - PP LEVEL READING OF 101-JT			EWR No.
CHD	PAWAN GARG				
APD	28.05.2009	DRAWING No. CODE AMM-405	PLANT FROM NUMBER P1ES08----	SHEET OF 1 1	REV. 0
SCALE	N. T. S.				

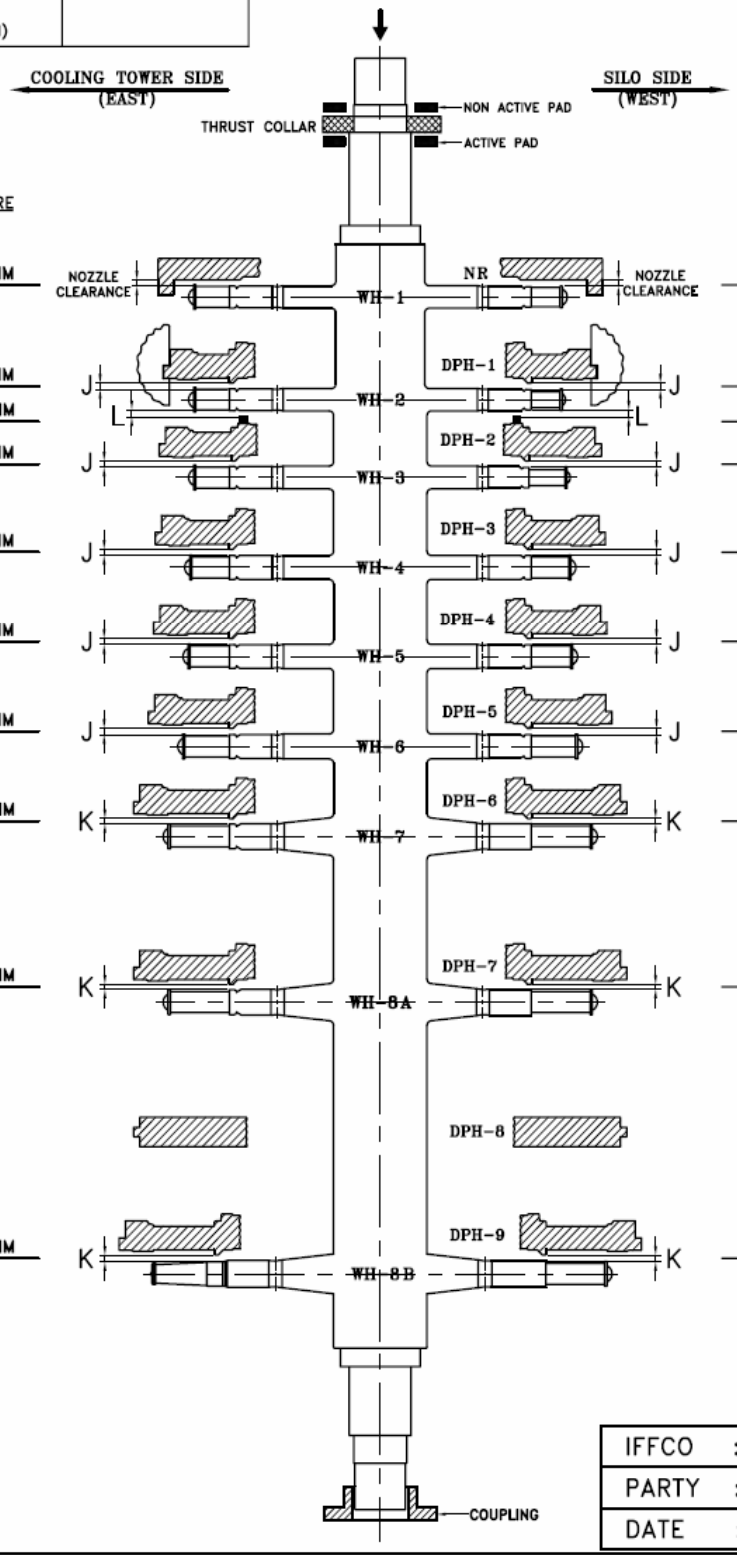
IFFCO – KALOL

WHEEL TO DIAPHRAGM CLEARANCE (101-JT)

REF.	DESIGN CLEARANCES – INCHES CLEARANCES – MM	MEASUREMENT RELEVANCE
J	0.055"–0.065" (1.375–1.625MM)	ACTIVE PADS IN POSITION & ROTOR PUSHED TOWARDS COUPLING SIDE
K	0.110"–0.120" (2.75–3.00MM)	
L	0.115"–0.125" (2.875–3.125MM)	
NOZZLE CLEARANCE	0.055"–0.065" (1.375–1.625MM)	

	TOTAL FLOAT ("WITHOUT" ACTIVE & NON ACTIVE THRUST PAD IN POSITION)	AXIL FLOAT ("WITH" ACTIVE & NON ACTIVE PAD IN POSITION)
DESIGN	4.35MM	0.08"–0.012" (0.2–0.3MM)
BEFORE	4.45MM	0.010"
AFTER	4.45MM	0.011"

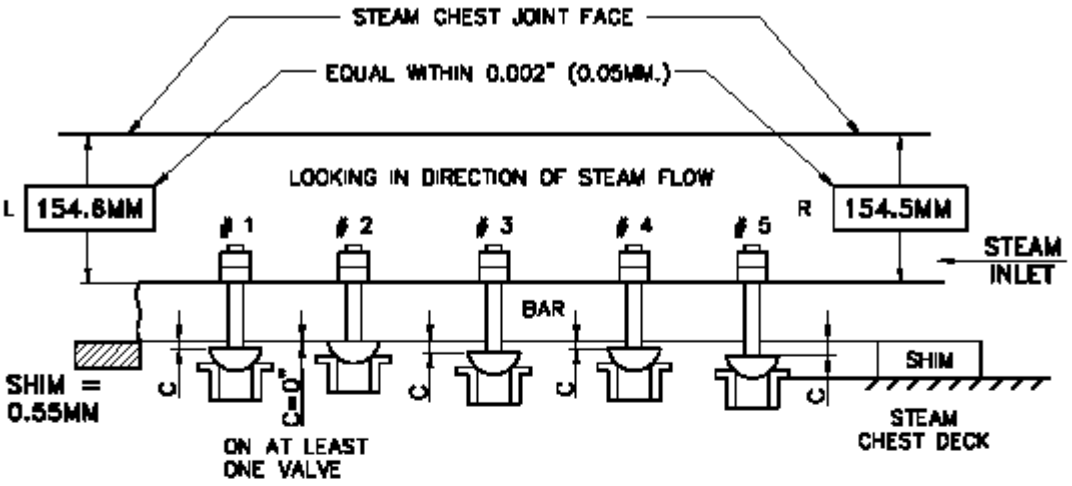
DPH : DIAPHRAGM
WH : WHEEL
N R : NOZZLE RING



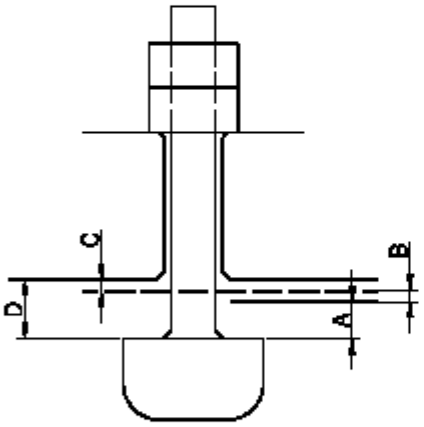
IFFCO	:–
PARTY	:–
DATE	:–

101–JT

DATE : 25/03/2009



SKETCH # 1



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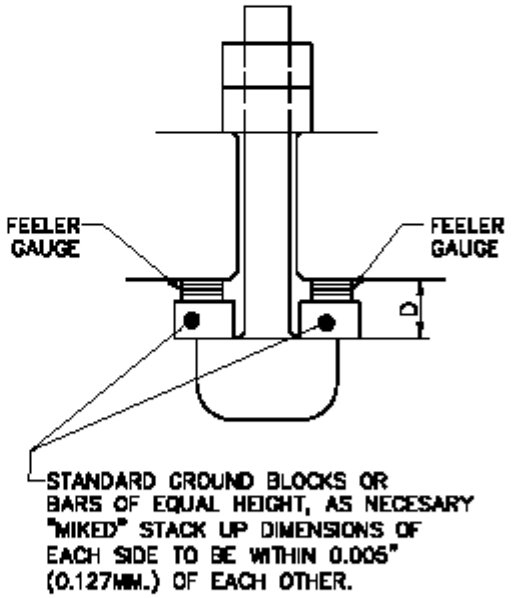


TABLE						
VALVE NUMBER		1	2	3	4	5
VALVE SETTING	A	17.50MM	7.87MM	2.50MM	13.20MM	22.60MM
COLD BAR CLEAR.	B	2.50MM	2.50MM	2.50MM	2.50MM	2.50MM
VALVE TO BAR CLEAR. (ERROR)	C	0.00MM	0.19MM	0.35MM	0.23MM	0.00MM
TOTAL	D	20.00MM	10.56MM	5.35MM	15.93MM	25.10MM

COUPLINGS INSPECTION REPORT – 101-J TRAIN

Description	Position		Design (Inch)	Before (Inch)	After (Inch)
DBSE (With Rotor at extreme ends)					
101 JT-JLP	---		10.50	10.50	10.50
101 JLP-JR	---		8.25	8.3	8.3
101 JR-JHP	---		8.25	8.30	8.30
Distance between Hub Face (With Rotor at extreme ends)					
101 JT-JLP	---		10.557	10.56	10.56
101 JLP-JR	---		8.25	8.320	8.470
101 JR-JHP	---		8.25	8.275	8.275
Overhang (Hub / Shaft)					
101 JAT	LP End	Shaft	0.057	0.060	0.060
101 JLP	JAT End	Hub	0.00	0.00	0.00
	JR end	Shaft	0.00	0.160	0.160
101 JR	LP End	Hub	0.00	0.005	0.005
	HP End	Hub	0.00	0.024	0.024
101 JHP	JR End	Shaft	0.00	0.007	0.007

CLEARANCE CHART -101-JT

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
JLP End				
Journal Bearing	Mandrel	0.007-0.009	---	---
	Filler / lead wire		0.009	0.009
Oil Guard For Jr. Brg Housing	South	0.015-0.021	0.018	0.018
	North	0.058-0.097	0.080	0.080
Oil Guard (For Seal Housing)	---	0.077-0.109	0.098	0.098
Shaft Diameter	Jr. Brg.	4.993	----	----
Bearing Pinch	Jr. Brg.	---	----	----
Governor End				
Journal Bearing	Mandrel	0.007-0.009	----	----
	Filler / lead wire		0.008	0.008
Oil Guard (For Brg. Housing)	South	---	---	--
	North	0.015-0.021	0.018	0.019
Oil Guard (For Thrust Brg.)	South	0.002-0.04	0.003	0.003
	North	0.002-0.004	0.003	0.003
Oil Guard (For Seal Housing)	---	0.077-0.109	0.099	0.099
Axial Thrust.	With Top Housing	0.008-0.012		0.012
	Without top Housing			
Shim thickness. (Thrust adjusting)	North	---	0.017	0.017
	South	---	0.0946	0.0946
Trip Lever - Plunger Gap	---	0.120-0.130	0.136	0.136

Journal Bearing Pads Thickness - 101 – JT

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	20.68	20.68	20.63	20.63
No 2	20.67	20.67	20.63	20.63
No 3	20.68	20.68	20.65	20.65
No 4	20.68	20.68	20.65	20.65
No 5	20.67	20.67	20.63	20.63

Thrust Bearing Pad Thickness - 101 – JT

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	15.90	15.90	12.70	12.70
No 2	15.90	15.90	12.71	12.71
No 3	15.91	15.91	12.71	12.71
No 4	15.91	15.91	12.71	12.71
No 5	15.90	15.90	12.70	12.70

CLEARANCE CHART - 101 – JLP

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
101-JT END				
Journal Bearing Clearance	Mandrel	0.005-0.008	NA	NA
	Filler / lead wire		0.006	0.006
Bearing Pinch	Journal Bearing	------	0.01 mm	0.01 mm
Shaft Dia.	Journal Bearing	4.493	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.015	0.32 mm	0.32 mm
	South	0.013-0.015	0.32 mm	0.33 mm
Oil Guard (For Outer Housing)	North	0.021-0.027	0.64 mm	0.65 mm
	South	0.021-0.027	0.64 mm	0.65 mm
Gear Box End.				
Journal Bearing Clearance	Mandrel	0.005-0.008	NA	NA
	Filler / lead wire		0.14 mm	0.14 mm
Bearing Pinch	Journal bearing	------		
Shaft Dia	Journal bearing	4.493	NA	NA
Oil Guard	North	0.013-0.015	0.31 mm	0.31 mm

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
(For Journal Bearing)	South	0.013-0.015	0.32 mm	0.33 mm
Oil Guard (For Thrust bearing)	North	0.002-0.004	--	--
	South	0.002-0.04	--	--
Oil Guard (For Outer Housing)	North	0.021-0.027	0.61 mm	0.61 mm
	South	0.021-0.027	0.60 mm	0.60 mm
Axial Thrust	With Top Housing	0.010 - 0.015	0.25 mm	0.25 mm
	Without Top Housing		NA	NA

Journal Bearing Pads Thickness - 101 – JLP

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	NA	NA	0.751 “	0.751 “
No 2	NA	NA	0.751 “	0.751 “
No 3	NA	NA	0.751”	0.751”
No 4	NA	NA	0.750”	0.750”
No 5	NA	NA	0.750”	0.750”

Thrust Bearing Pad Thickness - 101 – JLP

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	19.86	19.86	19.93	19.93
No 2	19.78	19.78	19.90	19.90
No 3	19.86	19.86	19.91	19.91
No 4	19.85	19.85	19.92	19.92
No 5	19.87	19.87	19.93	19.93
No 6	19.86	19.86	19.91	19.91
No 7	19.84	19.84	19.92	19.92
No 8	19.85	19.85	19.93	19.93

CLEARANCE CHART - 101-JR

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal Bearing (Low Speed drive gear)	North	0.008-0.010	0.265 mm	0.265 mm
	South	0.008-0.010	0.300 mm	0.300 mm
Axial Thrust	---	0.014-0.024	0.30 mm	0.30 mm
Journal Bearing (High Speed driven Pinion)	North	0.009-0.011	0.237 mm	0.237 mm
	South	0.009-0.011	0.266 mm	0.266 mm
Free float	---	---	1.12 mm	1.12 mm
Backlash	---	---	0.45 mm	0.45 mm
Shaft Diameter (Low Speed drive Gear)	North Side Bearing	---	--	114.10 mm
	South Side Bearing	---	--	114.10 mm
Shaft Diameter (High Speed drive Gear)	North Side Bearing	---	--	88.74 mm
	South Side Bearing	---	--	88.73 mm

CLEARANCE RECORDS – 101JHP

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
GB End				
Journal Bearing Clearance	Mandrel	0.004-0.007		
	Filler / lead wire		0.17mm	0.17 mm
Bearing Pinch	Journal Bearing	------	--	--
Shaft Dia.	Journal Bearing	2.996	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.016	0.36 mm	0.36 mm
	South	0.013-0.016	0.33 mm	0.36 mm
Oil Guard (For Top Housing)	North	0.015-0.022	0.41 mm	0.41 mm
	South	0.015-0.022	0.42 mm	0.42 mm
Non Drive End				
Journal Bearing Clearance	Mandrel	0.015-0.022	--	--
	Filler / lead wire		0.17 mm	0.17 mm
Bearing Pinch	Journal bearing	------	--	--
Shaft Dia	Journal bearing	2.996	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.016	0.37 mm	0.38 mm
	South	0.013-0.016	0.37 mm	.38 mm
Oil Guard (For Thrust bearing)	North	0.002-0.004	--	--
	South	0.002-0.04	--	--
Oil Guard (For Top Housing)	North	------	------	------
	South	0.015-0.022	--	--
Axial Thrust	With Top Housing	0.008 - 0.012	0.30 mm	0.30 mm
	Without Top Housing		NA	NA

Journal Bearing Pads Thickness - 101 – JHP

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	14.28 mm	14.28 mm	14.30 mm	14.30 mm
No 2	14.28 mm	14.28 mm	14.29 mm	14.29 mm
No 3	14.30 mm	14.30 mm	14.29 mm	14.29 mm
No 4	14.28 mm	14.28 mm	14.28 mm	14.28 mm
No 5	14.30 mm	14.30 mm	14.29 mm	14.29 mm

Thrust Bearing Pad Thickness - 101 – JHP

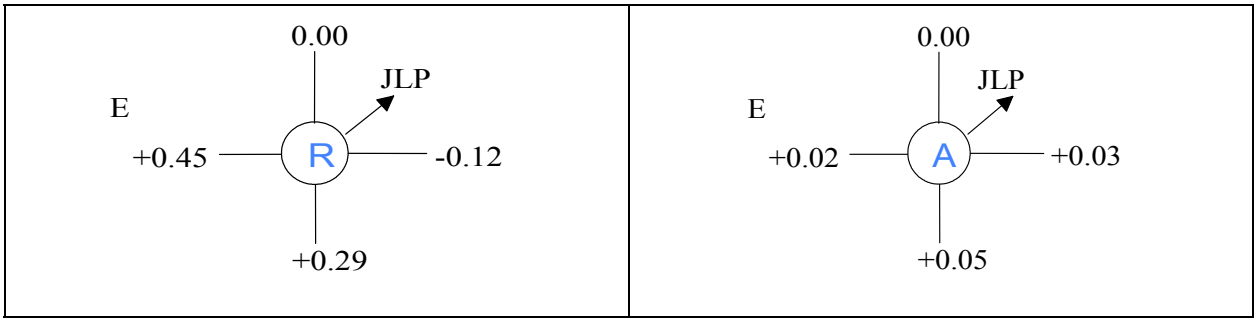
Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	12.71 mm	12.71 mm	12.68 mm	12.68 mm
No 2	12.68 mm	12.68 mm	12.68 mm	12.68 mm
No 3	12.70 mm	12.70 mm	12.70 mm	12.70 mm
No 4	12.70 mm	12.70 mm	12.69 mm	12.69 mm
No 5	12.68 mm	12.68 mm	12.68 mm	12.68 mm

Gauss readings 101-J TRAIN

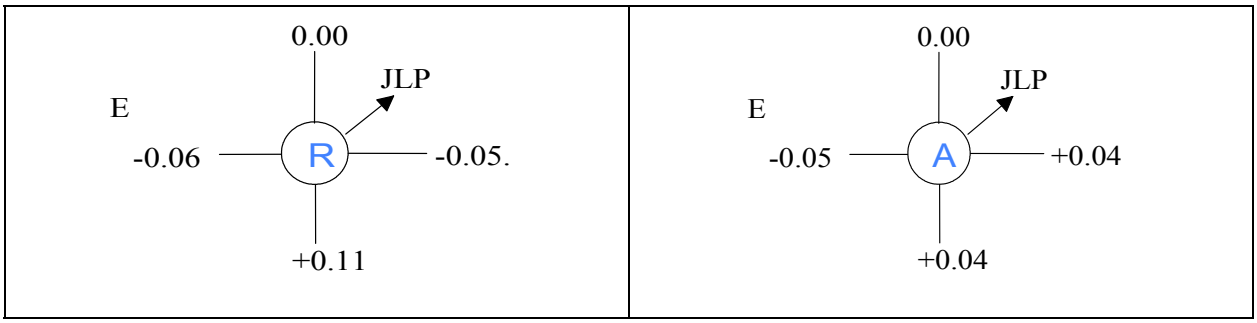
Description	Position	Before (Gauss)	After (Gauss)
101- JT			
Journal Bearing pads	Thrust End	0.8	o.k.
	Non thrust end	0.8	o.k.
Journal Bearing base ring	Thrust End	1.8	o.k.
	Non thrust end	1.3	o.k.
Thrust bearing pads	Active	0.9	o.k.
	Inactive	1.3	o.k.
Thrust Bearing base ring	Active	1.9	o.k.
	Inactive	--	--
Thrust collar	----	--	--
Shaft Journal	Thrust End	2.5	o.k.
	Non thrust end	1.6	o.k.
101 – JLP			
Journal Bearing pads	Thrust End	2.0	o.k.
	Non thrust end	2.6	o.k.
Journal Bearing base ring	Thrust End	1.5	o.k.
	Non thrust end	2.0	o.k.
Thrust bearing pads	Active	1.4	o.k.
	Inactive	1.6	o.k.
Thrust Bearing base ring	Active	2.3	o.k.
	Inactive	1.3	o.k.
Shaft Journal	Thrust End	0.6	o.k.
	Non thrust end	0.8	o.k.
Thrust collar	------	--	--

101 – JR			
Gear Journal Bearing	North	--	--
	South	0.8	o.k.
Pinion Journal Bearing	North	--	--
	South	1.2	o.k.
Thrust bearing	Active	2.6	o.k.
	Inactive	1.0	o.k.
Oil Guard for Above	South	--	--
	North	--	--
Shaft Journal	Thrust End	1.1	o.k.
	Non thrust end	1.2	o.k.
101 – JHP			
Journal Bearing pads	Thrust End	1.8	o.k.
	Non thrust end	2.0	o.k.
Journal Bearing base ring	Thrust End	2.9	o.k.
	Non thrust end	3.1	o.k.
Thrust bearing pads	Active	2.7	o.k.
	Inactive	3.7	o.k.
Thrust Bearing base ring	Active	0.7	o.k.
	Inactive	1.2	o.k.
Oil Guard for Above	South	2.5	o.k.
	North	2.2	o.k.
Shaft Journal	Thrust End	2.4	o.k.
	Non thrust end	2.3	o.k.

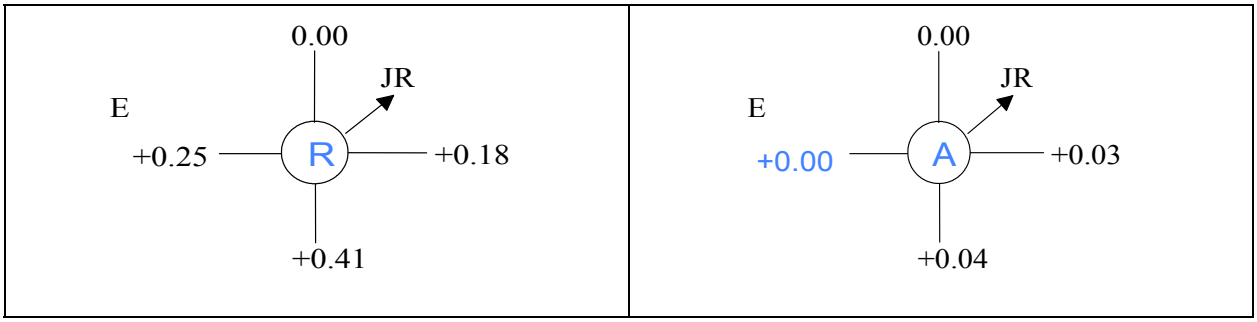
Alignment: **101-JT to 101-JLP** - Before Preventive Maintenance



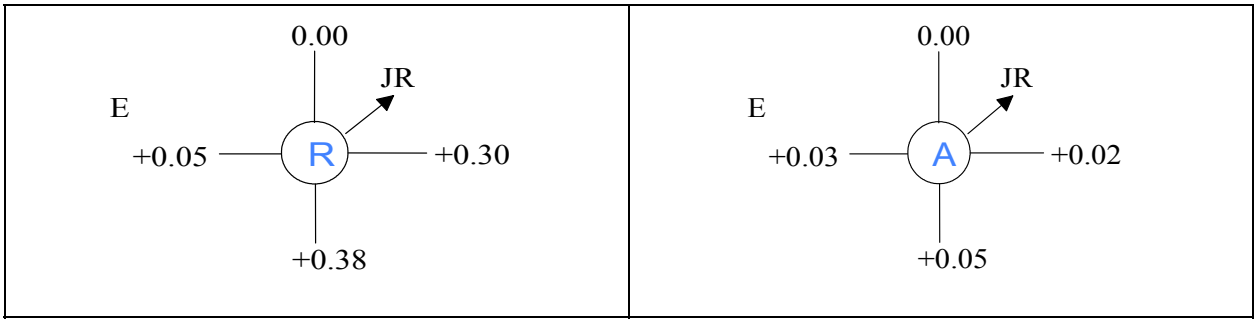
Alignment: **101-JT to 101-JLP** - After Preventive Maintenance



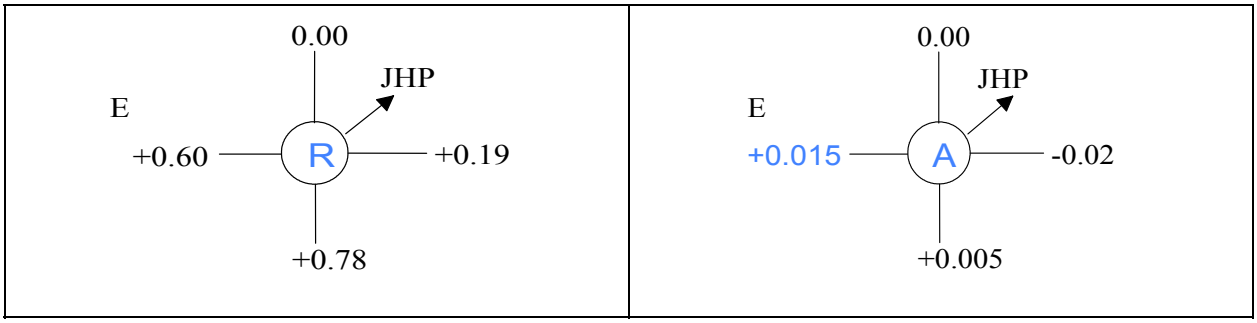
Alignment: **101-JLP to 101-JR -** Before Preventive Maintenance



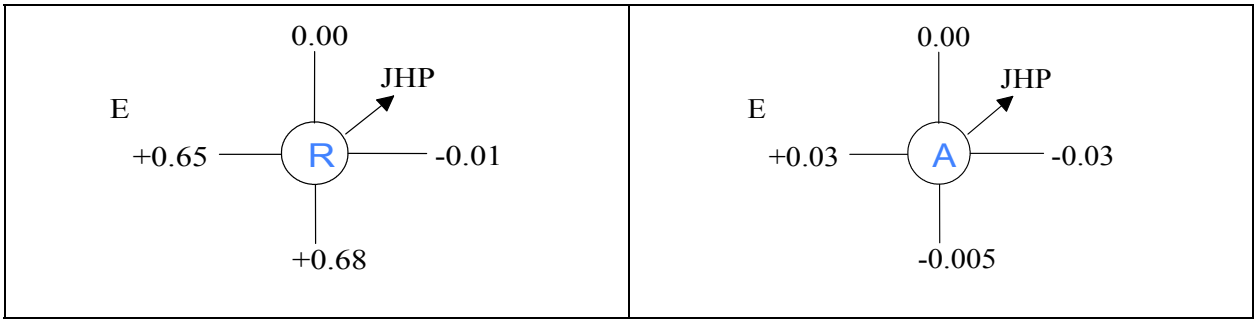
Alignment: **101-JLP to 101-JR -** After Preventive Maintenance



Alignment: **101-JR to 101-JHP** Before Preventive Maintenance



Alignment: **101-JR to 101-JHP** 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 o.k. The governor drive GB at front end of the turbine was also overhauled. The governor oil pipe leakage was attended by replacing the damaged pipe with SS 304 pipe & fitting.

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 both end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found o.k. Bearing clearances were taken and found within the design range. The governor end seal housing was opened to attend steam leakage. The Labyrinth Seals No HJ-141-AR X1, HJ-141-AH X1 & HJ-141 AV X1 was replaced with new one. The governor oil line was attended by replacing with SS 304 pipes & fittings. The emergency Trip valve was attended due to oil leakage from the top.

103-JLP, Synthesis Gas Compressor Preventive Maintenance.

Journal bearings and thrust 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.

103-JHP Damaged Jr. Bearing Pad

103-JHP Damaged Thrust Bearing Pad Seat

The compressor was decoupled and thrust bearing and both end Journal bearing were inspected. Gauss readings of 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. The non-drive end journal bearing clearance was found high and also burn marks were observed on pads. The journal bearing was replaced. The thrust bearing pads were observed slightly worn-out as shown in the photo; hence new thrust bearing was issued for installation. But the base ring of new thrust bearing was not having drill for RTD cables, hence new thrust pads with old base ring was used.

COUPLING RECORDS 103-J TRAIN

Description	Position		Design (Inch)	Before (Inch)	After (Inch)
DBSE (With Rotor at extreme end position)					
103 JBT - JAT	---		--	--	333.82 mm
103 JAT - JLP	---		--	--	444.80 mm
103 JLP- JHP	---		--	--	488.45 mm
Distance between Hub Face (With Rotor at extreme end position)					
103 JBT - JAT	---		--	278.14 mm	278.06 mm
103 JAT - JLP	---		--	444.90 mm	444.90
103 JLP- JHP	---		--	487.45	487.45
Coupling Hub / Shaft Overhang					
103 JBT	JAT End	Hub	--	2.86 mm	2.86 mm
		Shaft	--	---	---
103 JAT	JBT End	Hub	--	1.00 mm	1.00 mm
		Shaft	--	---	---
	JLP end	Hub	--	1.37 mm	1.37 mm
		Shaft	--	---	---
103 JLP	JAT End	Hub	--	0.48 mm	0.48 mm
		Shaft	--	---	---
	JHP End	Hub	--	---	---
		Shaft	--	0.0055	0.0055
103 JHP	JLP End	Hub	--	---	---
		Shaft	--	0.0035	0.0035

CLEARANCE CHART 103 – JBT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
JAT End					
Journal Bearing	Mandrel	A	0.010-0.012	0.21 mm	0.20 mm
	Filler / lead wire			--	--
Oil Guard (For Jr.Brg Housing)	South	C	0.008-0.014	0.008”	0.008”
	North	------	-----	-----	-------
Bearing Pinch	Jr. Brg.			0.07 mm	0.07 mm
Governor End					
Journal Bearing	Mandrel	A	0.010-0.012	0.20 mm	0.20 mm
	Filler / lead wire				
Oil Guard (For Brg. Housing	South	---	---	---	--
	North	C	0.008-0.014	0.010”	0.010”
Oil Guard (For Seal Housing)	---	D	0.039-0.071	0.010”	0.010”
Axial Thrust.	With Top Housing		0.008-0.012	0.22 mm	0.22 mm
	Without top Housing				
Total Float	---	--	--	5.52 mm	5.52 mm

Journal Bearing Sleeve Thickness 103 – JBT

HALF	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
TOP	24.65	24.65	24.65	24.65
BOTTOM	24.65	24.65	24.65	24.65

Thrust Bearing Pad Thickness 103 – JBT

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After(mm)
No 1	15.84	15.84	12.72	12.72
No 2	15.85	15.85	12.70	12.70
No 3	15.84	15.84	12.70	12.70
No 4	15.82	15.82	12.71	12.71
No 5	15.86	15.86	12.71	12.71

CLEARANCE CHART 103 - JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
JAT End					
Journal Bearing	Mandrel	N	0.006-0.008	0.17 mm	0.17 mm
	Filler / lead wire			--	--
Oil Guard (For Jr. Brg Housing)	South	C	0.015-0.021	0.006”	0.006”
	North	---	-----	-----	-------
Bearing Pinch	Jr. Brg.	---	---	0.07 mm	
JBT End					
Journal Bearing	Mandrel	B	0.010-0.012	0.26 mm	0.26 mm
	Filler / lead wire				
Oil Guard (For Brg. Housing)	South	---	---	---	--
	North	C	0.015-0.021	0.010”	--
Oil Guard (For Seal Housing)	---	D	0.077-0.110	--	--
Axial Thrust.	With Top Housing	---	0.008-0.012	0.29 mm	0.30 mm
	Without top Housing	---		--	--
Oil Guard (For Thrust Bearing)	North	A	0.002-0.004	0.002”	0.002”
	South	A	0.002-0.004	0.002”	0.002”
Bearing Pinch	Jr. bearing	---		0.002	0.002

Journal Bearing Sleeve Thickness 103 – JAT

HALF	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
TOP	20.60	20.60	20.60	20.60
BOTTOM	20.62	20.62	20.61	20.61

Thrust Bearing Pad Thickness 103-JAT

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	25.38	25.38	Not Applicable	Not Applicable
No 2	25.40	25.40	-- do --	-- do --
No 3	25.37	25.37	-- do --	-- do --
No 4	25.37	25.37	-- do --	-- do --
No 5	25.36	25.36	-- do --	-- do --
No 6	25.37	25.37	-- do --	-- do --

CLEARANCE CHART 103 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (Inch)	After (Inch)
NON THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002”-0.004”	NA	NA
	Filler / lead wire			0.14 mm	0.14 mm
Bearing Pinch	Journal Bearing	---	---	0.0035	0.0035
Shaft Dia.	Journal Bearing		--	NA	NA
Oil Guard (For Journal Bearing)	North	C2	0.008”- 0.013”	--	0.15 mm
	South	C2	0.008”- 0.013”	--	0.18 mm
THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002”-0.004”	NA	NA
	Filler / lead wire			0.15 mm	0.15 mm
Oil Guard (For Journal Bearing)	North	C2	0.008”- 0.013”	0.17 mm	0.17 mm
Axial Thrust	With Top Housing	--	0.015”- 0.022”	--	0.40 mm

CLEARANCE CHART 103 – JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (Inch)	After (Inch)
NON THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.023”-0.033”	NA	NA
	Filler / lead wire			--	0.13 mm
Oil Guard	North	A2	0.085”- 0.0115”	0.20 mm	0.20 mm
(For Journal Bearing)	South	A2	0.0085”- 0.0115”	0.17 mm	0.16 mm
THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.023”-0.033”	NA	NA
	Filler / lead wire			0.006”	0.004”
Oil Guard	North	A2	0.0085”- 0.0115”	NA	NA
(For Journal Bearing)	South	A2	0.0085”- 0.0115”	0.20 mm	0.22 mm
Axial Thrust	With Top Housing		0.015” - 0.022”	-	0.32 mm
	Without Top Housing			NA	NA

Thrust Bearing Pad Thickness 103 – JHP

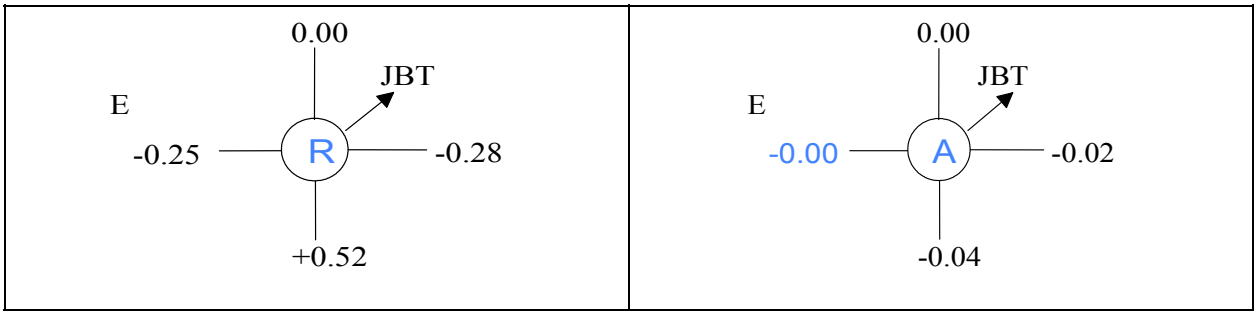
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	14.26	14.28	Not accessible	
No 2	14.29	14.29	-- do --	
No 3	14.26	14.28	-- do --	
No 4	14.26	14.28	-- do --	
No 5	14.24	14.28	-- do --	
No 6	14.26	14.28	-- do --	
No 7	14.25	14.27	-- do --	
No 8	14.24	14.27	-- do --	

GAUSS: 103-J TRAIN

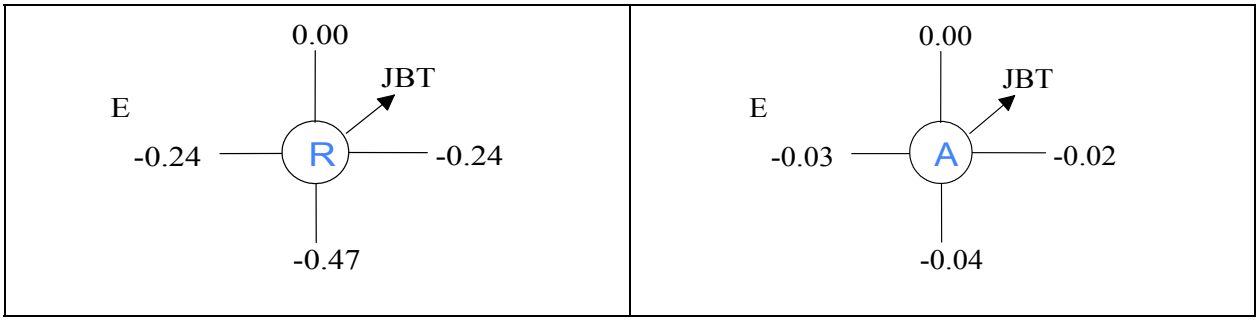
Description	Position	Before (Gauss)	After (Gauss)
103- JBT			
Journal Bearing Sleeve	Thrust End	1.7	o.k.
	Non thrust end	1.3	o.k.
Thrust bearing pads	Active	1.6	o.k.
	Inactive	1.2	o.k.
Thrust Bearing base ring	Active	1.6	o.k.
	Inactive	NA	NA
Shaft Journal	Thrust End	0.9	o.k.
	Non thrust end	1.3	o.k.
Thrust collar	---	1.9	o.k.
103 - JAT			
Journal Bearing Sleeve	Thrust End	1.1	o.k.
	Non thrust end	1.3	o.k.
Thrust bearing pads	Active	1.1	o.k.
	Inactive	1.5	o.k.
Journal bearing base ring	---	1.2	o.k.
Thrust Bearing base ring	Active	1.3	o.k.
	Inactive	NA	NA
Shaft Journal	Thrust End	1.6	o.k.
	Non thrust end	0.9	o.k.
Thrust collar	---	1.2	o.k.
103 - JLP			
Journal Bearing Sleeve	Thrust End	NA	NA
	Non thrust end	2.9	o.k.
	Non thrust end	2.2	o.k.

103-JHP			
Journal Bearing Pads	Thrust End	1.9	o.k.
	Non thrust end	1.2	o.k.
Thrust bearing pads	Active	1.7	o.k.
	Inactive	1.8	o.k.
Thrust Bearing base ring	Active	1.4	o.k.
	Inactive	NA	NA
Shaft Journal	Thrust End	1.7	o.k.
	Non thrust end	1.2	o.k.
Journal bearing base ring	---	1.9	o.k.

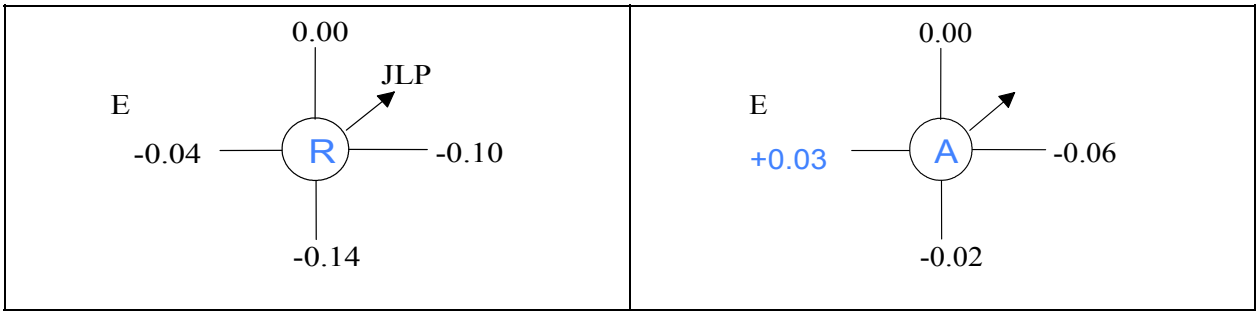
Alignment **103-JBT to JAT** (Before PM)



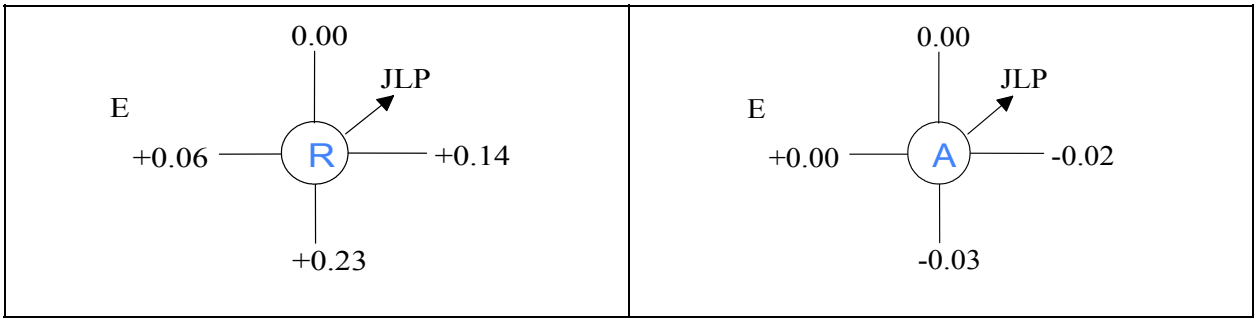
Alignment **103-JBT to JAT** (After PM)



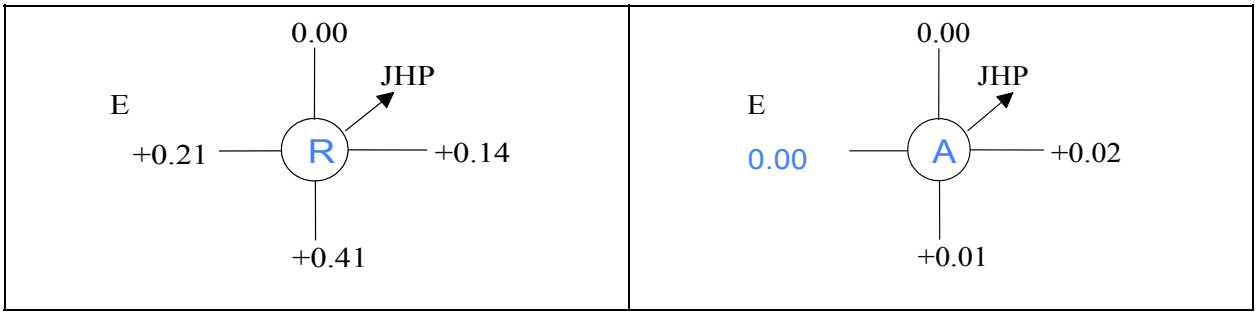
Alignment **103-JAT to JLP** (Before PM)



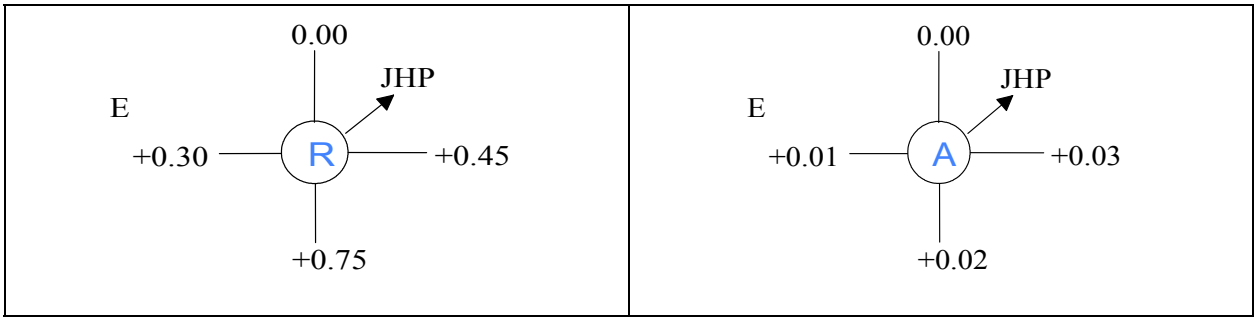
Alignment **103-JAT to JLP** (After PM)



Alignment **103-JLP to JHP (**Before PM)



Alignment **103-JLP to JHP** (After PM)



REFRIGERATION COMPRESSOR TRAIN 105-J

Major Overhauling of Drive Turbine (105-JT)

Following major activities were carried out during the overhauling:

Exhaust piping removed after locking the bellow in the exhaust piping. The casing bolts loosened after locking the front end floating end bearing pedestal and lifted the top casing of the compressor. Bolts were loosened with the help of Sweeny torque machine.

All internal clearances are noted and lifted the rotor. The condition of Rotor was observed good. Hence the same Rotor was cleaned and kept ready for re-installation.

As per Shut-down-2008 observation, the Spare set of diaphragms was kept ready for replacement of running diaphragms. The spare diaphragms were reconditioned at M/s Man Turbo Pvt Ltd, Vadodara vide WO No 20070030 dtd 14.02.2008 @ cost of 12.39 Lacs.

During installation of Diaphragms, The parting plane reading were measured and recorded.

After placement of diaphragms, the rotor was lifted and assembled on bottom casing and axial float, Total Float and axial clearance between Rotor wheel and diaphragms were measured and recorded.

The Design Axial Clearance “J” between Rotor wheel and Diaphragm for stage 2 to stage 6 is 0.055” -0.065” and for stage 7 & stage 8 the design clearance “K” is 0.110” - 0.120”.

The “J” clearance of Stage 2, 3, 4, 5 & 7 were found less than designed values as mentioned in following Table. Hence it was decided to rework on these five diaphragms for maintain the clearance as per design value.

Diaphragm No	Clearance “J” Design : 1.39 – 1.65 mm	Addition of weld thickness on sealing face after machining
Stage-2 / KJ-52-BAZ	0.95 mm	0.60
Stage-3 / KJ-52-BBA	1.25 mm	0.40
Stage-4 /KJ-52-BBB	0.75 mm	0.80
Stage-5 /KJ-52-BBH	1.05 mm	0.50
Stage-7 / KJ-52-BBE Design : 2.8 -3.04 mm	1.45 mm	1.60

The rework was done by deposition of weld built-up on sealing face of diaphragm after positive locking of same for prevention of distortion. The welding was carried out with TIG using ER-70S filler wire. Then machining was carried out.

105-JT Diaphragm Welding

105-JT Diaphragm machining

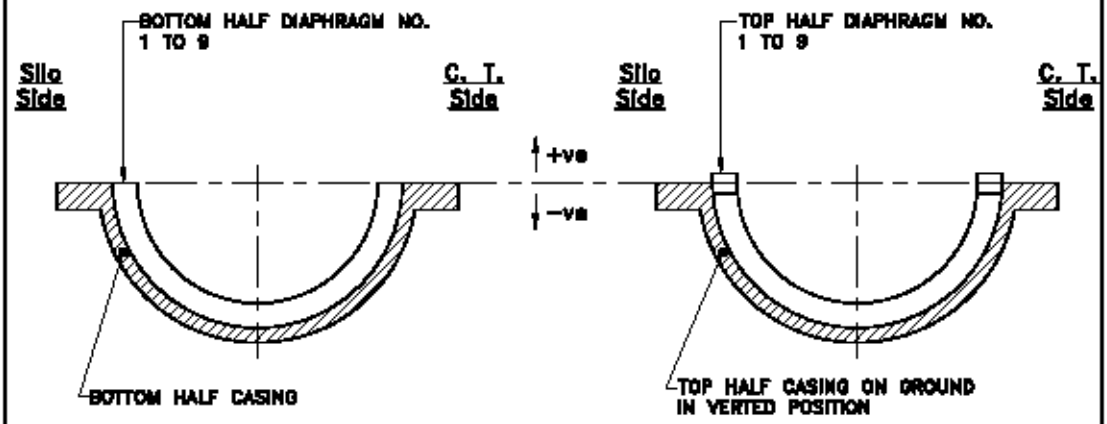
After completion of rework on diaphragms, the diaphragms were installed back and Rotor was placed. The Axial clearance between Rotor Wheel to Diaphragms was measured and found as per design values as mentioned in attached drawing.After measurement of all clearances, the Top casing was installed back and the Turbine was boxed-up. Then bellow and elbow was installed.

The Exhaust line butterfly valve was reported jammed. Hence the gear box of valve was attended by removal of old caked grease and applying new grease.

The governor drive gear assembly clearances were noted and found within desired value. No job has been carried out on governor assembly.

The turbine was finally boxed up. All clearances are given separately.

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL



ALL DIMENSIONS ARE IN MM.

DIAPHRAGM NOS. FROM GOVERNOR END	NO.:1	NO.:2	NO.:3	NO.:4	NO.:5	NO.:6	NO.:7	NO.:8	NO.:9
	BOTTOM CASING WITH BOTTOM HALF DIAPHRAGM								
SILO SIDE (X1)	+0.32	−0.10	+0.30	+0.25	−0.35	+0.09	−0.02	−0.75	−1.48
C.T. SIDE (X2)	+0.03	−0.50	−0.10	+0.75	+0.10	+0.90	+0.57	−0.40	−0.55
	TOP CASING WITH TOP HALF DIAPHRAGM								
SILO SIDE (X3)	−0.20	+0.15	−0.07	−0.45	+0.10	−0.60	−0.40	−1.30	+0.70
C.T. SIDE (X4)	−0.25	−0.17	+0.05	−0.92	+0.10	−0.70	−0.30	−0.82	+1.10
NET CLEARANCE (SUM OF ALL FOUR i.e. (X1 + X2) + (X3 + X4) with reference to parting plane)	−0.10	−0.92	+0.32	−0.37	−0.05	−0.31	−0.15	−0.10	−0.10

DRN	N.V. PANCHAL	TITLE - PP LEVEL READING OF 105-JT			EWR No.	
CHD	PAVAN DARG					
APD	02.04.2008	DRAWING No. CODE AMM-404	PLANT P1	FROM NUMBER E5 08----	SHEET 1 OF 1	REV. 0
SCALE	N. T. S.					

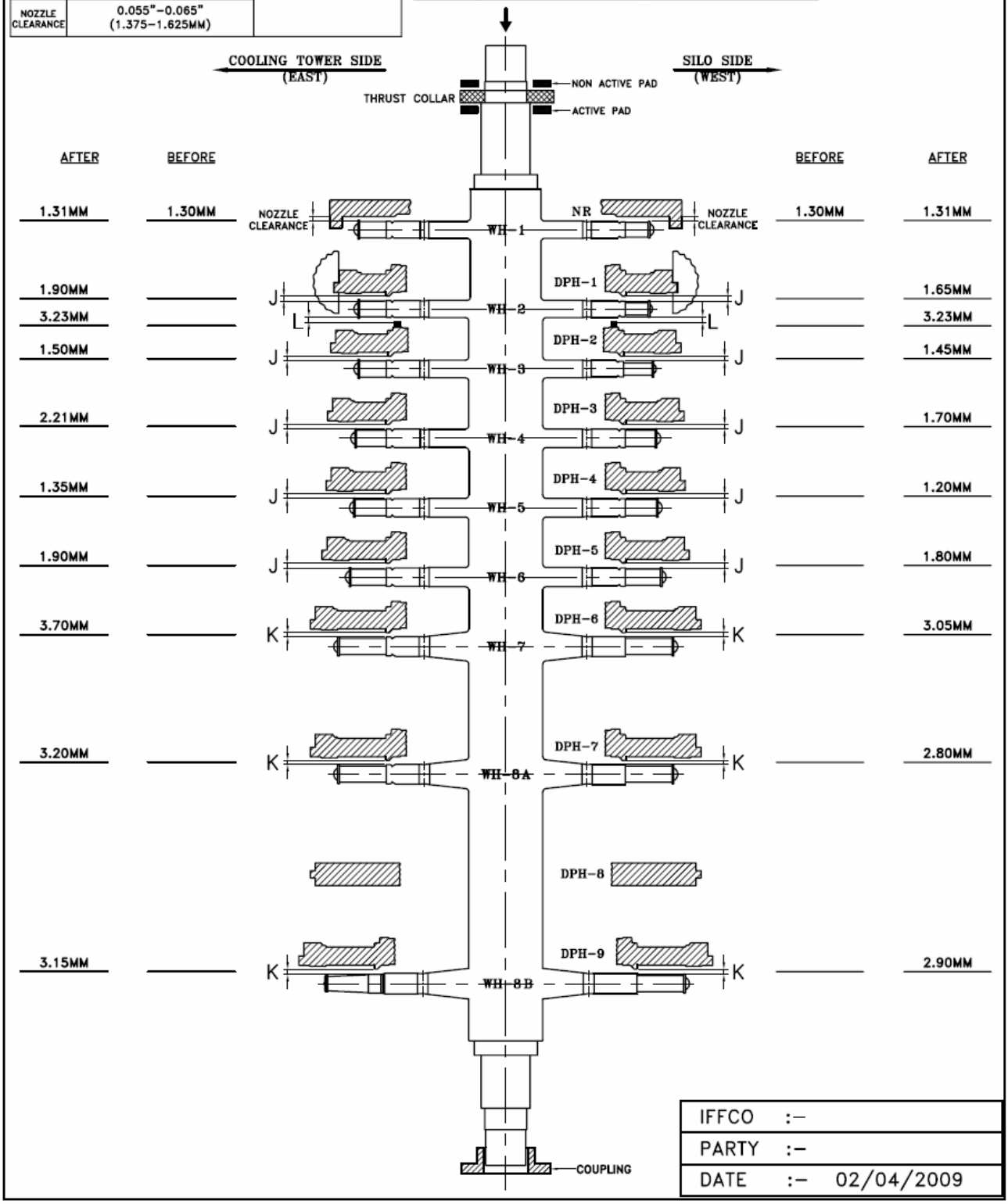
IFFCO – KALOL

WHEEL TO DIAPHRAGM CLEARANCE (105-JT)

REF.	CLEARANCES – INCHES CLEARANCES – MM	MEASUREMENT RELEVANCE
J	0.055"–0.065" (1.375–1.625MM)	ACTIVE PADS IN POSITION & ROTOR PUSHED TOWARDS COUPLING SIDE
K	0.110"–0.120" (2.75–3.00MM)	
L	0.115"–0.125" (2.875–3.125MM)	
NOZZLE CLEARANCE	0.055"–0.065" (1.375–1.625MM)	

	TOTAL FLOAT ("WITHOUT" ACTIVE & NON ACTIVE THRUST PAD IN POSITION)	AXIL FLOAT ("WITH" ACTIVE & NON ACTIVE PAD IN POSITION)
DESIGN	4.40MM	0.08"–0.012" (0.2–0.3MM)
BEFORE	4.41MM	0.011"
AFTER	4.43MM	0.011"

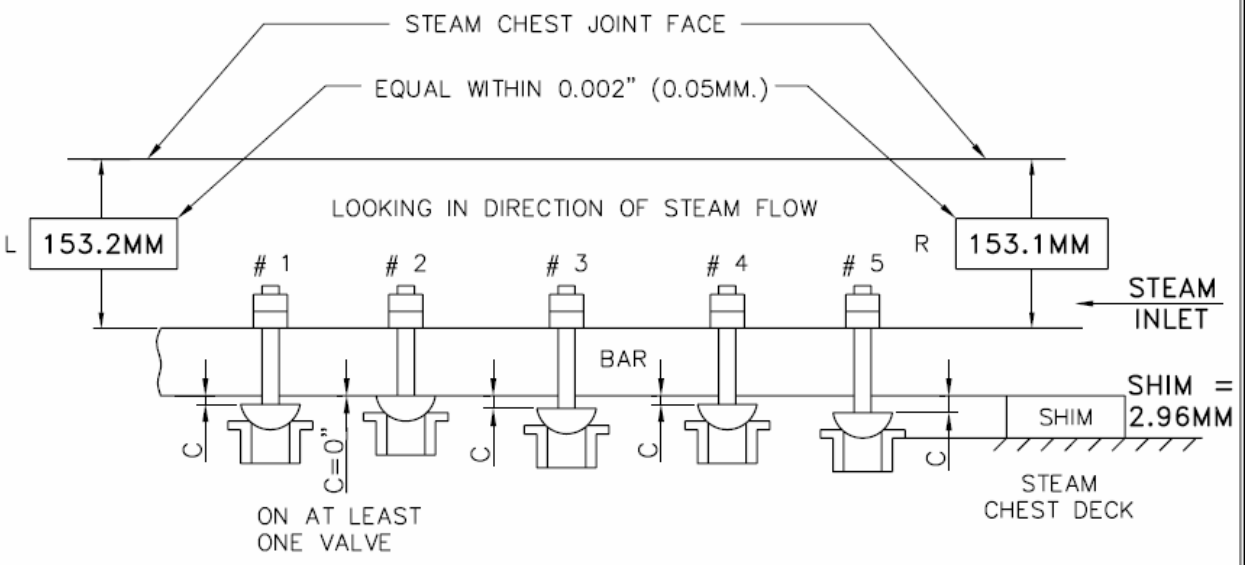
DPH : DIAPHRAGM
WH : WHEEL
NR : NOZZLE RING



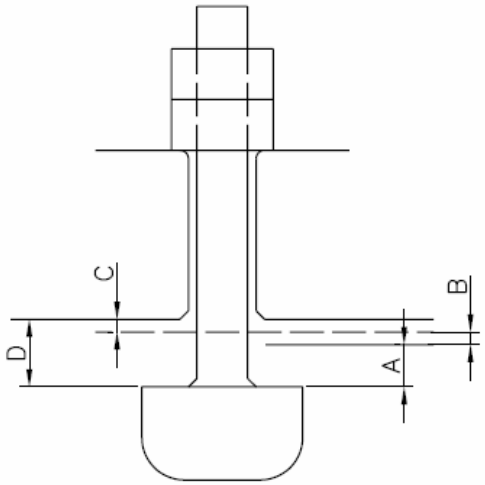
IFFCO	:–
PARTY	:–
DATE	:– 02/04/2009

105–JT

DATE : 26/03/2009



SKETCH # 1



SKETCH # 2

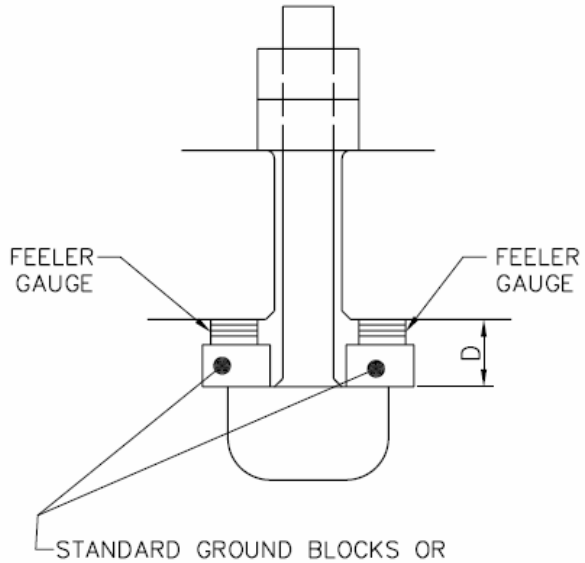


TABLE						
VALVE NUMBER		1	2	3	4	5
VALVE SETTING	A	17.52MM	7.87MM	2.5MM	13.20MM	25.9MM
COLD BAR CLEAR.	B	2.5MM	2.5MM	2.5MM	2.5MM	2.5MM
VALVE TO BAR CLEAR. (ERROR)	C	0.00MM	0.53MM	1.66MM	0.55MM	0.00MM
TOTAL	D	20.02MM	10.90MM	6.66MM	16.25MM	28.40MM

105-JR Preventive Maintenance.

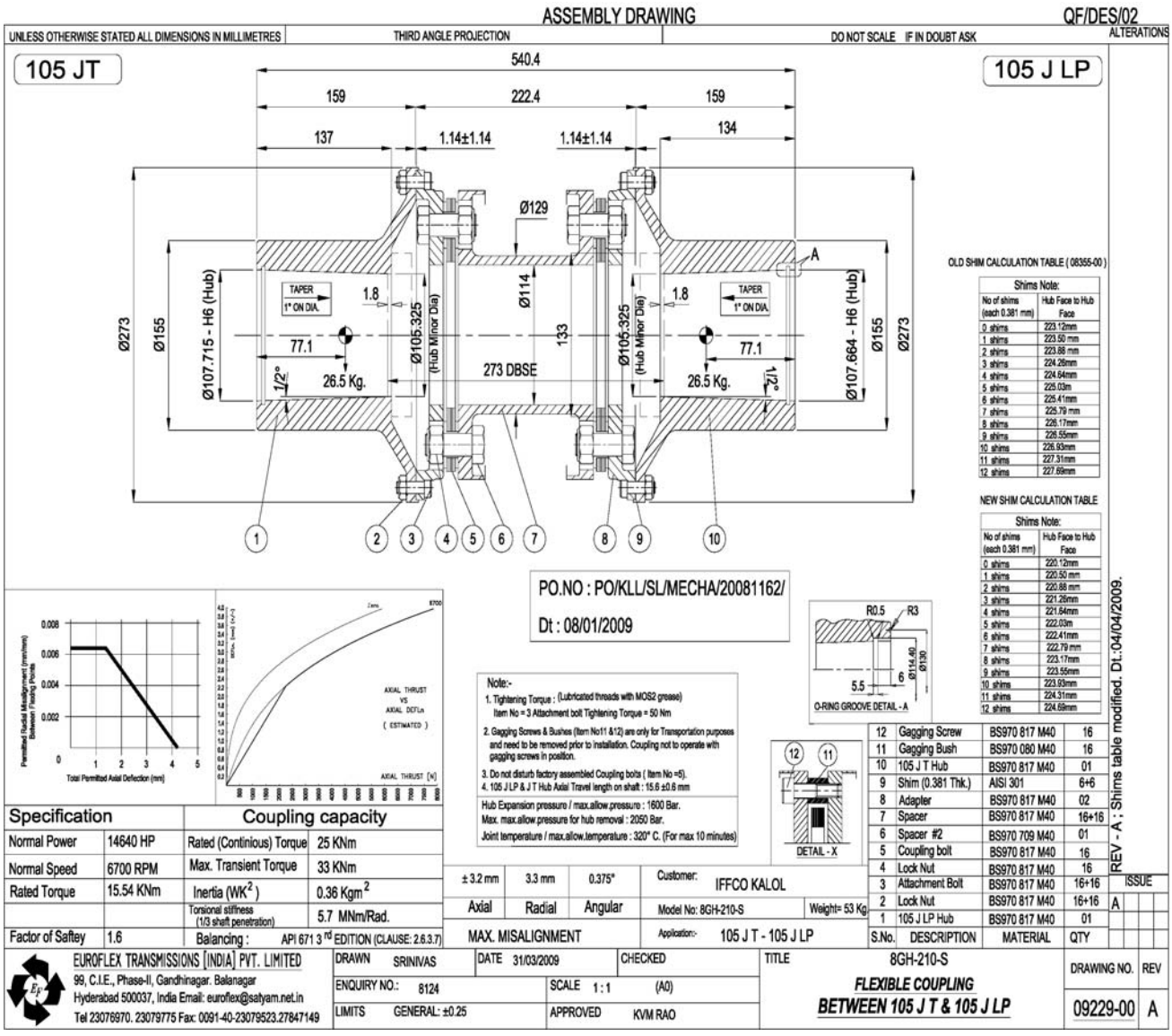
Decoupled the gear box and HP case. Opened the gear box cover and the bearings were inspected and found O.K. Both the gear and Pinion were inspected and found to be O.K. Gauss readings of bearings and shaft journal areas was measured and found within limit. Bearings clearance were measured and found within limit. Boxed up with same bearing and gears after thorough cleaning.

105-JHP Preventive Maintenance.

Both ends Journal bearing and Thrust bearing were inspected. Bearings were inspected and found O.K. Gauss readings of bearings and shaft journal areas was measured and found within limit. Boxed up with same bearing after thorough cleaning & DP check.

Replacement of Couplings.

During shut-down 2009, all the three couplings of 105-J Train was replaced with "Euroflex" make Shimpack couplings.



Coupling Hub Installation 105-JLP

Equipment : 105-JT to 105-JLP	**Coupling make : "Euroflex" As Built Drawing No 09229-00 Rev A**
Coupling Location : 105-JLP (Turbine Side)	

Sr. No	**Description**	**Readings mm**	**Remarks**
1.	Coupling Hub Blue match (min 80-85 %) (%)	80	
2.	Dry fit Stand off **'A'** (Without 'O'-Ring & Backup washer) (mm)	17.2	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	17.2	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	15.6 +/- 0.6	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	1.8	
6	Actual Push '**C1'** (After installation) (mm)	16.0	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	1.2	
7.	Hub Lock Nut step '**F**' (mm)	1.25	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	--	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.05	
10	Maximum Expander pump pressure (PSI)	23000	
11.	Maximum Pusher pump pressure (kg/cm^2)	180	
12.	Pusher pressure hold up time at final pressure (Minutes)	20 minutes	

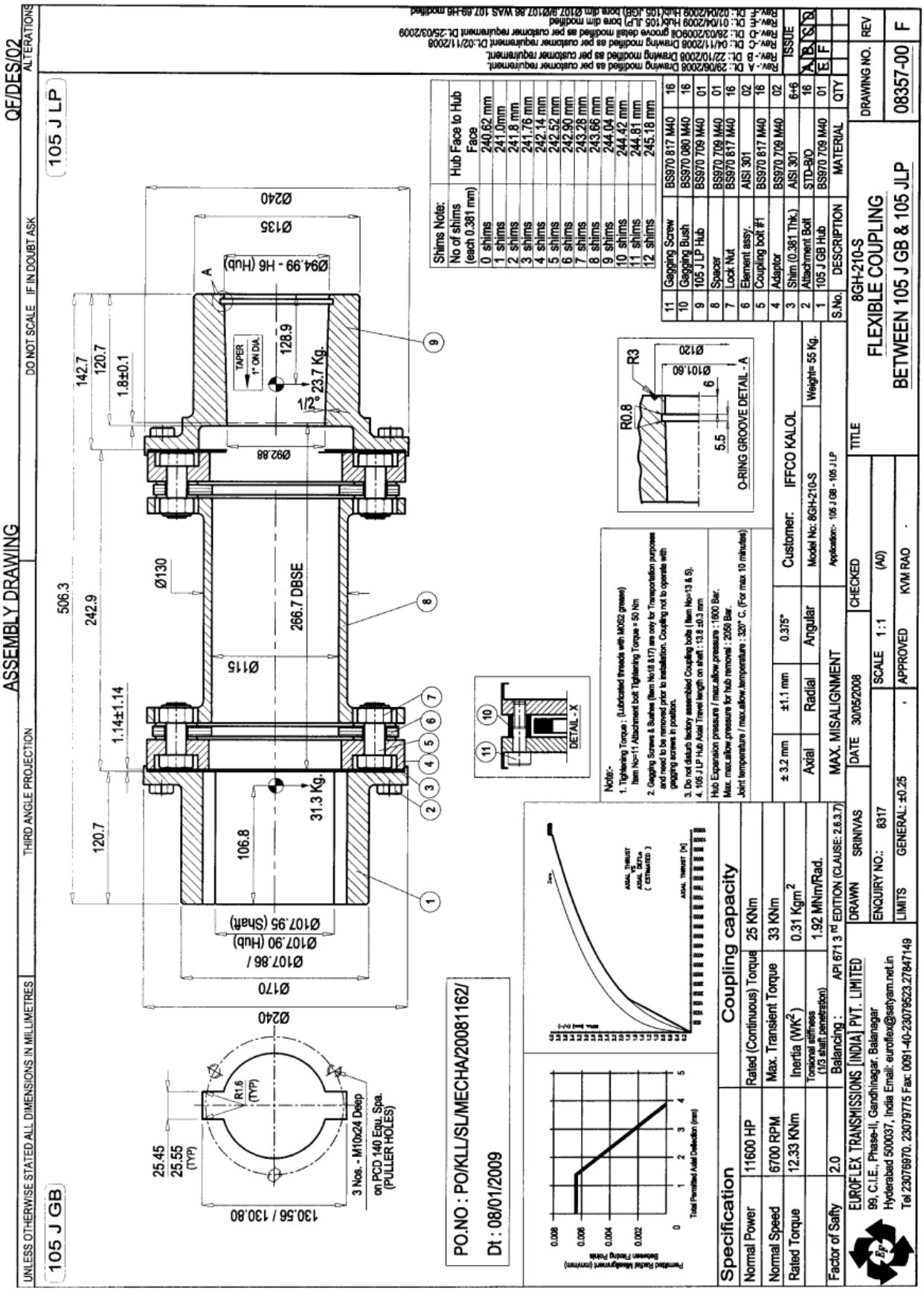
Coupling Hub installation: 105-JT

Equipment : 105-JLP to JT	**Coupling make : "Euroflex" As Built Drawing No 09229-00 Rev A**

Coupling Location : 105-JT (Turbine Hub)

Sr. No	**Description**	**Readings**	**Remarks**
1.	Coupling Hub Blue match (min 80-85 %) (%)	85	
2.	Dry fit Stand off **'A'** (Without 'O'-Ring & Backup washer) (mm)	18.4	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	18.4	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	15.6 +/- 0.6	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	2.4	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	2.6	
7.	Hub Lock Nut step '**F**' (mm)	2.65	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	--	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.05	
10	Maximum Expander pump pressure (PSI)	25000	
11.	Maximum Pusher pump pressure (kg/cm^2)	200	
12.	Pusher pressure hold up time at final pressure (Minutes)	20 Minutes	

Coupling Hub installation: 105-JLP (GB side)

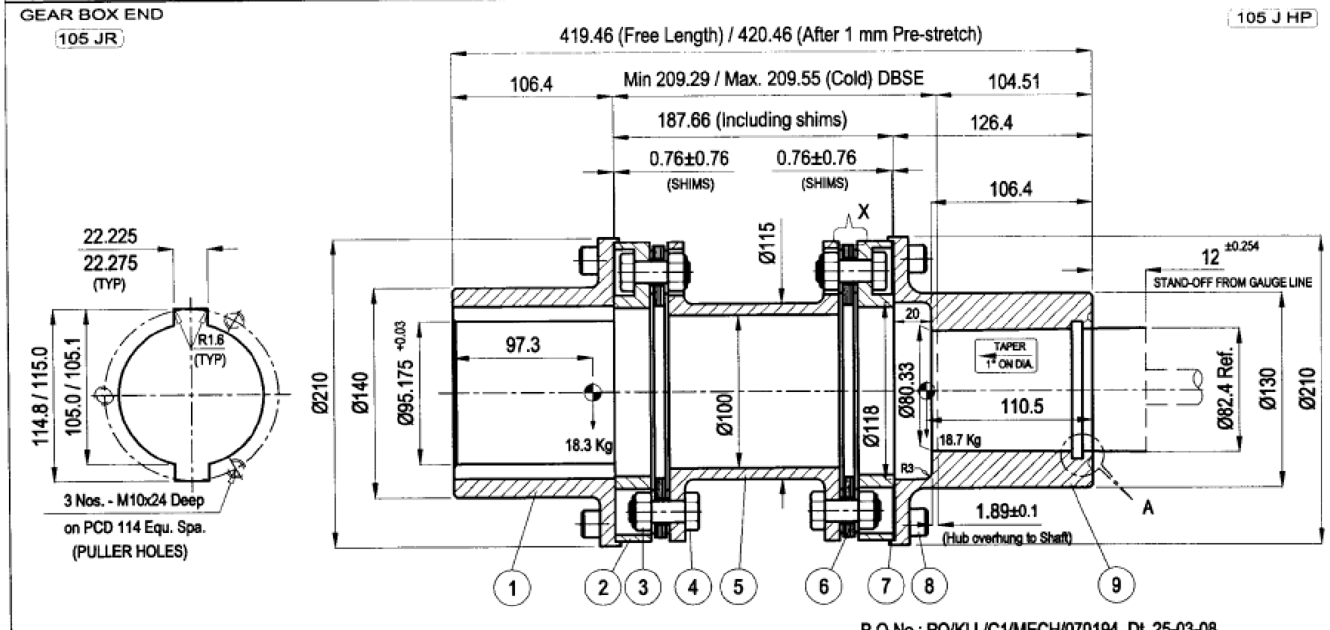


Equipment : 105-JLP to GB		Coupling make : “Euroflex” As Built Drawing No : 08357-00 Rev D	
Coupling Location : 105-JLP (GB End)			
Srl No	**Description**	**Readings**	**Remarks**
1.	Coupling Hub Blue match (min 80-85 %) (%)	85	
2.	Dry fit Stand off **‘A’** (Without ‘O’-Ring & Backup washer) (mm)	15.8	Make B = A by hand push
3.	Wet fit Stand off ‘**B**’ (With ‘O’-Ring & Backup washer) (mm)	15.8	
4.	Design Push ‘**C**’ (As per Coupling OEM’s Drawing) (mm)	13.8 +/- 0.3	
5.	Calculated Shaft over hang ‘**D**’ = **C** – **A** (mm)	2.0	
6	Actual Push ‘**C1**’ (After installation) (mm)		
6.	Actual shaft Over Hang ‘**E**’ (After final installation) (mm)	2.1	
7.	Hub Lock Nut step ‘**F**’ (mm)		
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)		
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)		
10	Maximum Expander pump pressure (PSI)	22000	
11.	Maximum Pusher pump pressure (kg/cm^2)	170	
12.	Pusher pressure hold up time at final pressure (Minutes)	20	

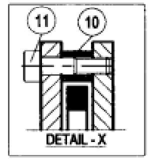
ASSEMBLY DRAWING

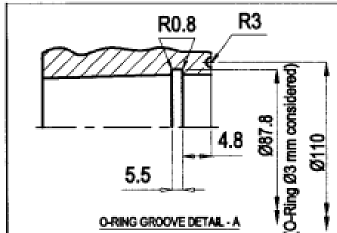
QF/DES/02

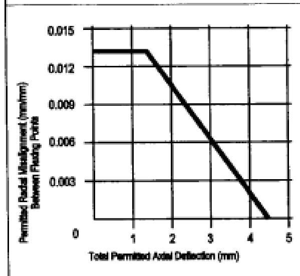
UNLESS OTHERWISE STATED ALL DIMENSIONS IN MILLIMETRES | THIRD ANGLE PROJECTION | DO NOT SCALE | IF IN DOUBT ASK

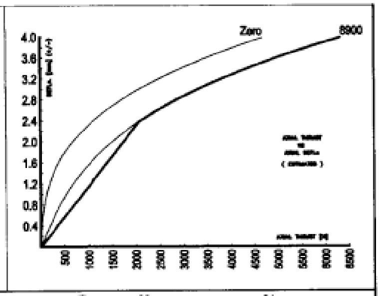


Shims Note:	
No of shims (each 0.381 mm)	Hub Face to Hub Face Cold Set
0 shims	206.136 mm
1 shims	206.517 mm
2 shims	206.898 mm
3 shims	207.279 mm
4 shims	207.66 mm
5 shims	208.041 mm
6 shims	208.422 mm
7 shims	208.803 mm
8 shims	209.184 mm









P.O.No.: PO/KLL/C1/MECH/070194 Dt. 25-03-08

REFRIGERATION COMPRESSPR

COUPLING SUITABLE FOR REPAIRED ROTOR

(ROTOR NO : AFS - 2052 PX2 786 - 1 ST - 17 0356)

Note:-

1. Tightening Torque : (Lubricated threads with MOS2 grease) Item No=8 Attachment screw/Tightening Torque = 90 Nm
2. Gagging Screws & Bushes (Item No11 &10) are only for Transportation purposes and need to be removed prior to installation. Coupling not to operate with gagging screws in position.
3. Do not disturb factory assembled Coupling bolts (Item No=4).
4. 105 J HP Hub Axial Travel length on shaft : 12 ±0.3 mm

Hub Expansion pressure / max.allow.pressure : 1600 Bar.
Max. max.allow.pressure for hub removal : 2050 Bar.
Joint temperature / max.allow.temperature : 320° C. (For max 10 minutes)

Specification		Coupling capacity	
Normal Power	11350 HP	Rated (Continious) Torque	16 KNm
Normal Speed	8900 RPM	Max. Transient Torque	24 KNm
Max. Power	12500 HP	Inertia (WK^2)	0.19 Kgm ^{2}
Rated Torque	8.9 KNm	Torsional stiffness (1/3 shaft penetration)	1.9 MNm/Rad.
Factor of Safty	1.79	Balancing :	API 671 3 rd EDITION (CLAUSE: 2.6.3.7)

± 4.3 mm	2.24 mm	0.75°
Axial	Radial	Angular
MAX. MISALIGNMENT		

Customer: IFFCO KALOL
Model No: 6GH-175-S | Weight= 37 Kg.
Application:- 105 J GB - 105 J HP

S.No.	DESCRIPTION	MATERIAL	QTY
11	Gagging Screw	BS970 817 M40	12
10	Gagging Bush	BS970 080 M40	12
9	105 J HP Compressor Hub	BS970 817 M40	01
8	Attachment Screw	Gr.-12.9	6+6
7	Shim (0.381 Thk.)	AISI 301	4+4
6	Element assy.	AISI 301	02
5	Spacer	BS970 817 M40	01
4	Coupling bolt	BS970 817 M40	12
3	Lock Nut	BS970 817 M40	12
2	Adaptor	BS970 817 M40	02
1	105 J GB Hub	BS970 817 M40	01

ALTERATIONS

Rev-A, Dt.: 29/05/2007, 1mm Pre-stretch has been added as per Customer requirement.
Rev-B, Dt.: 28/06/2007, Drg notes and stand off dim. modified based on MOM Dt.:28/06/2007.
Rev-C, Dt.: 30/06/2007, DBSE MIN/MAX ADDED as per customer requirement on Dt.:30/06/2007.
Rev-D, Dt.: 24/10/2007, Adaptor added at gearbox side as per customer requirement on Dt.:24/10/2007.
Rev-E, Dt.: 20/03/2008 Detail Drawing of Part no.-9 & Hub Pressures are shown as per customer requirement
Rev-F, Dt.:09/04/2008, Drawing modified as per customer comments on 09/04/2008.
Rev-G, Dt.:15/06/2008, Drawing modified as per customer comments on 26/04/2008.
Rev-H, Dt.:27/06/2008, Drawing modified as per customer comments on 26/04/2008.
Rev-I, Dt.:12/07/2008, Drawing modified as per customer requirement on 12/07/2008.
Rev-J, Dt.:22/03/2009, Spare rotor no Incorporated.

ISSUE: A B C D E F G H I J

EUROFLEX TRANSMISSIONS [INDIA] PVT. LIMITED
99, C.I.E., Phase-II, Gandhinagar, Balanagar
Hyderabad 500037, India Email: euroflex@satyam.net.in
Tel 23076970. 23079775 Fax: 0091-40-23079523.27847149

DRAWN	M.SHANKER	DATE	20/05/2007	CHECKED	
ENQUIRY NO.:	7071	SCALE	1 : 1	(A0)	
LIMITS	GENERAL: ±0.25	APPROVED	KVM RAO		

TITLE	DRAWING NO.	REV
6GH-175-S FLEXIBLE COUPLING BETWEEN 105-JHP CASE & GEAR BOX	07331-00	J

Coupling Hub Installation: 105-JHP (GB side)

Equipment : 105-JLP to GB	**Coupling make : "Euroflex"**

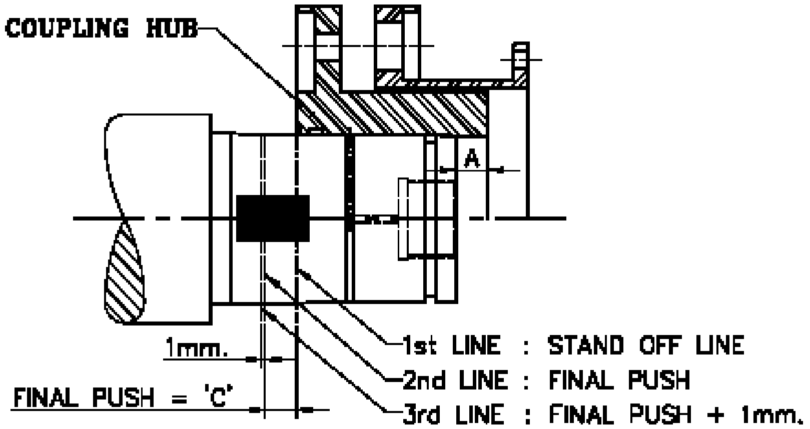
Coupling Location : 105-JHP (GB End)

Srl No	**Description**	**Readings**	**Remarks**
1.	Coupling Hub Blue match (min 80-85 %) (%)	80	
2.	Dry fit Stand off **'A'** (Without 'O'-Ring & Backup washer) (mm)	12.9	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	12.9	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	12.0	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	0.9	
6	Actual Push '**C1**' (After installation) (mm)	12.31	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	0.68	
7.	Hub Lock Nut step '**F**' (mm)	0.89	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	0.09	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.21	
10	Maximum Expander pump pressure (PSI)	25000	
11.	Maximum Pusher pump pressure (kg/cm^2)	150	
12.	Pusher pressure hold up time at final pressure (Minutes)	15	

INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

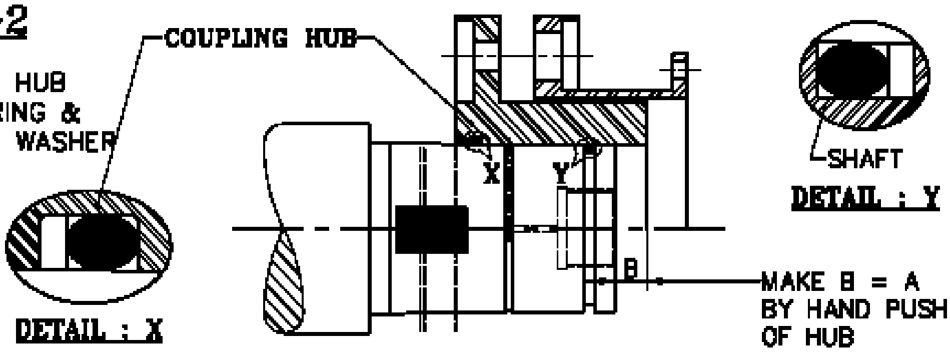
STEP-1

COUPLING HUB
WITHOUT O-RING &
BACK-UP WASHER



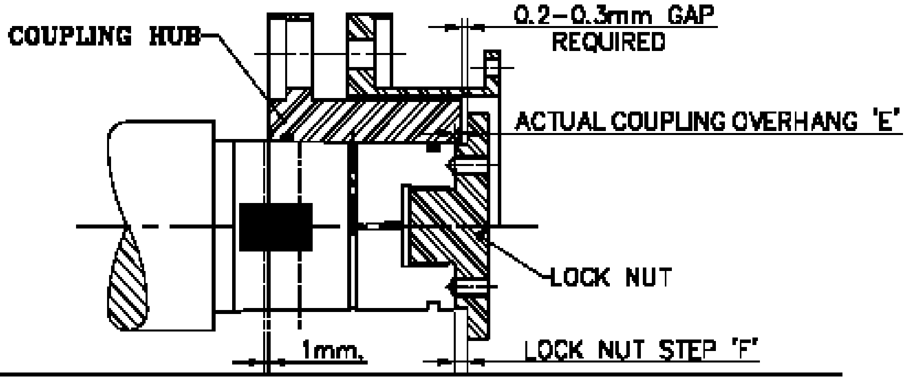
STEP-2

COUPLING HUB
WITH O-RING &
BACK-UP WASHER



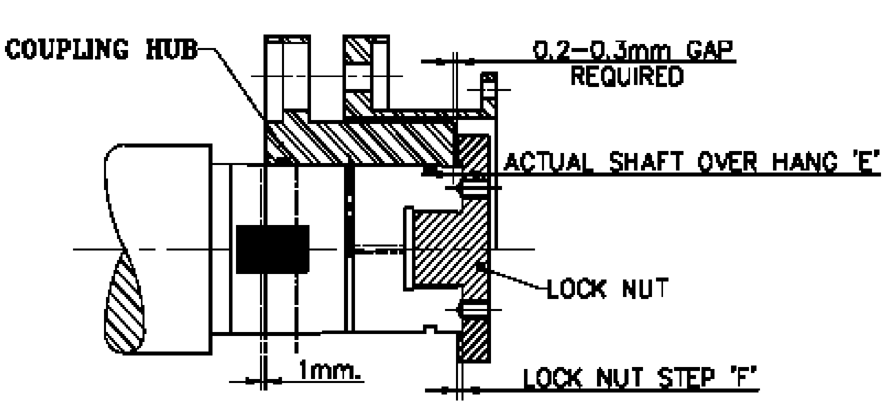
STEP-3A

FINAL POSITION WITH
LOCK NUT & HUB
OVERHANG



STEP-3B

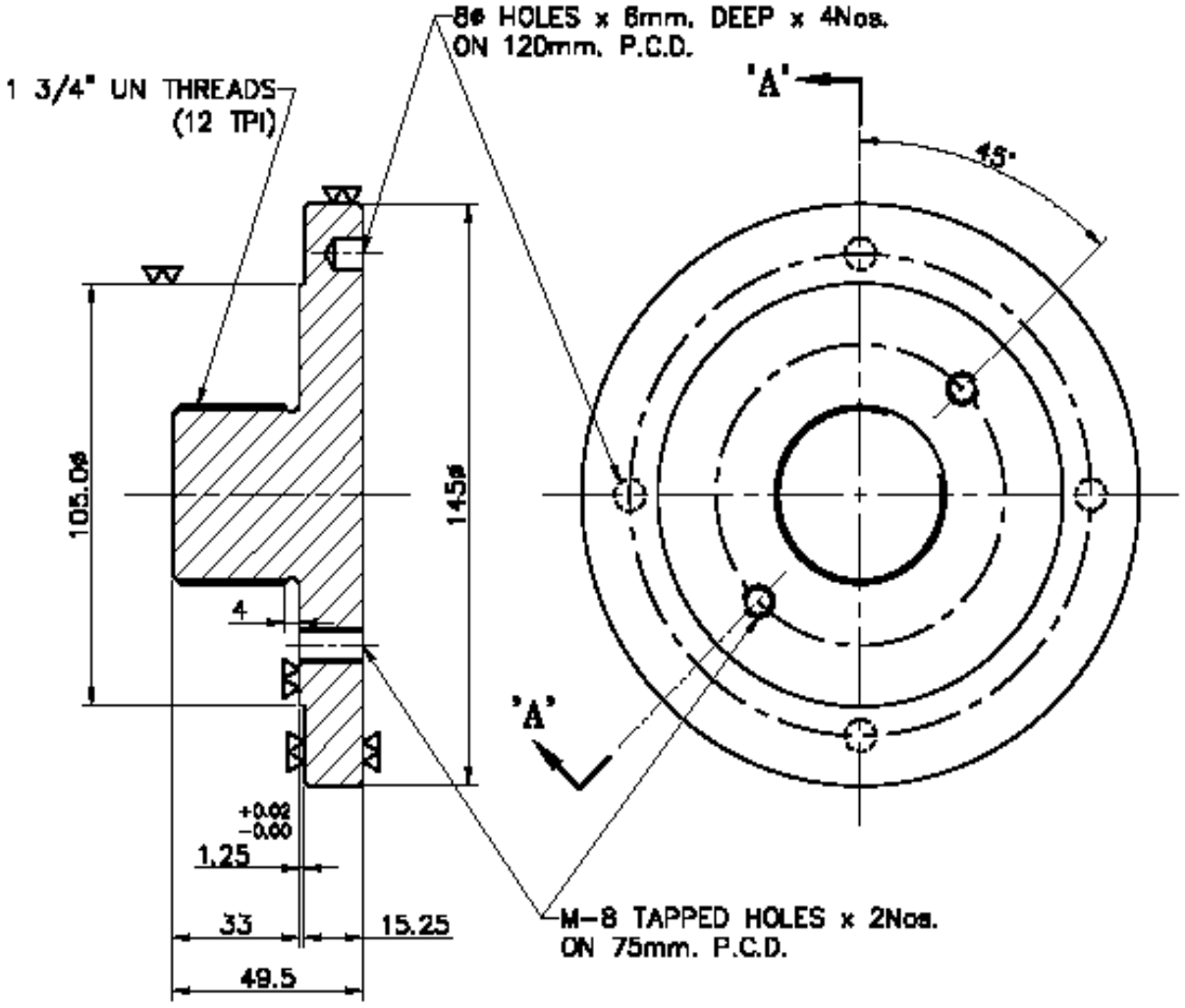
FINAL POSITION WITH
LOCK NUT & SHAFT
OVERHANG



DRN	N.V. PANCHAL	TITLE - COUPLING HUB INSTALLATION PROCUDURE FOR 101/103/105 TRAIN				EWR No.	
CHD							
APD		DRAWING No.	PLANT	FROM	NUMBER	SHEET OF	REV.
SCALE	N. T. S.	CODE AMM-000	P 1	E S	0 7 - - -	1 1	0

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

S/D-2009



SECTION :- 'A-A'

SIDE VIEW

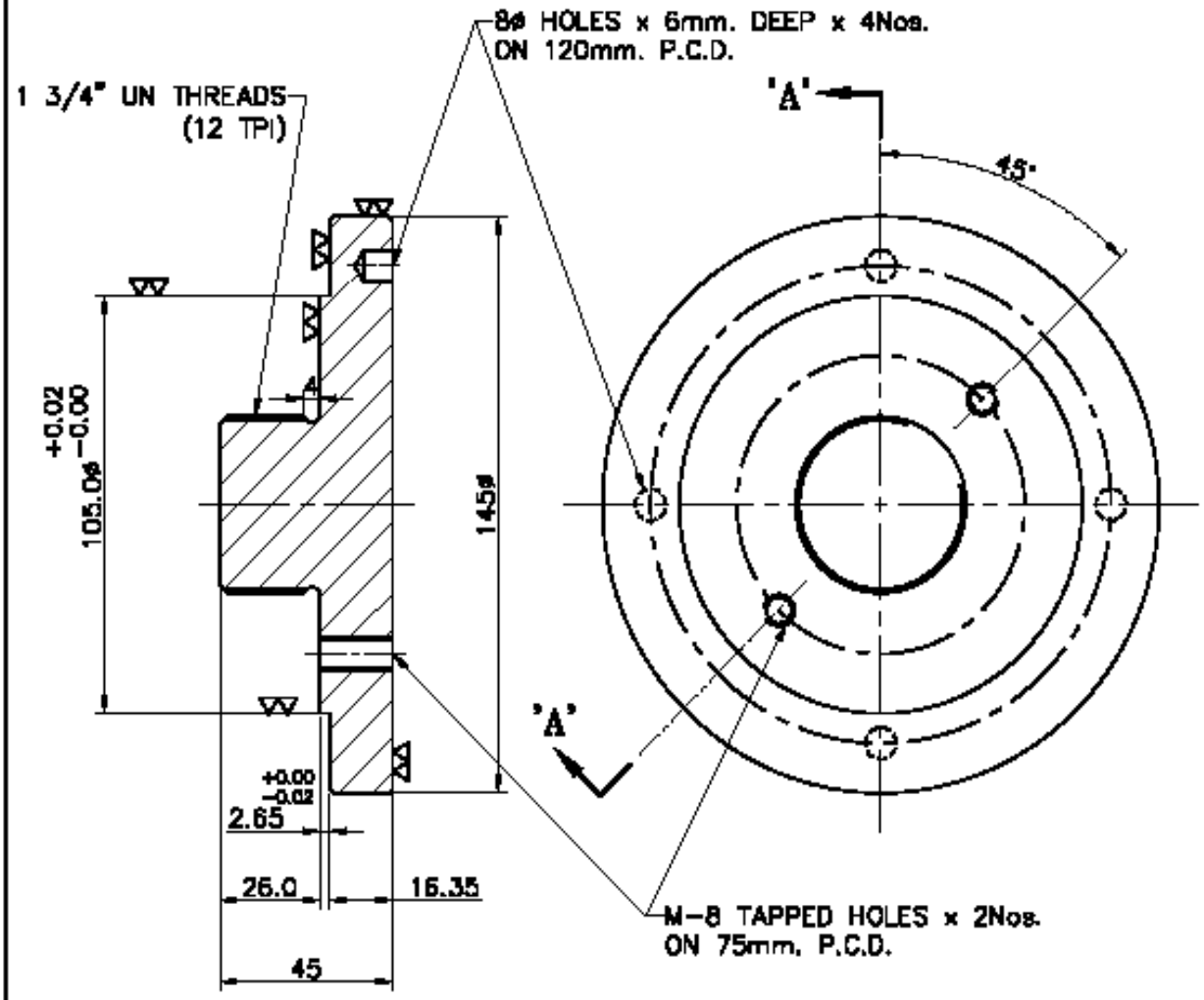
MATERIAL :- EN-24 FORGED

NOTE :- SMOOTH MACHINING ALLOVER

DRN	N.V. PANCHAL	TITLE - LOCK NUT FOR COUPLING HUB OF 105-JLP ROTOR (TOWARDS 105-JT)		EWR No.
CHD				
APD		DRAWING No.	PLANT FROM NUMBER	SHEET OF / REV.
SCALE	1 : 1.75	CODE AMM-000	P1 ES 07----	1 1 / 0

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

S/D-2009



SECTION :- 'A-A'

SIDE VIEW

MATERIAL :- EN-24 FORGED

NOTE :- SMOOTH MACHINING ALLOVER

DRN	N.V. PANCHAL	TITLE - LOCK NUT FOR COUPLING HUB OF 105-JT ROTOR		EWR No.	
CHD					
APD		DRAWING No.	PLANT FROM NUMBER	SHEET OF	REV.
SCALE	1 : 1.75	CODE AMM-000	P1ES08----	1 1	0

MAJOR OVERHAULING RECORDS 105 - JT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
JLP End					
Journal Bearing	Mandrel	B	0.007-0.009		
	Filler / lead wire			0.22	0.22
Oil Guard For Jr. Brg Housing	South	C	0.015-0.021		
	North	G	0.058-0.097	0.006”	0.006”
Oil Guard For Seal Housing	---	D	0.077-0.109	0.085”	0.086”
Shaft Diameter	Jr. Brg.	---	4.993		
Bearing Pinch	Jr. Brg.	---	---	0.04	0.04
Governor End					
Journal Bearing	Mandrel	B	0.007-0.009	0.22	0.22
	Filler / lead wire			0.24	0.24
Oil Guard For Brg. Housing	South	---	---	---	--
	North	C	0.015-0.021	0.016”	0.016”
Oil Guard For Thrust Brg.	South	A	0.002-0.04		
	North	A	0.002-0.004		
Oil Guard For Seal Housing	---	D	0.077-0.109		
Axial Thrust.	With Top Housing	---	0.008-0.012	0.3 mm	0.27 mm
	Without top Housing	---			
Shim thickness. Thrust adjusting	North	---	---		
	South	---	---		
Nozzle Clearance.	---	---	0.055-0.065	1.65 mm	1.31 mm
Shim thickness. Nz. Cl. adjusting	North	---	---	7.35 mm	7.35 mm
	South	---	---	14.3 mm	14.3 mm
Total Float	With Top Housing	---	0.180	5.61 mm	4.63 mm
	Without Top Housing	---			
Shaft Diameter	Journal bearing	---	4.993		
Bearing Pinch	Jr. bearing	---	---	0.04	0.04
Expansion Key	---	---	---		
Trip Lever - Plunger	---	---	0.120-0.130	4.00 mm	4.00 mm

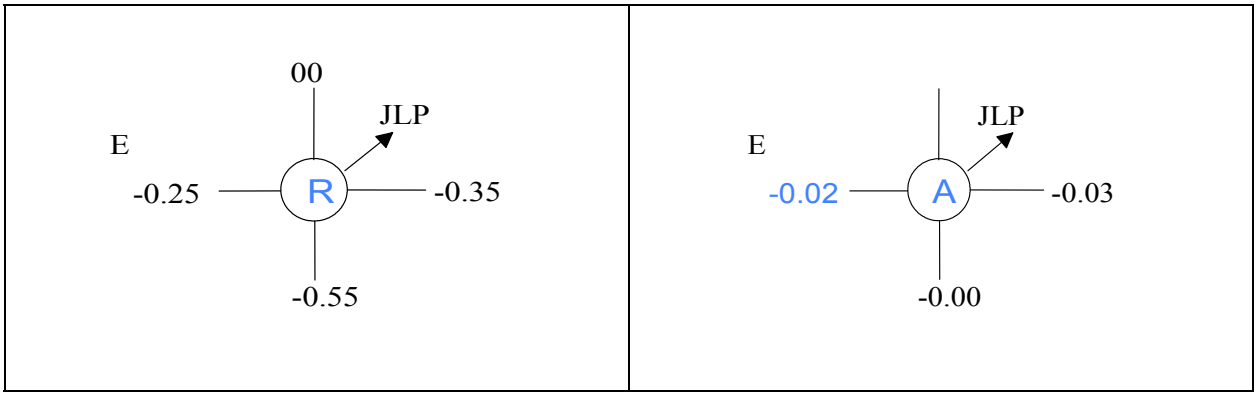
MAJOR OVERHAULING RECORDS 105 – JT

Journal Bearing Pads thickness				
PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.65	20.65	20.65	20.65
No 2	20.65	20.65	20.65	20.65
No 3	20.65	20.65	20.69	20.69
No 4	20.95	20.95	20.67	20.67
No 5	20.75	20.75	20.69	20.69
Thrust Bearing Pad Thickness				
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	19.01	19.01	15.89	15.89
No 2	19.01	19.01	15.89	15.89
No 3	19.01	19.01	15.89	15.89
No 4	19.01	19.01	15.89	15.89
No 5	19.01	19.01	15.89	15.89
Casing Bolt Expansion Clearance				
Bolt	Cooling Tower Side		Silo Side	
	Before	After	Before	After
No 1		Checked & found ok		Checked & found ok
No 2		Checked & found ok		Checked & found ok

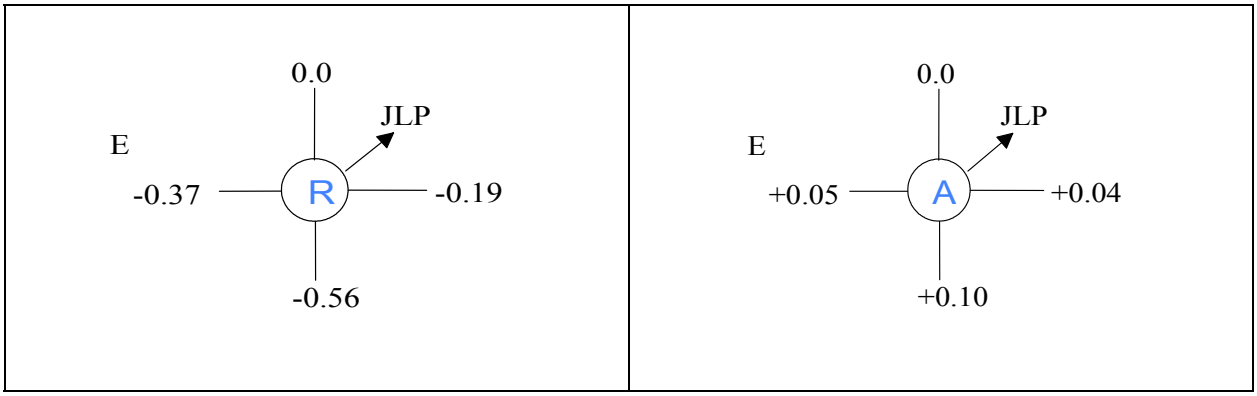
GAUSS RECORDS			
Description	Position	Before (Range)	After (Range)
Journal Bearing pads	Thrust End	1.0	o.k
	Non thrust end	0.6	o.k
Journal Bearing base ring	Thrust End	0.5	o.k
	Non thrust end	0.2	o.k
Thrust bearing pads	Active	1.06	o.k
	Inactive	0.7	o.k
Thrust Bearing base ring	Active	2.7	o.k
	Inactive	0.4	o.k
Shaft Journal	Thrust End	0.5	o.k
	Non thrust end	0.9	o.k

Alignment: 105-JT to 105-JLP

Before Preventive Maintenance



After Preventive Maintenance



CLEARANCE CHART : 105 – JLP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (Inch)	After (Inch)
TURBINE END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	0.16 mm	0.16 mm
	Filler / lead wire			NA	NA
Bearing Pinch	Journal Bearing	----	----	NA	NA
Shaft Dia.	Journal Bearing	----		4.492	4.494
Bushing (For Journal bearing)	North	G	0.005-0.007	0.008	0.007
Housing (For Journal bearing)	South	E	0.014-0.017	0.016	0.016
Oil Guard (For Outer Housing)	------	T	0.020-0.026	0.004	0.004

GEAR BOX END					
Journal Bearing Clearance	Mandrel	F	0.006-0.008	0.15 mm	0.15 mm
	Filler / lead wire			NA	NA
Bearing Pinch	Journal bearing	----	----	NA	NA
Shaft Dia	Journal bearing	-----		4.492	4.494
Bushing (For Journal bearing)	North	G	0.005-0.007	0.008	0.007
Housing (For Journal bearing)	South	E	0.014-0.017	0.016	0.016
Oil Guard (For Thrust bearing)	North	C	0.002-0.004	0.004	0.004
	South	C	0.002-0.004	0.004	0.005
Oil Guard (For Outer Housing)	North	A	0.020-0.026	0.028	0.028
Axial Thrust	With Top Housing	----	0.011 – 0.015	0.36 mm	0.36 mm
	Without Top Housing	----		NA	NA
Shim Thickness (Axial Thrust adjusting)	North	----	---	0.372	0.372
	South	----	---	0.393	0.393
Total Float	------	----	2.38 – 3.96	NA	NA

Journal Bearing Pads thickness: 105 – JLP

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm) (NEW PADS)	Before (mm)	After (mm)
No 1	19.02	19.05	19.02	19.02
No 2	19.01	19.06	19.01	19.02
No 3	19.00	19.05	19.00	19.00
No 4	19.01	19.05	19.01	19.01
No 5	19.00	19.05	19.00	19.01

Thrust Bearing Pad Thickness: 105-JLP

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	19.76	19.76	19.77	19.77
No 2	19.76	19.76	19.77	19.77
No 3	19.77	19.77	19.77	19.77
No 4	19.77	19.77	19.76	19.76
No 5	19.76	19.76	19.77	19.77
No 6	19.77	19.77	19.76	19.76
No 7	19.77	19.77	19.76	19.76
No 8	19.75	19.75	19.77	19.77

CLEARANCE CHART 105-JR

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal Bearing (Low Speed drive gear)	North (JHP)	0.014 – 0.016	0.35 mm	0.35 mm
	South (JLP)	-- do --	0.37 mm	0.37 mm
Axial Thrust	---	0.014-0.024	0.53 mm	0.53 mm
Journal Bearing (High Speed driven Pinion)	North	0.013 -	0.45 mm	0.45 mm
	South	-- do --	0.30 mm	0.35 mm
Free float	---	---	---	---
Backlash	---	---	0.25 mm	0.25 mm
Shaft Diameter (Low Speed drive Gear)	North Side Bearing	---	---	---
	South Side Bearing	---	---	---
Shaft Diameter (High Speed driven Pinion)	North Side Bearing	---	---	---
	South Side Bearing	---	---	---

CLEARANCE CHART : 105 – JHP

Description	Position	Dwg. Ref.	Design Clearances (Inch)	Before (Inch)	After (Inch)
GEAR BOX END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	0.14 mm	0.14 mm
	Filler / lead wire			NA	NA
Bearing Pinch	Journal Bearing	---	---	NA	NA
Shaft Dia.	Journal Bearing	---	---	NA	NA
Housing (For Journal Bearing)	South	B	0.014 - 0017	NA	NA
Bushing (For Journal Bearing)	North	D	0.004 - 0.006	NA	NA
Oil Guard (For Top Housing)	South	A	0.018 - 0.024	0.010	0.010
Nut	---	T	0.001 - 0.003	NA	NA

NON DRIVE END					
Journal Bearing Clearance	Mandrel	C	0.004 – 0.007	0.15 mm	0.15 mm
	Filler / lead wire			NA	NA
Bearing Pinch	Journal bearing	---	---	NA	NA
Shaft Dia	Journal bearing	---	---	NA	NA
Housing (For Journal Bearing)	South	B	0.014 - 0017	NA	NA
Bushing (For Journal Bearing)	North	D	0.004 - 0.006	NA	NA
Oil Guard (For Thrust bearing)	North	P	0.002 – 0.004	0.003	0.003
	South	P	0.002 – 0.004	0.008	0.002 (New)
Oil Guard (For Top Housing)	North	P	0.002 – 0.004	NA	NA
Axial Thrust	With Top Housing	---	0.009 – 0.013	0.34 mm	0.31 mm
	Without Top Housing	---		NA	NA
Shim Thickness (Axial Thrust adjusting)	North	---	---	9.41	9.41
	South	---	---	9.72	9.72
Total Float	------	---	5.55 -7.15	NA	NA

Thrust Bearing Pad Thickness: 105-JHP

Pad	ACTIVE		INACTIVE	
	Before (mm)	**After – NEW (mm)**	**Before (mm)**	**After (mm)**
No 1	**14.25**	**14.33**	14.24	14.24
No 2	**14.25**	**14.33**	14.26	14.26
No 3	**14.27**	**14.33**	14.23	14.23
No 4	**14.27**	**14.33**	14.26	14.26
No 5	**14.26**	**14.33**	14.24	14.24
No 6	**14.25**	**14.33**	14.25	14.25
No 7	**14.26**	**14.33**	14.26	14.26
No 8	**14.26**	**14.33**	14.26	14.26

GAUSS RECORDS: 105 – JT

Description	Position	Before (Range)	After (Range)
Journal Bearing pads	Thrust End	1.0	OK
	Non thrust end	0.6	OK
Journal Bearing base ring	Thrust End	0.5	OK
	Non thrust end	0.2	OK
Thrust bearing pads	Active	1.6	OK
	Inactive	0.7	OK
Thrust Bearing base ring	Active	2.7	OK
	Inactive	0.4	OK
Shaft Journal	Thrust End	0.5	OK
	Non thrust end	0.9	OK
Thrust Collar	---	--	--

GAUSS RECORDS : 105 – JLP

Description	Position	Before	After
Journal Bearing pads	Thrust End	--	
	Non thrust end	--	
Journal Bearing base ring	Thrust End	--	
	Non thrust end	--	
Thrust bearing pads	Active	0.6	OK
	Inactive	0.7	OK
Thrust Bearing base ring	Active	0.9	OK
	Inactive	0.6	OK
Shaft Journal	Thrust End	--	
	Non thrust end	--	
Thrust Collar	----	--	

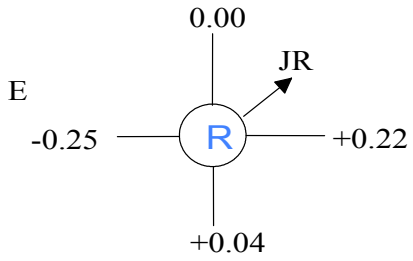
GAUSS RECORDS: 105 – JR

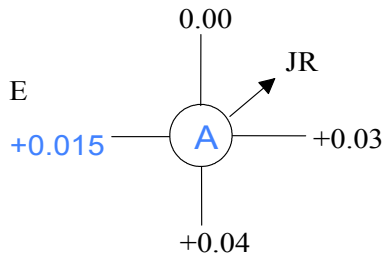
Description	Position	Before (Gauss)	After (Gauss)
Gear Journal Bearing	North	0.9	OK
	South	1.2	OK
Pinion Journal Bearing	North	0.4	OK
	South	1.2	OK
Thrust bearing	Active	0.4	OK
	Inactive	1.3	OK
Oil Guard for Above	South	--	--
	North	--	--
Shaft Journal	GEAR (Both ends)	1.7	OK
	PINION (Both ends)	1.0	OK

GAUSS RECORDS : 105 – JHP

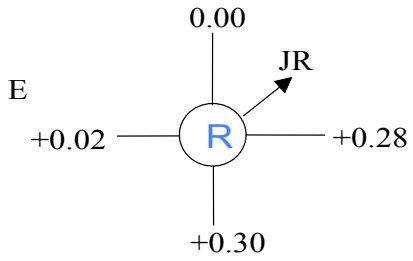
Journal Bearing pads	Thrust End	NA	NA
	Non thrust end	NA	NA
Journal Bearing base ring	Thrust End	NA	NA
	Non thrust end	NA	NA
Thrust bearing pads	Active	0.6	OK
	Inactive	1.2	OK
Thrust Bearing base ring	Active	0.9	OK
	Inactive	0.9	OK
Oil Guard for Above	South	NA	NA
	North	NA	NA
Shaft Journal	Thrust End	NA	NA
	Non thrust end	NA	NA
Thrust collar		--	--

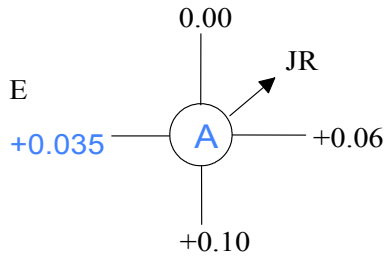
105 JLP to 105-JR (Before)



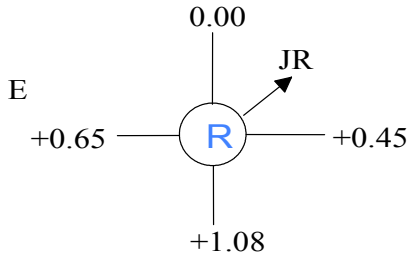


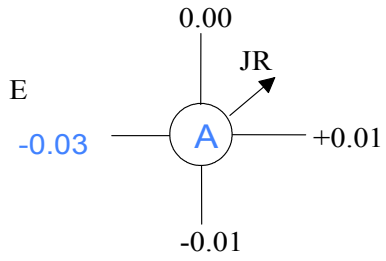
105 JLP to 105-JR (After)



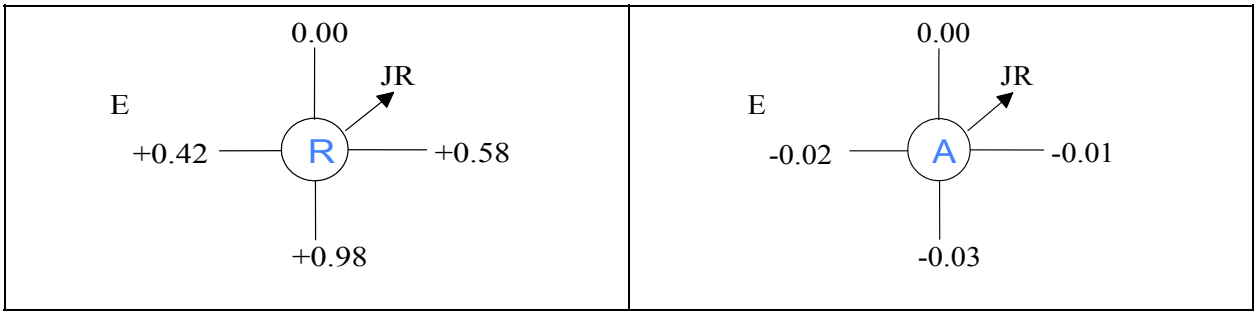


105 GB to JHP (Before PM)





105 GB to JHP (After PM)



INDUCED DRAFT FAN 101-BJT TRAIN

ID Fan Drive Turbine, 101- BJT, Preventive Maintenance

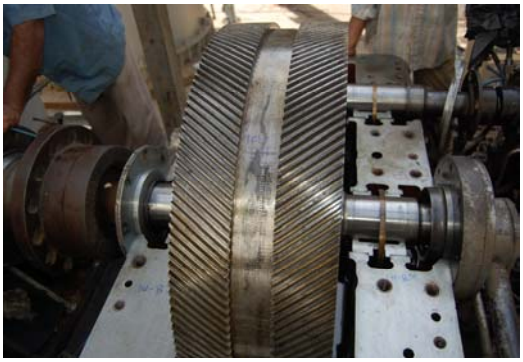
Turbine was decoupled and both ends bearings as well as thrust bearings were inspected and found O.K. Gauss measurement of rotor both end shaft journal, journal and thrust bearing pads / base rings and thrust collar, was measured and found within limit. The anti-rotation lock of coupling side Journal Bearing was found damaged. Hence the Journal bearing was replaced with new one. Rest all the bearing pads were Dye Penetration tested and no surface defects were found. Bearing clearances were taken and found within the design range.

ID Fan, 101- BJ, Preventive Maintenance

101-BJ Journal Bearing

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. Light scoring marks were observed at shaft journal area, which was attended by stone. The coupling end bearing dust seals were replaced by new one with shortened spring length and ends joined with adhesive. Cooling water was circulated in lines and no leaks were observed. The final bearing clearance was measured and found within design range.

Gear Box, 101-BJR, Preventive Maintenance



101-BJR Gears

101-BJR Bearings DP Tested

The gear and pinion were inspected and found O.K. The condition of Bull Gear teeth is found o.k. All the bearings were inspected and one no anti-friction bearing no 6216 was replaced. The coupling key, Bush Bearings of MOP of Gear Box was found worn-out and hence the complete pump assembly alongwith new coupling was replaced. Gauss measurement of gear shaft and bearings carried out and found within limit. The oil was flushed with new oil. The final bearing clearance was measured and found within design range.

Couplings

Both the coupling i.e between turbine to gear box and between gearbox to fan were inspected and found OK. The various readings noted are as follows :

COUPLING RECORDS 101-BJ TRAIN

Description		Before	After
COUPLING FLOAT			
101-BJ to 101-BJR		3.7 mm	3.7 mm
DISTANCE BETWEEN HUB FACE.			
101-BJ to 101-BJR		15.8 mm	15.8 mm
101-BJT to 101-BJR		NA	NA
COUPLING HUB / SHAFT OVERHANG.			
101-BJT (BJR End)	Hub	--	--
101-BJR (BJT End)	Hub	--	--

CLEARANCE CHART 101- BJT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
Gear Box End					
Journal Bearing	Mandrel	---	0.006-0.009	---	---
	Filler / lead wire			0.29 mm	0.29 mm
Oil Guard (For Jr. Brg Housing)	CT Side	---	0.015”-0.0195”	0.25 mm	0.25 mm
	SILO Side	---	0.015”-0.0195”	0.005	0.005
Bearing Pinch	Jr. Brg.	---	---		
Governor End					
Journal Bearing	Mandrel	---	0.006-0.009	---	---
	Filler / lead wire			0.21mm	0.21 mm
Oil Guard (For Brg. Housing	CT Side	---	0.015”-0.0195”	0.25 mm	0.25 mm
	SILO Side	----	----	----	---
Axial Thrust.	With Top Housing	---	0.014”		0.32 mm
	Without top Housing	---			0.44 mm

101-BJR				
Description	**Position**	**Design Clearances (Inch)**	**Before (Inch)**	**After (Inch)**
Journal Bearing (High Speed drive Pinion)	CT Side	0.005”-0.008”	0.20 mm	0.20 mm
	SILO Side	0.005”-0.008”	0.24 mm	0.24 mm
Axial Thrust	---		--	--
Journal Bearing (Low Speed driven Gear)	CT Side	0.005”-0.008”	0.22 mm	0.22 mm
	SILO Side	0.005”-0.008”	0.23 mm	0.23 mm
Backlash	---	0.013”-0.017”	0.44 mm	0.45 mm
Shaft Diameter (High Speed drive Pinion)	CT Side	---	4.47	4.47
	SILO Side	---	4.47	4.47
Shaft Diameter. (Low Speed driven Gear)	CT Side	---	4.47	4.47
	SILO Side	---	4.47	4.47

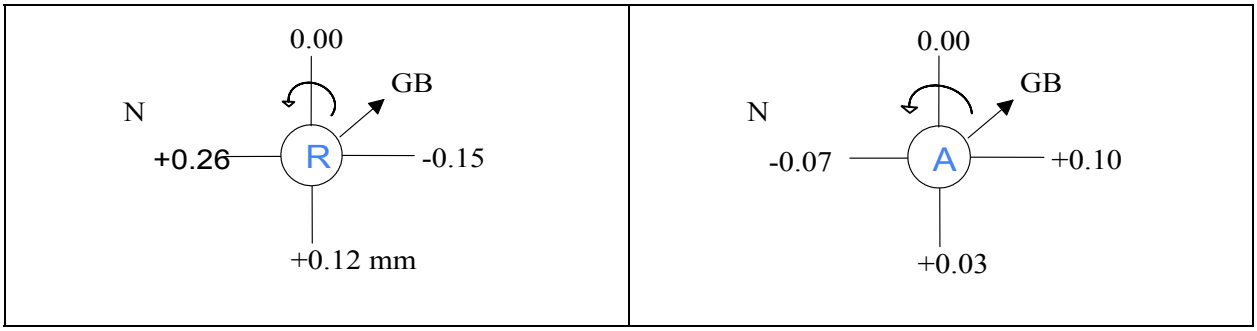
CLEARANCE CHART: 101 - BJ

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
Gear Box End					
Journal Bearing	Mandrel	---	0.008” - 0.012”	NA	NA
	Filler / lead wire			0.24 mm	0.24 mm
Free End					
Journal Bearing	Mandrel	---	0.008” - 0.012”	NA	NA
	Filler / lead wire			0.28 mm	0.28 mm
Axial Thrust.	With Top Housing	---	---	0.60 mm	0.60 mm
Shaft Diameter	Journal bearing	---	---	NA	NA
Bearing Pinch	Jr. bearing	---	---	0.0011	0.0011

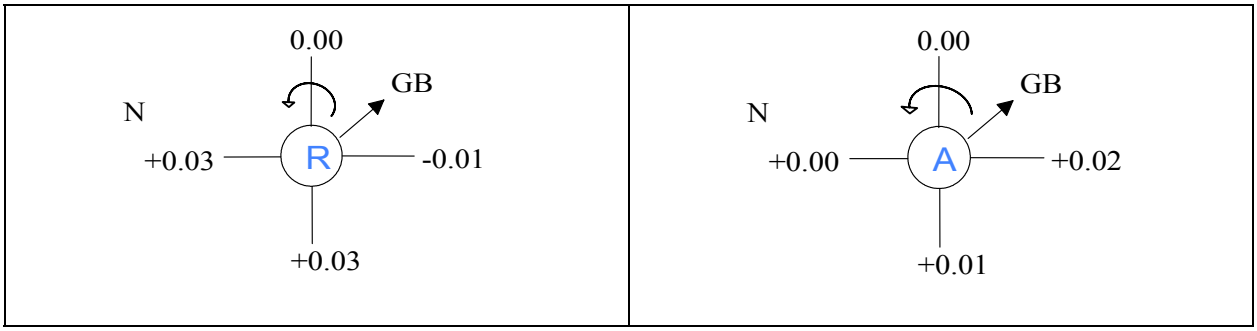
AUSS RECORDS - 101-BJ TRAIN

Description	Position	Before (Gauss)	After (Gauss)
101- BJT			
Journal Bearing liner	CT Side	2.2	o.k.
	SILO Side	2.7	o.k.
Shaft Journal	CT Side	3.0	o.k.
	SILO Side	2.5	o.k.
101 – JR (High Speed drive Pinion)			
Journal Bearing	CT Side	0.4	o.k.
	SILO Side	0.6	o.k.
Shaft Journal	CT Side	5.6	o.k.
	SILO Side	0.9	o.k.
101 – JR (Low Speed driven Gear)			
Journal Bearing	CT Side	0.9	o.k.
	SILO Side	1.3	o.k.
Shaft Journal	CT Side	1.1	o.k.
	SILO Side	1.7	o.k.
101-BJ			
Journal Bearing	CT Side	1.6	o.k.
	SILO Side	0.4	o.k.
Shaft Journal	CT Side	3	o.k.
	SILO Side	0.6S	o.k.

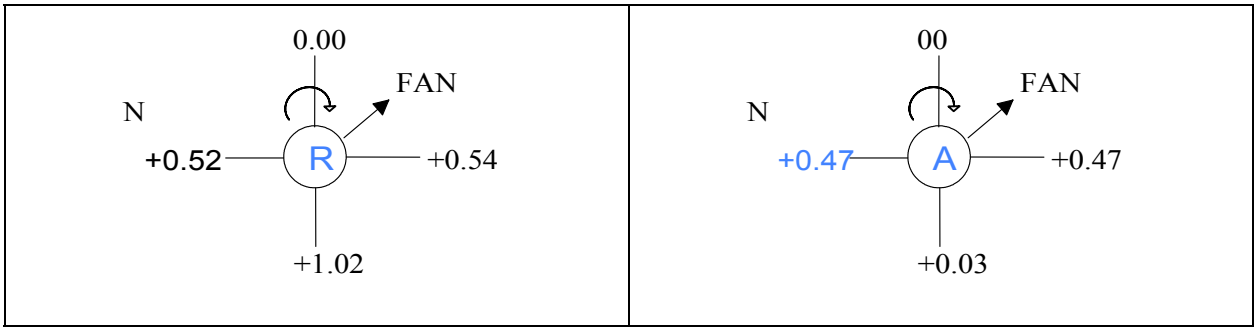
101 BJT to 101 BJR (Before PM)



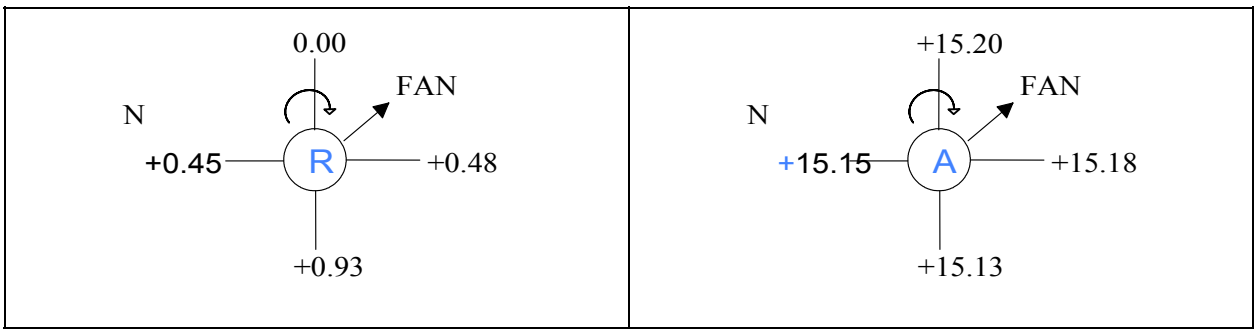
101 BJT to 101 BJR (After PM)



101 BJR (G/B) to 101 BJ (Before PM)



101 BJR (G/B) to 101 BJ (After PM)



PREVENTIVE MAINTENANCE OF SEMILEAN SOLUTION PUMP115-JA TRAIN

Preventive maintenance of pump 115-JA

The pump 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 suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned.

Preventive maintenance of turbine 115-JAT

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 governing system actuator cover was opened and cleaned. The filter was cleaned and boxed up.

Preventive maintenance of pump 115-JAR

All the bearings were inspected and found O.K. 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.

Preventive maintenance of Hydraulic Turbine 115-HT

The hydraulic coupling 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 suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned. The oil line of clutch was checked and found o.k.

CLEARANCE RECORD 115-JA

Description		Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal bearing (Thrust end)		0.005-0.0098	0.19 mm	0.19 mm
Labyrinth seal for above		NA	0.013-0.016	0.013-0.016
Journal bearing (Non thrust end)		0.005-0.0098	0.18 mm	0.18 mm
Labyrinth seal for above	Inboard	NA	0.014-0.015	0.014-0.015
	Outboard	NA	0.014-0.015	0.014-0.015
Axial Thrust		0.013 – 0.015 (0.35 - 0.40 mm)	0.27 mm	0.27 mm

Journal Bearing Pads Thickness 115-JA

SLEEVE	THRUST END BEARING		NON THRUST END BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
TOP	0.11	0.11	0.11	0.11
BOTTOM	NA	NA	NA	NA

Thrust Bearing Pad Thickness 115-JA

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	29.53	29.53	29.53	29.53
No 2	29.55	29.55	29.53	29.53
No 3	29.54	29.54	29.53	29.53
No 4	29.53	29.53	29.53	29.53
No 5	29.54	29.54	29.54	29.54
No 6	29.53	29.53	29.53	29.53
No 7	29.53	29.53	29.53	29.53
No 8	29.53	29.53	29.54	29.54

CLEARANCE CHART 115-JAR

Description	Before	After
Back Lash		0.46 mm
Gear Wheel Front Bearing		0.22 mm
Gear Wheel Rear Bearing		0.22 mm
Pinion Front Bearing		0.19 mm
Pinion Rear Bearing		0.18 mm

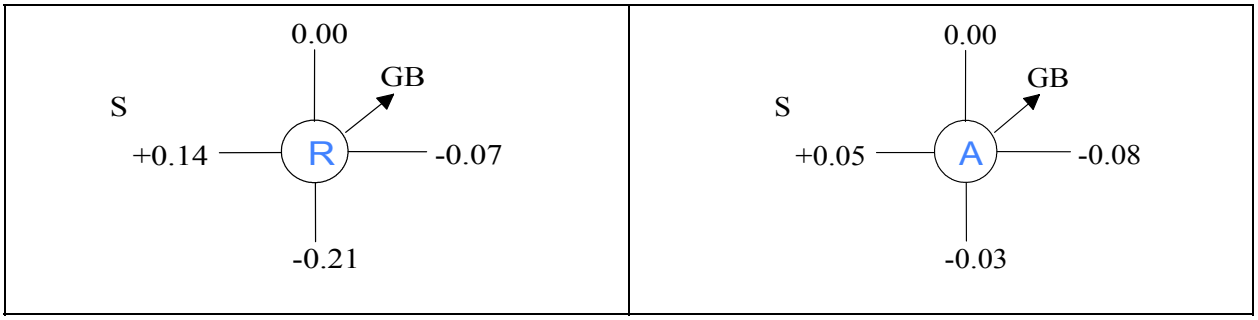
CLEARANCE CHART 115-HT

Description	Design Clearances (Inch)	Before	After
Thrust end bearing	0.0048-0.0058	0.19 mm	0.19 mm
Opp Thrust end bearing	0.0048-0.0058	0.18 mm	0.18 mm
Axial Thrust	0.010-0.011	0.27 mm	0.27 mm

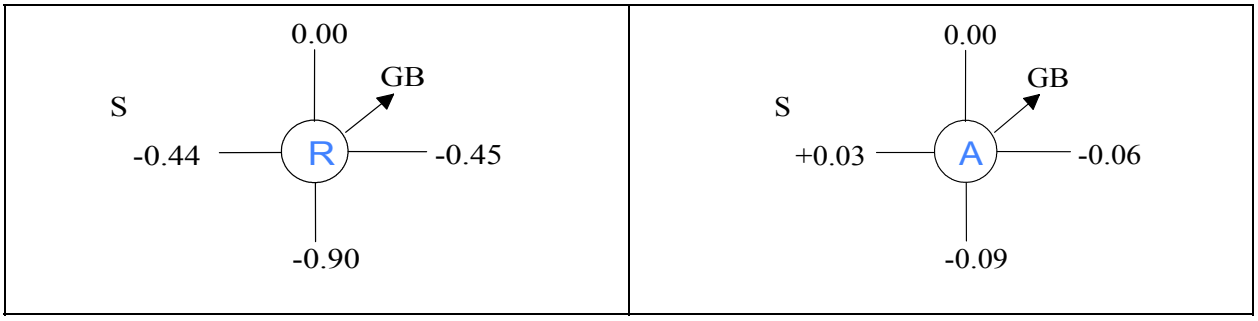
CLEARANCE CHART 115- JAT

Description		Design Clearances (Inch)	Before	After
Axial Thrust		0.010 – 0.012	0.26 mm	0.26 mm
Coupling side bearing		0.0055-0.008	0.32 mm	0.32 mm
Governor side bearing		-- do --	0.19 mm	0.19 mm
Oil Guard Coupling side (inboard)	Radial	0.0100-0.0125	0.006-0.007	0.006-0.007
	Axial	0.040-0.050	NA	NA
Oil Guard Coupling side (outboard)	Radial	0.0100-0.0125	0.004-0.008	0.004-0.008
	Axial	0.080-0.090	NA	NA
Oil Guard Governor side	Radial	0.0100-0.0125	0.0045-0.005	0.0045-0.005
	Axial	0.030-0.040	NA	NA

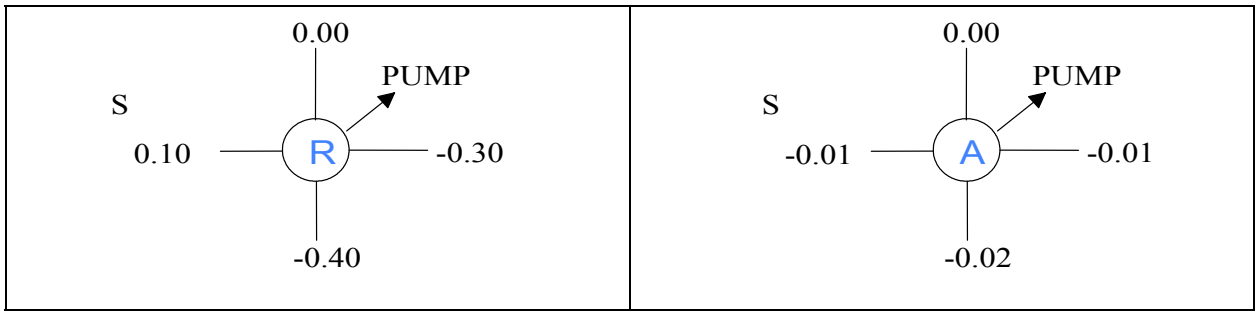
115-JAT to 115-GB (BEFORE)



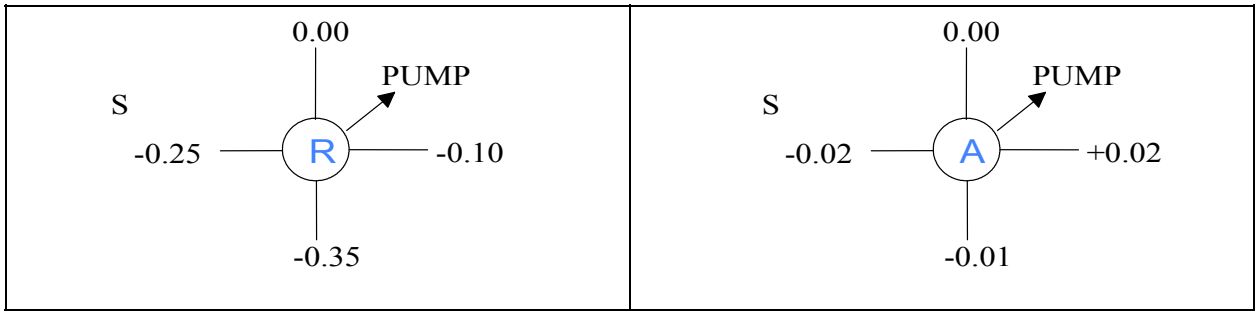
115-JAT to 115-GB (AFTER)



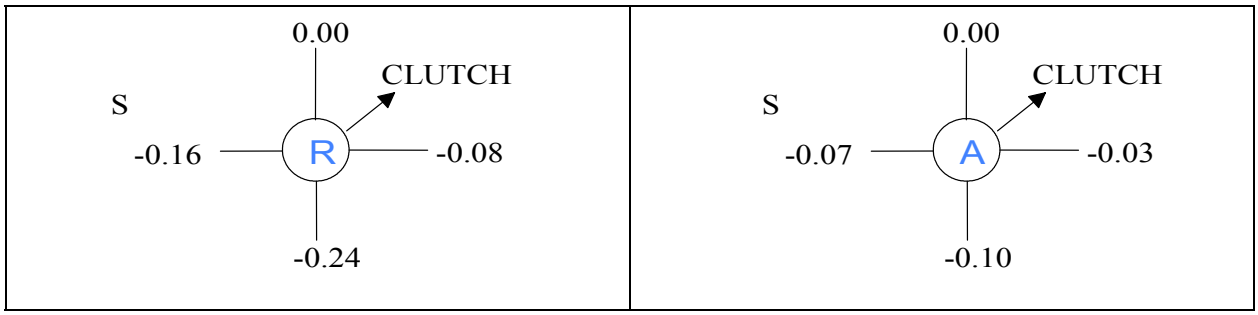
115-GB to 115-JA (BEFORE PM)



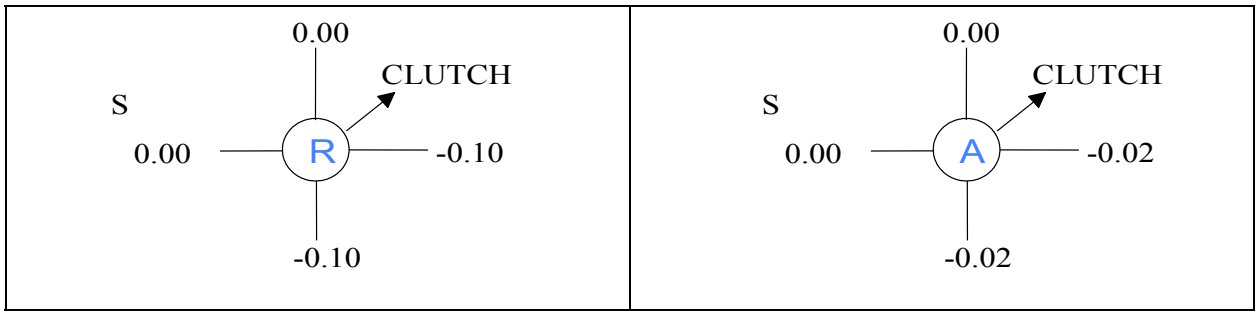
115-GB to 115-JA (AFTER PM)



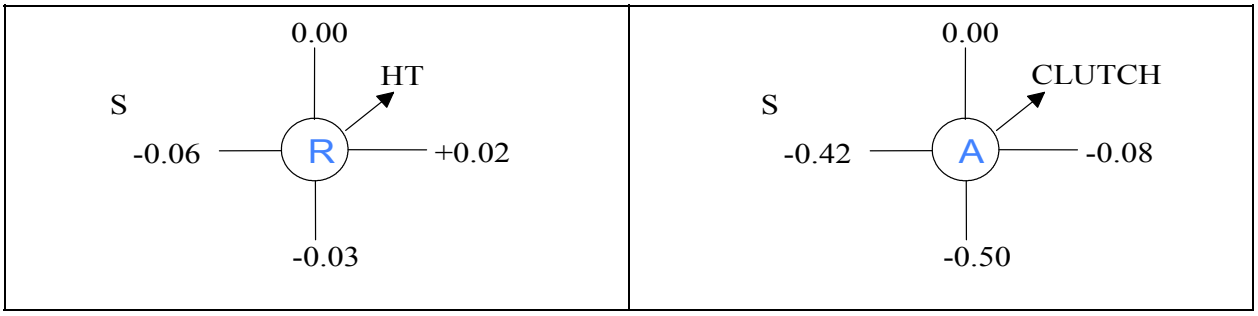
115-JA to CLUTCH (BEFORE PM)



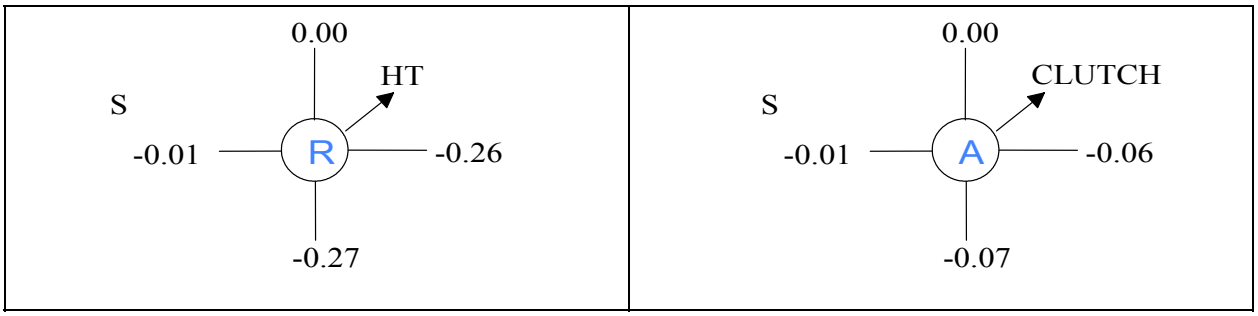
115-JA to CLUTCH (AFTER PM)



CLUTCH to 115-HT (BEFORE PM)



CLUTCH to 115-HT (AFTER PM)



PREVENTIVE MAINTENANCE OF SEMILEAN SOLUTION PUMP115-JB TRAIN

Preventive maintenance of pump 115-JB

The pump 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 suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned.

Preventive maintenance of turbine 115-JBT

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 governing system actuator cover was opened and cleaned. The filter was cleaned and boxed up. The Sealing Steam lines were completely flushed and checked.

Preventive maintenance of pump 115-JBR

All the bearings were inspected and found O.K. 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.

CLEARANCE RECORD 115-JB

Description		Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal bearing (Thrust end)		0.005-0.0098	0.22 mm	0.22 mm
Labyrinth seal for above		NA	0.013-0.016	0.013-0.016
Journal bearing (Non thrust end)		0.005-0.0098	0.22 mm	0.22 mm
Labyrinth seal for above	Inboard	NA	0.014-0.015	0.014-0.015
	Outboard	NA	0.014-0.015	0.014-0.015
Axial Thrust		0.013 – 0.015 (0.35 - 0.40 mm)	0.24 mm	0.24 mm

CLEARANCE CHART 115-JBR

Description	Before	After
Back Lash		0.48 mm
Gear Wheel Front Bearing	0.23 mm	0.24 mm
Gear Wheel Rear Bearing	0.26 mm	0.26 mm
Pinion Front Bearing	0.27 mm	0.27 mm
Pinion Rear Bearing	0.24 mm	0.26 mm

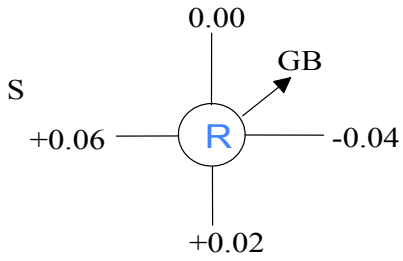
CLEARANCE CHART 115- JBT

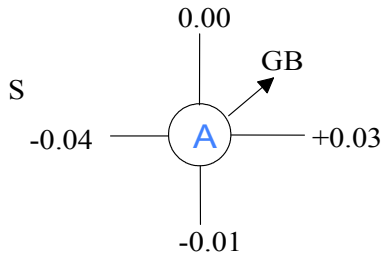
Description		Design Clearances (Inch)	Before	After
Axial Thrust		0.010 – 0.012	0.24 mm	0.24 mm
Coupling side bearing		0.0055-0.008	0.26 mm	0.26 mm
Governor side bearing		-- do --	0.27 mm	0.27 mm
Oil Guard Coupling side (inboard)	Radial	0.0100-0.0125	0.006-0.007	0.006-0.007
	Axial	0.040-0.050	NA	NA
Oil Guard Coupling side (outboard)	Radial	0.0100-0.0125	0.004-0.008	0.004-0.008
	Axial	0.080-0.090	NA	NA
Oil Guard Governor side	Radial	0.0100-0.0125	0.0045-0.005	0.0045-0.005
	Axial	0.030-0.040	NA	NA

Thrust Bearing Pad Thickness 115-JBT

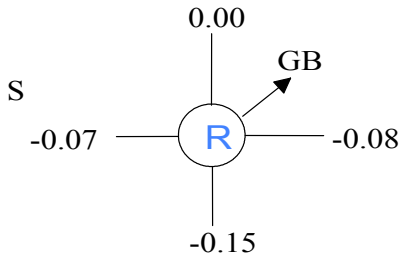
Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	17.45	o.k	17.45	o.k
No 2	17.45	o.k	17.45	o.k
No 3	17.44	o.k	17.45	o.k
No 4	17.45	o.k	17.45	o.k
No 5	17.45	o.k	17.44	o.k
No 6	17.45	o.k	17.45	o.k

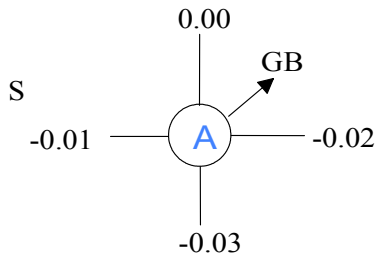
115-JBT to 115-GB (BEFORE)



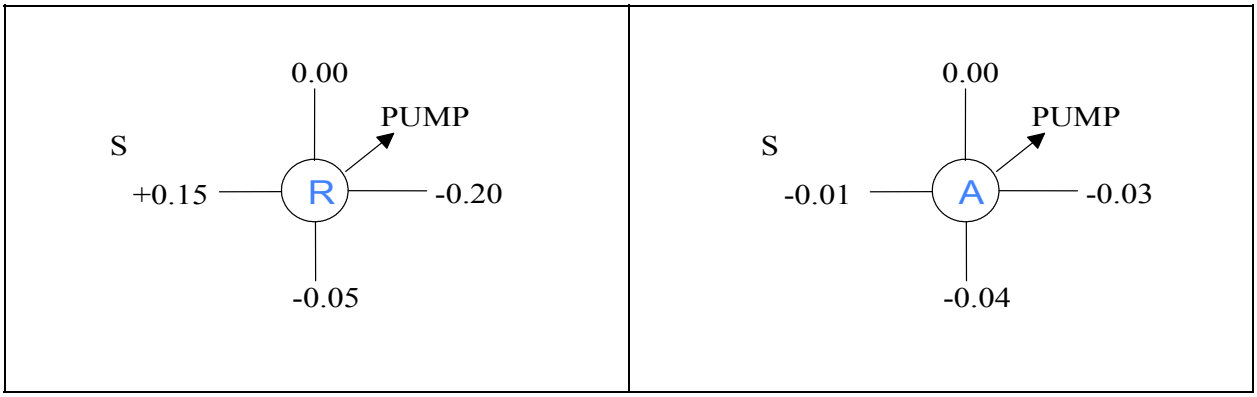


115-JBT to 115-GB (AFTER)

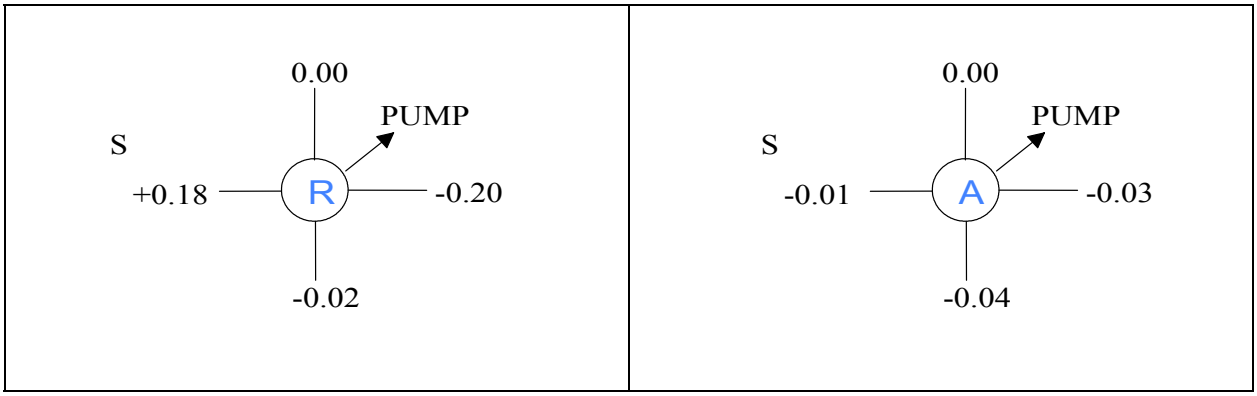




115-GB to 115-JB (BEFORE PM)



115-GB to 115-JB (AFTER PM)



BOILER FEED WATER PUMP, TRAIN 104-JA

Pump, 104-JA preventive maintenance.

The pump 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 lube oil console and filters were cleaned and installed.

Turbine 104-JAT 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 thrust was adjusted by grinding of spacer. (Original Spacer thk = 15.55 mm, after gringing thk = 15.37 mm)The bearing pads were visually inspected and DP inspected and found OK. The gauss measurement was taken and found within acceptable limit. The low lube oil trip linkages were checked. The governor was checked at Test bench.

Coupling inspection

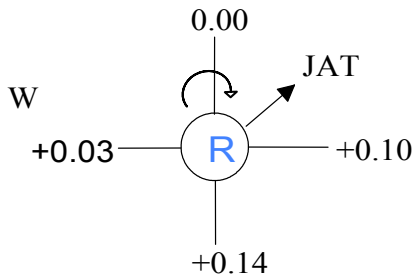
The coupling was inspected and found normal. The DBSE and coupling hub / shaft overhang was measured and found within limit.

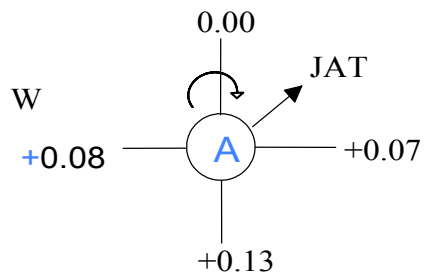
CLEARANCE CHART 104-J TRAIN

Description	Design Clearance (Inch)	Before PM (Inch)	After PM (Inch)
104-JAT (TERRY TURBINE)			
Journal bearing (Thrust end bearing)	0.005-0.007	0.20 mm	0.20 mm
Journal bearing (Opposite thrust end)	0.005-0.007	0.14 mm	0.14 mm
Axial Thrust	0.011-0.0016	0.43 mm	0.31 mm
104 JA			
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.12 mm	0.12 mm
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.12 mm	0.12 mm
Axial Thrust	0.014	0.27 mm	0.27 mm

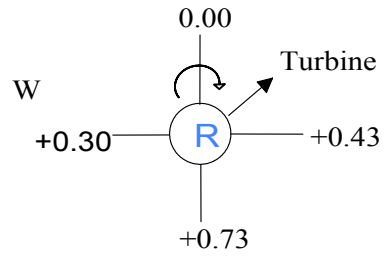
The alignment readings are as follows.

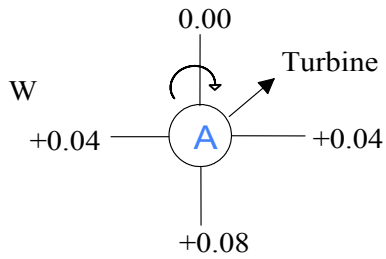
104-JAT to 104-JA (Before PM)





104-JAT to 104-JA (After PM)





MAJOR OVERHAULING OF AMDEA PUMP DRIVE TURBINE (107-JT)

The turbine was taken for overhauling. After dismantling, the condition of Diaphragms & Rotor was found o.k and the same Rotor & diaphragms were installed back after cleaning etc. The Carbon packing at Gland & at inter-stage were replaced. The thrust float was found at 0.35 mm which was above acceptable limit. 0.15 mm shim was provided in the non active side of the bearing and the float reduced to 0.20mm. All other clearances were measured and found within desirable range and hence the turbine was assembled back. The coupling flexible element assembly was found damaged and the same was replaced with new flexible element. The inlet steam control valve was replaced by new one by the instrument department. OST was carried out and achieved at 4182 RPM. While coupled run the train could not be run due abnormal vibration in front bearing of the turbine.

PROBLEMS OBSERVED

High vibrations of the range 44 -46 mm/sec at Horizontal plane at thrust end was noticed. Also the speed of turbine was not under control due to malfunctioning of new control valve. Various attempts to reduce the vibration by providing support for the turbine inlet line went in vain. Finally it was decided to reorient the inlet line and replace the new control valve by the old control valve. At the same time it was observed that the main oil pump drive gear assembly was chocked and found lot of debris inside. Hence it was decided to reopen the turbine for internal inspection. Ammonia plant continued operating with stand by train, put in normal operation.

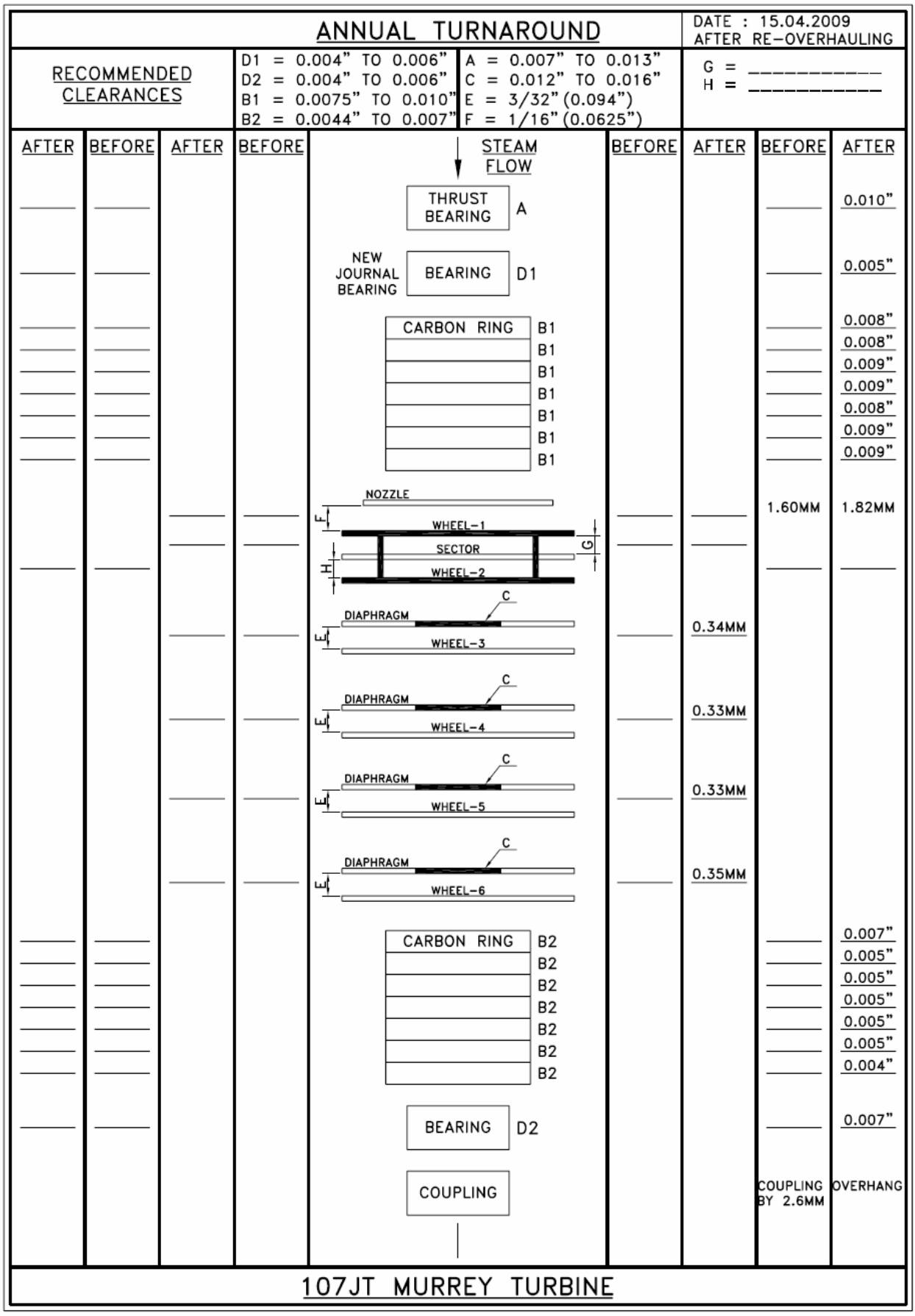
RE–OVERHAULING OF TURBINE 107-JT

The exhaust valve was closed and no vacuum break was observed. The expansion bellow assembly was unbolted from its flange ends and noticed 3mm prestretch in the bellow. Removed the expansion bellow and turbine top casing. It was absorbed, heavy rubbing marks of 2^{nd} wheel shroud with the sector in between 1^{st} & 2^{nd} wheel.

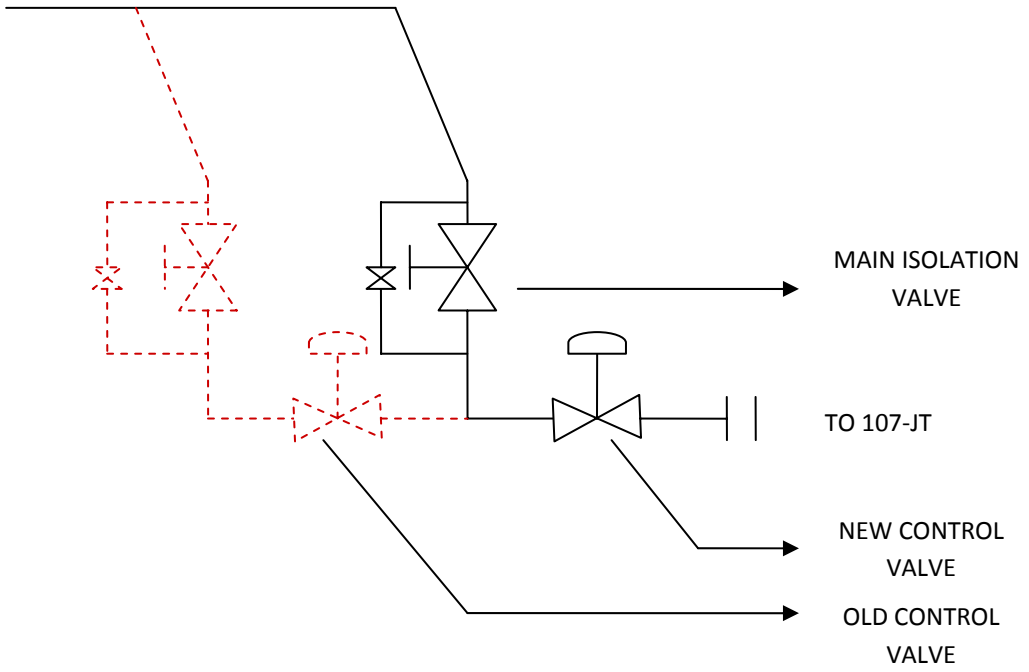
Removed rotor and taken to balancing machine for checking the run out and slow speed balance. Rotor run was found within the limit. The rotor was taken on balancing where in unbalance of 3.1 grm was removed from Plane -1 @ 140 Degree & unbalance of 12.9 Gm was removed from plane 2 @ 109 degree. The balanced rotor was again placed inside the bottom casing. The carbon rings at the inlet and the exhaust end were replaced by new ones. The carbon rings of the diaphragms were also replaced by new one. Drive end journal bearing clearance was measured and found within design value. Non drive end journal bearing clearance was above acceptable range and hence the bearing was replaced by new one. The axial thrust of the rotor was above acceptable range and hence it was reduced by increasing the shim thickness at the non active side. The nozzle clearance was adjusted and kept 1.80 mm. All internal clearances recorded and found within the permissible limit. Intermidiate carbon rings clearances recorder and found within the limit. Top covers placed and tightened the bolts. The details of the clearance and the alignment readings have been tabulated below.

The main oil pump and its drive assembly were overhauled. The bearings of the worm shaft & worm gear shaft, Part No 10 & 46 of Auxiliary Gear Drive assembly and worm gear shaft, driving and driven shafts were replaced with new ones. The coupling, part No 6 of main oil pump assembly had completely got worn out teeth and was replaced

with new one. PGPL governor which was not in use for the speed control of the turbine, removed and blinded the opening as the speed is controlled by Control valve.



The defective control valve was replaced by the existing old control valve and the inlet line was reoriented as shown in the sketch to keep the location of control valve 400 mm away from the turbine inlet, earlier it was very close to the nozzle. The new position of the line has been shown as dotted line.



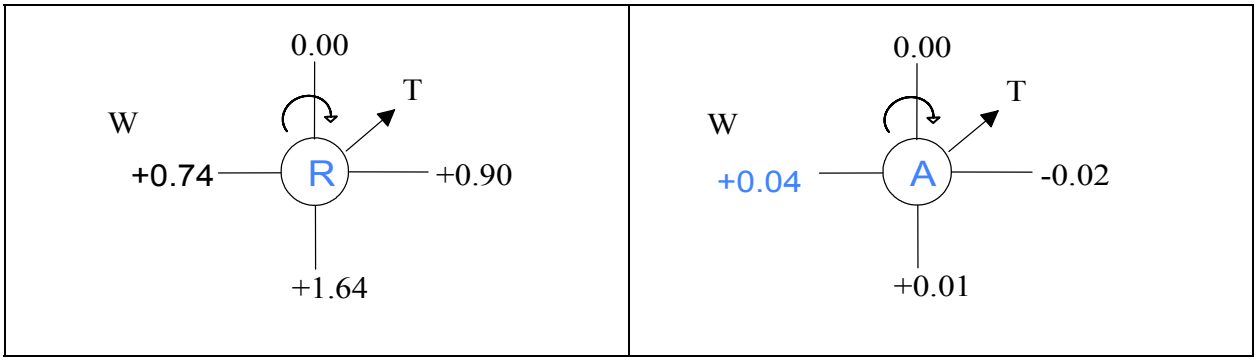
REORIENTATION OF 107-JT INLET LINE

CLEARANCE CHART: 107-JT (MURRY TURBINE)

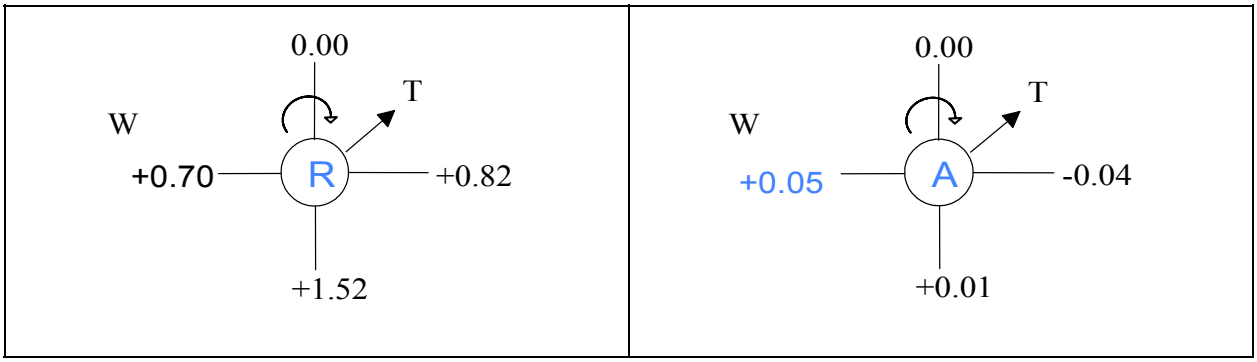
Description	Design Clearance (Inch)	Before PM (Inch)	After PM (Inch)
Journal bearing Thrust end	0.004 – 0.006	0.0065 – 0.009	0.005”
Oil Guard Thrust end - Inboard	0.011” – 0.017”	0.005”	0.005”
Oil Guard Thrust end - Outboard	0.011” – 0.017”	0.006”-0.065”	0.006”-0.065”
Journal bearing Opposite thrust end	0.004 – 0.006	0.0062 – 0.0085	0.006 – 0.007”
Oil Guard Opposite thrust end - Inboard	0.011” – 0.017”	0.006” – 0.007”	0.006” – 0.007”
Axial Thrust	0.007 – 0.013	0.0101	0.010
Nozzle clearance	0.0625”	0.057”	0.072” (Kept on higher side for reducing vibration level)

GAUSS			
LOCATION		**BEFORE (Gauss)**	**AFTER (Gauss)**
Journal bearing Governor end	Top half	2.4	o.k.
	Bottom half	2.3	o.k.
	Shaft	3.0	o.k.
Journal bearing Coupling end	Top half	2.5	o.k.
	Bottom half	1.6	o.k.
	Shaft	2.6	o.k.
Thrust bearing	Collar	2.7	o.k.
	Pad	1.8	o.k.

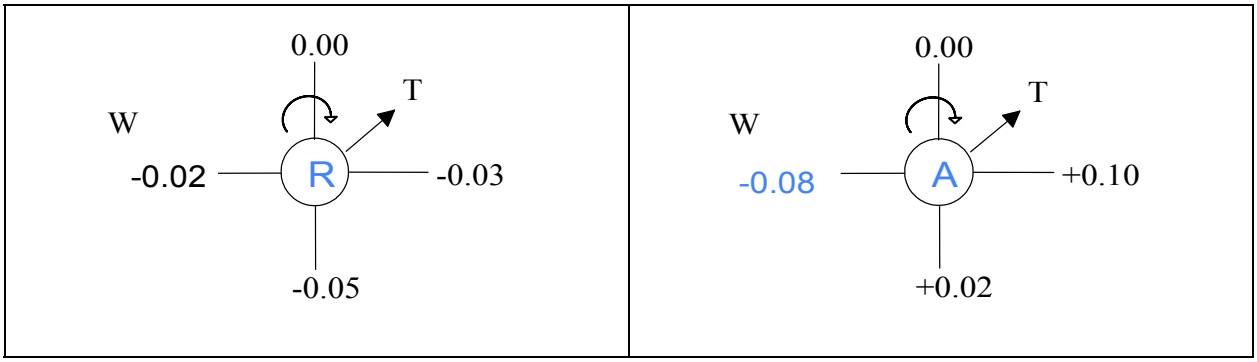
107-JT to 107-J (Before PM)



107-JT to 107-J (After PM)



Hot alignment readings of 107-J (after stopping of turbine dus to vibrations)



OVERHAULING OF RECIPROCATING CO_2 GAS COMPRESSOR, 117-J

Complete Overhauling was carried out of Re-cycle Gas compressor, 117-J. The job was carried out through M/s Malhan Enterprises, A'bad vide WO No 20081288 dated 15.02.2009

LP Cylinders

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 run out of the piston rod was checked and found on higher side. Also the Piston OD was also worn out. The complete Piston Rod assembly for LP stage was replaced. 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 200^0C 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

The end clearance at TDC and BDC were measured and found OK. The liner and Valva seating area of A'bad side HP cylinder were found worn out. Hence the cylinder was replaced. During this replacement, the cooling water lines were required to be modified to suit the connections of new Cylinder. Also the tapped holes provided on the new cylinder's for valve cage are M14 size (originally it was M12 size) , hence new studs were procured for valve assemblies. The runout of the piston rod was checked and found OK. 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 200^0C 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

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.

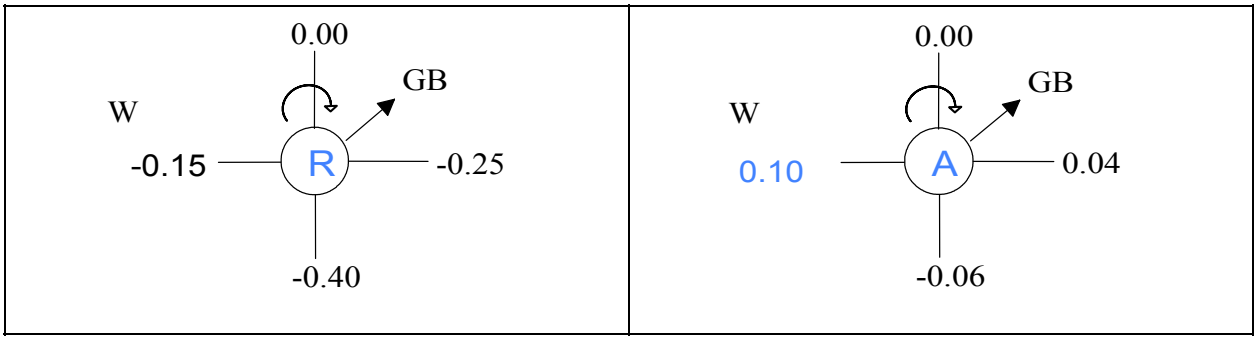
The tube bundle of the interstage cooler was pulled out and cleaned by hydro jetting. The LP and HP flow dampener were checked and found OK. The lube oil strainers were cleaned and reinstalled.

CLEARANCE CHART 117-J TRAIN

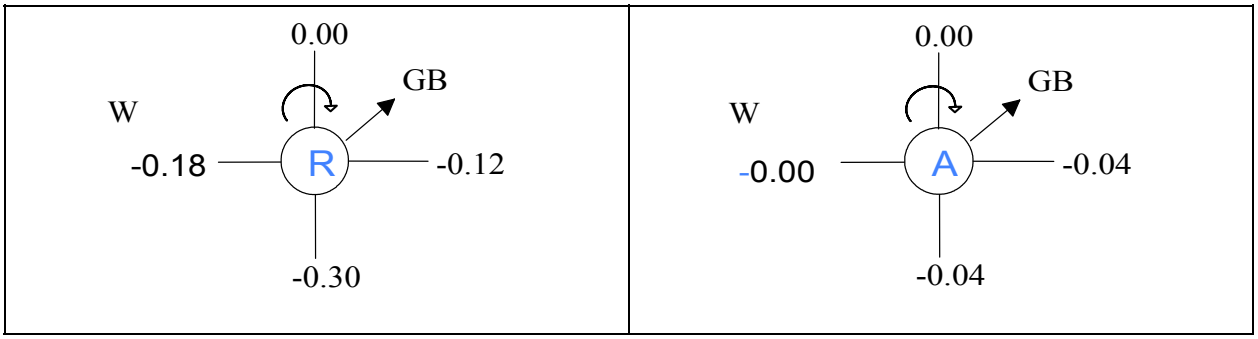
Description	Position		Design clearance(mm)	Before	After
Piston end clr. (Front /**TDC**)	LP	Urea side	2	4.1	3.2
		Ammonia side	-- do --	4.2	2.8
	HP	Urea side	-- do --	3.2	2.6
		Ammonia side	-- do --	2.9	3.0
Piston end clr. (Intermediate /**BDC**)	LP	Urea side	1.5	3.0	2.2
		Ammonia side	-- do --	2.7	2.6
	HP	Urea side	-- do --	2.2	2.0
		Ammonia side	-- do --	3.0	2.5
Main bearing	I	Urea side to Ammonia side	0.08-0.15 (0.3 MAX)	0.17	0.17
	II		-- do --	0.17	0.17
	III		-- do --	0.18	0.18
	IV		-- do --	0.17	0.17
	V		-- do --	0.18	0.18
Big end bearing	LP	Urea side	0.07-0.13 (0.3 MAX)	0.17	0.16
		Ammonia side	-- do --	0.18	0.16
	HP	Urea side	-- do --	0.18	0.17
		Ammonia side	-- do --	0.17	0.16
Small end bearing	LP	Urea side	0.05-0.10 (0.2 MAX)	0.10	0.05
		Ammonia side	-- do --	0.10	0.05
	HP	Urea side	-- do --	0.10	0.05
		Ammonia side	-- do --	0.10	0.10
Cross head guide	LP	Urea side	0.18-0.26 (0.6 MAX)	0.25	0.25
		Ammonia side	-- do --	0.35	0.35
	HP	Urea side	-- do --	0.25	0.25

		Ammonia side	-- do --	0.25	0.25
Side clearance (Crank shaft)	----	Crank shaft	0.45-0.60 (0.9 MAX)	0.60	0.60
Side clearance (Connecting rod big end)	LP	Urea side	0.33-0.42 (0.6 MAX)	0.35	0.35
		Ammonia side	-- do --	0.30	0.30
	HP	Urea side	-- do --	0.30	0.30
		Ammonia side	-- do --	0.30	0.30
End clearance piston rings	LP	Urea side	3.84		
		Ammonia side	3.84		
	HP	Urea side	2.52		
		Ammonia side	2.52		
Diametrical clr. (Piston – Cylinder)	LP	Urea side	3 - 4		
		Ammonia side	3 - 4		
	HP	Urea side	3 - 4		
		Ammonia side	3 - 4		
Piston rod OD	LP	Urea side	--		New
		Ammonia side	--		New
	HP	Urea side	--		
		Ammonia side	--		
Piston OD	LP	Urea side	--		New
		Ammonia side	--		New
	HP	Urea side	--		
		Ammonia side	--		
Cylinder ID	LP	Urea side			
		Ammonia side			
	HP	Urea side			
		Ammonia side			

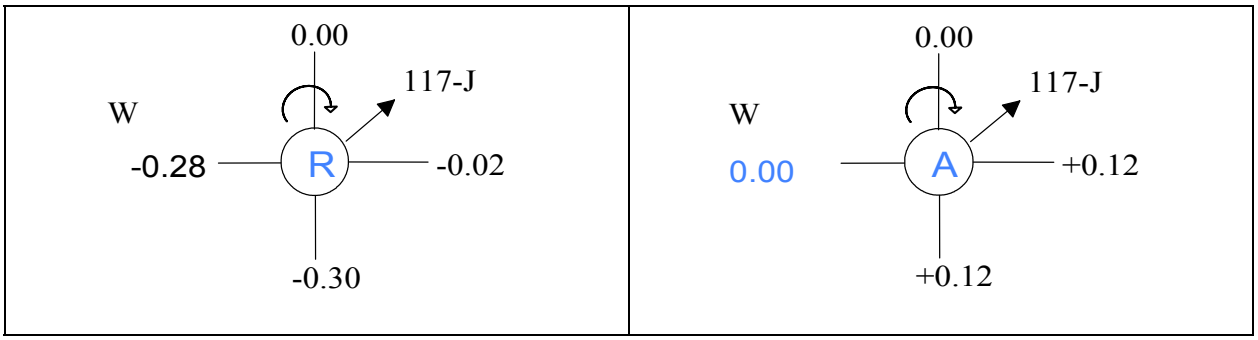
117-JM to Gear Box - (Before PM)



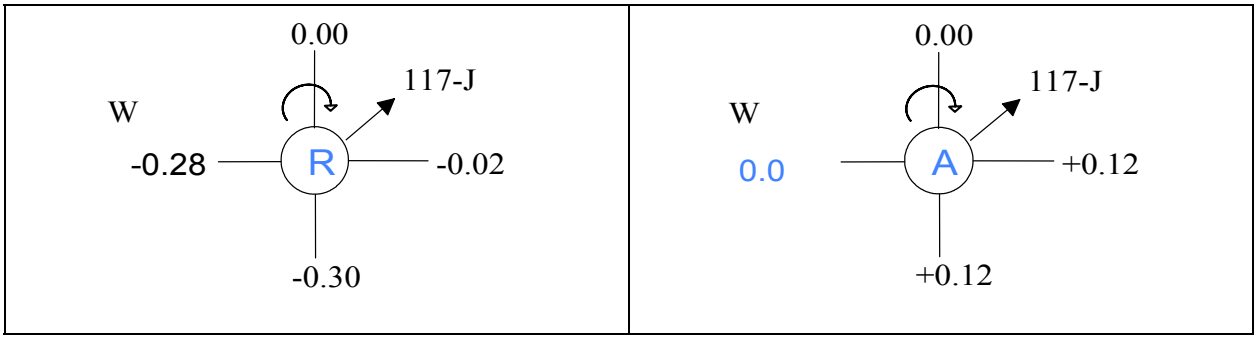
117-JM to Gear Box - (After PM)



Gear Box to 117-J - (Before PM)



Gear Box to 117-J - (After PM)



PM OF SPLIT STREAM PUMP DRIVE TURBINE 116-JAT

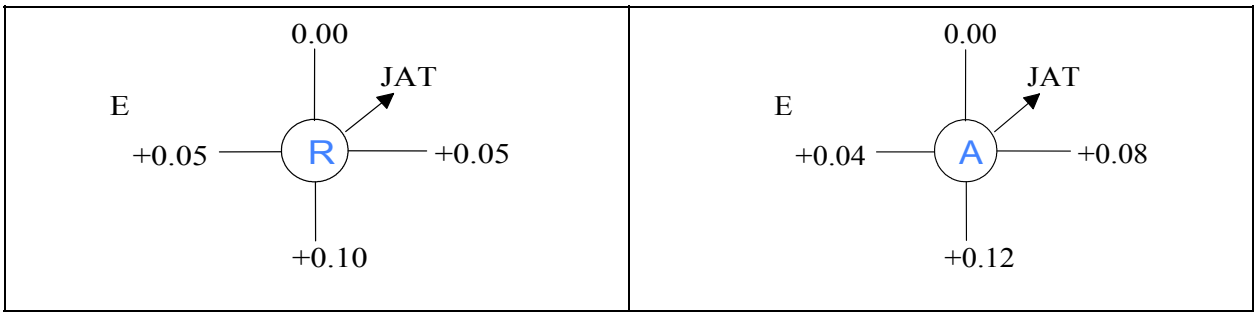
The turbine was taken for preventive maintenance. Both ends journal bearing clearance was measure and found within desirable range. The axial thrust was measured at 0.024" well above the desirable range of 0.010"-0.018". Hence the thrust bearing SKF 6209-Z/ C3 was replaced by new one. The final thrust was measured at 0.010" which was within the acceptable limit. The governor side carbon rings were inspected and three Nos found broken. The same were replaced by new ones. Coupling end carbon rings were inspected and two Nos found broken. The same were replaced by new ones. The clearances measured have been tabulated below. The trip pin to plunger clearance had reduced to 0.020" and hence it was increased to design value of 0.062"

CLEARANCE CHART 116- JAT

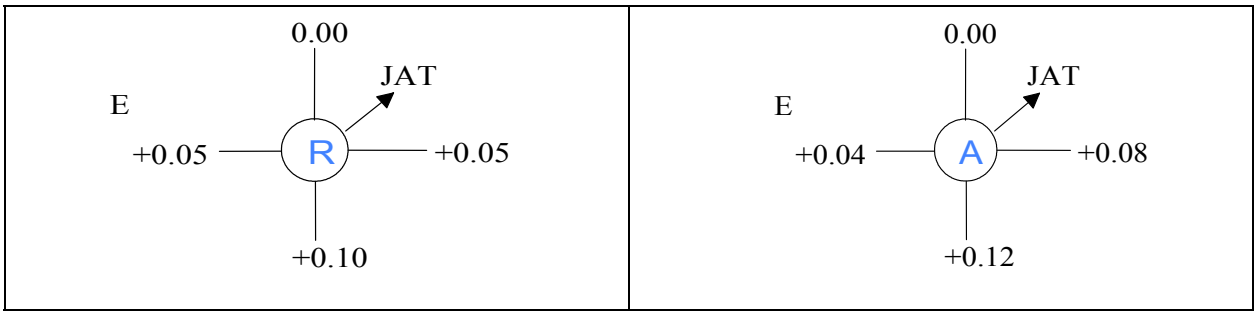
Description	Design Clearances (Inch)	Before (Inch)	After (Inch)
Axial Thrust	0.010 – 0.018	0.024	0.010
Journal bearing Coupling side	0.006-0.009	0.008	0.008
Journal bearing Governor side	-- do --	0.008	0.008
Trip pin - Plunger	0.062	0.020	0.062

ALIGNMENT READINGS

116-JAT to 116-JA (BEFORE)



116-JAT to 116-JA (AFTER)



Condition Assessment and Remaining Life Analysis

Waste Heat Boiler GT 1632.

RLA of waste heat boiler GT 1632 was carried out by M/S Thermax Pune. Last RLA was carried out in the year 2004. Validity of the certification by CIB Gujarat was valid for 5 years i.e upto 2009. Detailed activity performed by M/s Thermax, Pune is given in the section “Inspection of Ammonia Plant.”

Boiler Inspection

Annual inspection of following Boilers GT-1631 (112-C), GT-1632 (101-F), GT 5217 (107-C) were carried out by CIB Gujarat and permitted for further service. Open inspection was done on 27-03-2009 and hydrotest was witnessed by CIB on 01-04-2009.

Bench test of following Safety valves carried out on 23-03-2009

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^2g	9.5 Kg/cm^2g	10.0 Kg/cm^2g	9.5 Kg/cm^2g

Boiler No.GT-1632 (101-F)

Bench test of following Safety valves of GT-1632 was done on 27-03-2009 and the readings are as under.

	RV (North)	**RV (Middle)**	**RV (South)**	**RV (Super Heater)**
Poping Pressure	118.84 Kg/cm^2g	117.00 Kg/cm^2g	115.33 Kg/cm^2g	111.80 Kg/cm^2g
Reset Pressure	114.00 Kg/cm^2g	112.00 Kg/cm^2g	112.50 Kg/cm^2g	107.80 Kg/cm^2g
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 27-03-2009 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	44.9 Kg/cm^{2}g
Locking washer thickness	14.70mm	14.20mm	

SAFETY RELIEF VALVES OVERHAULING & SERVICING

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

Sr. No.	RV Tag No.	Valve Size	Set Pressure	Reset Pressure
1	RV – MS 9	4” x 6”	42.2	38.0
2	RV – S 7	4” x 6”	14.8	13.7
3	RV – LS 1	4” x 6”	12.7	11.5
6	RV – S 26	2.5” x 4”	14.0	12.0
7	RV – 103 JAT (2 Nos)	4” x 6”	46.5	42.0
8	RV – 103 JAT	¾” x 1”	46.5	42.0
9	RV – 104 JAT	6” x 8”	0.37	0.30
10	RV – 112 CA	1.5” x 3”	10.50	9.0
11	RV – 112 CB	1.5” x 3”	10.50	9.0
12	RV – 109 F	6” x 8”	19.0	16.5
13	RV – 110 F N & S (2 Nos)	3” x 4”	7.0	6.3
14	RV – 111 F	4” x 6”	6.3	5.5
15	RV – 112 F	4” x 6”	6.3	5.5
18	RV – 102 D	3” x 4”	43.9	39.5

Sr. No.	RV Tag No.	Valve Size	Set Pressure	Reset Pressure
19	RV 101- J	4” x 6”	36.9	33.2
20	RV – 105 JLO	2” x 3”	5.3	4.7
21	RV – 129 C	1” x 2”	8.4	7.56
22	RV – 104 D 2	1.5” x 2”	34.10	32.30
23	RV – 101 E	1” x 2”	30.6	27.0
24	RV – PG 39	4” x 6”	5.3	4.7
26	PSV-177	15” x 20”	57.08	52
27	PSV-1201	1 ½” x 3”	7	5.9
28	PSV-1202	1 ½”x 3”	7	6.3
30	PSV-1204	1 ½ “ x 2”	48	43
31	PSV-1205	3” x 4”	7	6.3
32	PSV-1206	1 ½” x 2 ½”	48	43.1
33	PSV-1209 A	1” x 2”	42	40
34	PSV-1210	1 ½” x 2 ½”	48	43.5
35	PSV-1212	¾ ” x 4”	7.0	6.2
36	PSV-301	1 ½” x 3”	10.0	9.0
37	RV 116-JAT	3 x 4	6.1	5.5
38	RV – 117 J-1	1 ½” x 3”	5.8	5.2
39	RV – 117 J-2	1 ½” x 3”	15.8	14
40	RV – 117 J-3	1” x 2”	30.2	27
41	RV – 115 JA- AOP-1	1” x 2”	11.0	10.0
42	RV – 115 JB- AOP-2	1” x 2”	11.0	10.0
43	RV – 115 JB AOP-1	1” x 2”	11.0	10.0
44	RV – 115 JB AOP-2	1” x 2”	11.0	10.0

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

Sr. No	RV Tag No	Valve Size	Set Pressure	Reset pressure
1	RV – 102 F (Anderson Green)	6” x 8”	29.5	27.5
2	RV-105-D (Anderson Green)	3”x 4”	152.95	138.90
3	RV – 103- J (Anderson Green)	3” x 4”	159.00	148.00
4	RV – 106-F (Anderson Green)	1.5’ x 2”	158.00	148.00
5	RV-104-D1	6” X8”	35.00	32.00
6	RV-123-CA	3” X6”	122.00	112.00
7	RV-123-CB	3” X 6”	122.00	112.00

HEAT EXCHANGERS

Air Compressor Interstage Cooler (129-JC)

The existing tube bundle was replaced by new tube bundle assembly procured form M/s Patel Airtemp, vide PO No 20080797 dated 24-10-08.

129-JC Tube Bundle Replacement Under Progress

103-JBT Gland Condenser

The complete tube bundle assembly was pulled out and found heavily choked. Since it was a U-Tube type bundle assembly, it was not possible to clean the tubes. A new tube bundle assembly was fabricated at workshop using SS tubes, baffles & tube sheets.

Ammonia Condenser (HE-2)

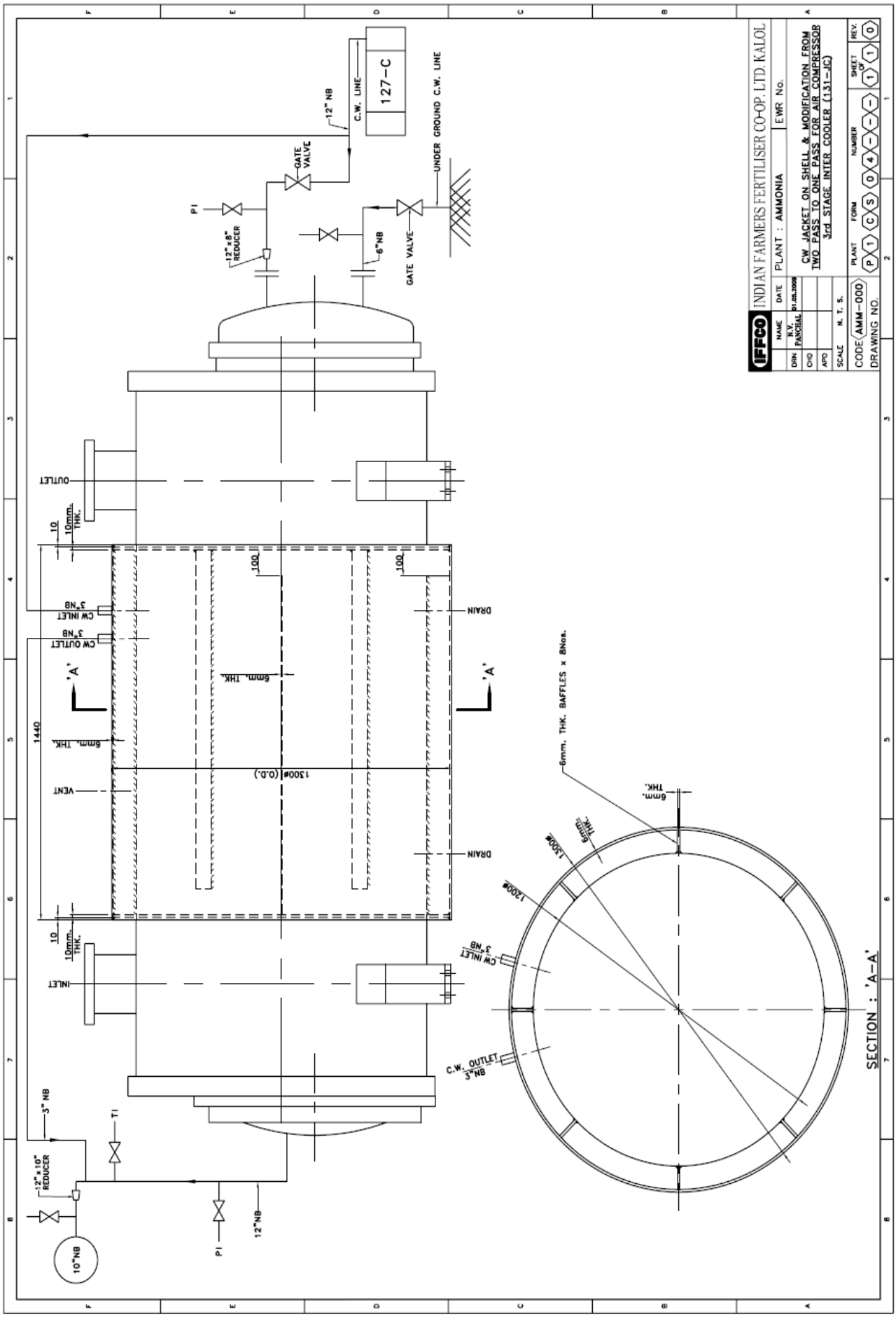
The complete tube bundle assembly was taken for retubing of all the 1280 No of tubes. The complete tube bundle assembly with integral shell was removed from installation and brought down to ground floor. The tubes to tube sheet joint were removed by drilling and the tubes pulled out by hydraulic puller. Seamless cold drawn ASTM A-179, low-carbon steel tubes, were inserted and strength weld done using TIG followed by light expansion of 3-5 %. The strength weld was DP tested and found OK. Hydrotesting was done on shell side at 37.5 kg/cm^2 and hold time of 15 min. No leakage was observed. The retubing was done by M/s S.R.Engineering, vide PO No 20081303, dated 07/02/2009.

HE-2 Re-tubing Under Progress

Air Compressor Interstage Cooler 131-JC was cleaned using hydro-jetting. Some of the tubes at the CW inlet were found chocked and the same was removed using rod pocking. The tube bundle assembly was hydro-tested and 84 No tubes all at the inlet side were found leaking. The same were plugged. Since all the tubes plugged were at the inlet side, the heat exchange capacity of the bundle dropped by around 40%. Hence it was decided to modify the exchanger to One Pass from two pass and provide a cooling water jacket around the shell. For converting from two pass to one pass CW**,** existing outlet line was connected to CW inlet header and one new outlet line was provided at the floating end cover. Additional cooling water jacketing was provided on the shell as shown in the sketch so that same can be utilized if at all required for cooling the air. The choked tube sample was sent to lab for checking and the following observations were made:

Acid insoluble matter : 17.0 % w/w
Phosphate as PO_4: 12.7 % w/w
Zinc as Zn: 3.7 % w/w
Iron as Fe: 0.75 % w/w
Moisture: 4.3 % w/w

131-JC Cooling Water Jacket Provided on Shell


INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
IFFCO
PLANT : AMMONIA
EWR No.
CW JACKET ON SHELL & MODIFICATION FROM TWO PASS TO ONE PASS FOR AIR COMPRESSOR 3rd STAGE INTER COOLER (131-JC)
CODE (AMM-000)
DRAWING NO.
SECTION : 'A-A'
127-C
C.W. LINE
12" NB
UNDER GROUND C.W. LINE
GATE VALVE
6"NB
12"x8" REDUCER
PI
OUTLET
INLET
10mm. THK.
CW INLET 3"NB
CW OUTLET 3"NB
DRAIN
VENT
6mm. THK.
1440
1300ø (O.D.)
100
12"x10" REDUCER
3" NB
TI
10"NB
12"NB
6mm. BAFFLES x 8Nos.
1200ø
C.W. OUTLET 3"NB

The following heat exchanger tube bundle were cleaned by hydrojetting.

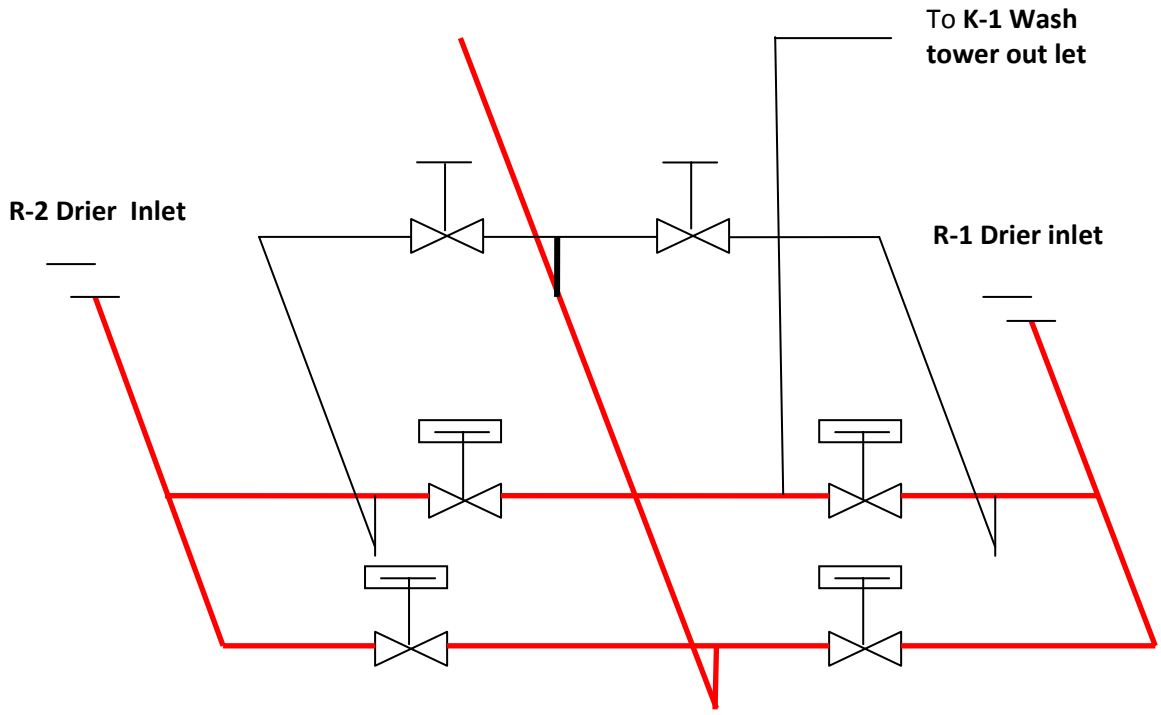
EQUIPT. NO.	OPENING START	OPENING COMP.	HYDROJETTING		HYDRO-TEST		BOX-UP DATE	REMARK
			START	COMP.	SHELL SIDE	TUBE SIDE		
105-CA	19/03/09	20/03/09	21/03/09	22/03/09	46.4 Kg/Cm2 25/03/09			Gasket between tube bundle & shell replaced
						Head Press 27/03/09		
					46.4 Kg/Cm2			
105-CB	19/03/09	20/03/09	22/03/09	22/03/09	46.4 Kg/Cm2 24/03/09			Gasket between tube bundle & shell replaced
						Head Press. 27/03/09		
					46.4 Kg/Cm2 30/03/09			
110-CA	16/03/09	17/03/09	17/03/09	18/03/09			19/03/09	
110-CB	16/03/09	17/03/09	17/03/09	18/03/09			19/03/09	
127-CA	16/03/09	17/03/09	18/03/09	20/03/09	31.5 Kg/cm2 22/03/09			103 -c side cover boxed up
127-CB	16/03/09	17/03/09	18/03/09	20/03/09	31.5 Kg/cm2 22/03/09			103-c side cover boxed up
128-C	17/03/09	17/03/09	20/03/09	21/03/09			22/03/09	
131-JC	19/03/09	19/03/09	20/03/09	20/03/09	16.0 kg/cm^2			84 tubes are plugged
173-C	21/03/09	21/03/09	20/03/09	20/03/09			24/03/09	
105-JT G.C.	18/03/09	18/03/09					01/04/09	New tube bundle
101-JLC/1	24/03/09	24/03/09	25/03/09	25/03/09			26/03/09	
101-JLC/2	24/03/09	24/03/09	25/03/09	25/03/09			26/03/09	
103-JLC/1	19/03/09	19/03/09	20/03/09	20/03/09			26/03/09	
103-JLC/2	19/03/09	19/03/09	20/03/09	20/03/09			26/03/09	
101-JCA I/A	19/03/09	19/03/09	25/03/09	25/03/09			28/03/09	
101-JCA S.C.	16/03/09	17/03/09	18/03/09	20/03/09			28/03/09	
101-JCB I/A	19/03/09	19/03/09	25/03/09	25/03/09			28/03/09	

101-JCB S.C.	16/03/09	17/03/09	17/03/09	19/03/09				
103-JBT GC	18/03/09	18/03/09	21/03/09	21/03/09			28/03/09	
101-JLC3	19/03/09	19/03/09	20/03/09	20/03/09			26/03/09	
101JT G.C.	18/03/09	18/03/09	21/03/09	21/03/09			28/03/09	
115-C	24/03/09	24/03/09	25/03/09	25/03/09	**15.8 Kg/cm2** 29/03/09		30/03/09	
116-C	18/03/09	19/03/09	25/03/09	25/03/09	**15.8 Kg/cm2** 24/03/09		29/03/09	
124-C	18/03/09	19/03/09	21/03/09	21/03/09	**26.5 Kg/cm2** 23/03/09		24/03/09	

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	19/03/09	22/03/09	23/03/09	25/03/09	**8.1 Kg/Cm2** 26/03/09		31/03/09	
						8.1 Kg/Cm2 29/03/09		
					8.1 Kg/Cm2 30/03/09			
108-C2A	19/03/09	22/03/09	23/03/09	25/03/09	**8.1 Kg/Cm2** 26/03/09		31/03/09	
						8.1 Kg/Cm2 29/03/09		
					8.1 Kg/Cm2 30/03/09			
109-C1A	19/03/09	22/03/09	23/03/09	25/03/09	**8.1 Kg/cm2** 26/03/09		31/03/09	
						8.10 Kg/cm2 29/03/09		
					8.1 kg/cm2 30/03/09			
109-C2 A	19/03/09	22/03/09	23/03/09	25/03/09	**8.1 Kg/cm2** 26/03/09		31/03/09	
						8.1 Kg/cm2 29/03/09		
					8.1 Kg/cm2 30/03/09			

FABRICATION JOBS Replacement of piping in loop between K1 wash tower out let to R1-R2 Drier inlet 100NB X SCH 40 line No 4-TG-04 of PGR. The latest inspection report indicated that the thickness of the 4" line had reduced below acceptable limit. Hence the line was replaced with new 4" X 80 SCH line. Root DP and radiography of each joint was carried out and found OK.



Replacement of Loop NO : 4" TG 04 in PGR

- The 50NB X SCH 10 line from 106-J discharge to CO_2 Absorber 101-E top was earlier erected from bottom of Absorber to the top, along the platform railings. Where-ever the distance between the platforms was long the line used to vibrate. Further the line was tack welded to the supports instead of clamping. This lead to development of cracks on the lines and subsequent leakages. The line from bottom to top was moved closer to the vessel and proper clamping was provided.

- Aux. Boiler burner No. -1 steam line union replaced to attend leakage.
- Steam trap 38 ata & its isolation valve near 156-F replaced.
- Platform lowered and fixed gratings behind Aux. Boiler for entering at hot zone.
- 101J lube oil turbine steam inlet line trap isolation valve and trap replaced
- CW jump over line vent valve near Aux. Boiler made straight in vertical position.
- 129-JC RV exhaust pipe connected with vent silencer header.
- FRC- 3 Vent silencer SP-77 extended to sufficient height to avoid high noise.

- 107-C steam line trap isolation passing valve near blow down drum & trap were replaced.
- PIC-17 main isolation valve was passing was replaced.
- PIC-14 steam trap replaced.
- Aux. Boiler burner No.- 2 atomizing steam valve replaced.
- Provided platform at 117-J discharge line 2nd isolation valve to 101-E gas inlet line.
- 38 ata steam trap, its bypass valve & its isolation valve were replaced. (Near P-111 Pre- reformer).
- Provided support of 107-C exhaust pipe.
- Line rerouted for silo side panel opening.
- 115- JBT exhaust RV platform repaired.
- 105- JT exhaust elbow removing platform extended & provided railing.
- 142-C gas inlet line butterfly valve platform repaired.
- Aux. boiler platform railing cut & made it folding for removing burner No - 1 & 2.
- Reoriented 117-J discharge line 2nd isolation valve to 101-E gas inlet.
- 114F outlet let drain line elbow bulged and hence replaced.
- FRC-3 vent silencer SP-77 extended up to sufficient height to avoid high noise pollution during working around FR/PR-32 TX.as per safety meeting.
- Fire hydrant point at compressor area shifted for easy crane movement.
- Steam sample line 1st isolation valve replaced.
- Provided platform for 108-D Elbow and 'T' inspection.
- 108J/JA discharge to FICV 14(102EB) top line 'T' joint crack repaired.
- PICV-502 bypass valve replaced.
- C-1 liquid outlet line elbow thickness reported at 2.03 mm and hence the elbow was replaced.
- 142-C bypass valve spindle broken, and hence replaced.
- 142-C outlet line drain valve fixed in down stream of isolation valve.
- 107-C IBD line vent isolation valve upstream weld joint pin hole leak repaired.
- SR-1 LI-502 isolation valve hard to operate and hence replaced.
- Hydrazine tank isolation valve for tank filling ,wheel free & hence replaced.
- 115-JAT/JBT both turbines steam traps were passing and hence replaced
- Ammonical water line from K-1 to 172-F rerouted away from PC-2A/B towards 172-F
- 115JA/JB'S flushing fluid line isolation valve replaced since the spinde was damaged and wheel was free.
- Dearator drain pipe was replaced.

- Air dryer new tapping provided and 2''x800 # valve provided as per instrumentation requirement.

VALVE GLAND LEAK JOBS:

- Reformer burner no. – 402 Naphtha valve gland leak rectified.
- PIC- 5 Snuffing steam 1st valve gland leak rectified.
- PIC-13 B Jump over valve gland leak rectified.
- 101F high level switch (South side) top isolation valve gland leak rectified.
- HCV 12(South side) gland leak rectified.
- 115JB steam inlet valve gland leak rectified.
- High level switch top isolation valve gland leak rectified.
- Down comer PDR roof valve gland leak rectified.
- LIC 1007 LP and HP tapping top isolation valve gland leak rectified.
- TRC-10 both side g/l, one bolt to be replace of gland leak rectified.
- SP-39 both side gland leak rectified.
- 102-C south side IBD valve gland leak rectified.

VALVE BONNET LEAK

- PIC 13B control valve bonnet leak attended.
- PIC 13B control valve bonnet leak attended
- 106-F level troll bottom drain valve bonnet leak attended.
- 106-F level troll bottom drain valve bonnet leak attended.

FLANGE LEAK & VALVE PASSING JOBS:

- LIC- 490 upstream flange leak attended.
- 115JBT steam inlet line strainer flange leak attended.
- 107C north side LG bottom isolation valve upstream flange leak attended.
- 115 JBT sealing steam p/l down stream flange leak attended.
- PRCV 25 flange leak attended.
- PIC 13B control valve bonnet leak attended.
- PICV-14 upstream flange leak attended.
- 103JAT steam inlet line strainer flange leak attended.
- PIC-3 upstream and downstream valve passing attended.
- 103-C Silo side down commer flange leak attended.
- R112 outlet check valve top flange leak attended.
- PC-2B glycol pot vent valve upstream flange leakage attended.

- 106-F level troll bottom drain valve bonnet leak attended.
- 102-C bottom north and south side inspection flange leak attended.

PAINTING JOBS

- **ID STACK**: The complete stack was cleaned by copper slag blasting to Swedish SA 2 1/2 ISO: 8501-1, ASTM 2200D, SSPC-SP 5. Then a coating of 150-170 micron of aluminium was applied using arc spraying, 99.5% pure aluminium, as per IS: 5905, BS: 2569 (PART I & II), BS: 5493 T. One coat of heat resistant aluminium sealant "HR 123", Aluminium paint was applied.
- **PGR VESSELS :** On the shell side of Gas exchanger, E-3 and Wash tower K-1, atmospheric moisture used to condense leading to corrosion on the surface. The surface was cleaned using sand blasting and STANVAC make, special corrosion protection compound, Z-1311, Corrokote was applied on the surface
- **OTHERS:** The other areas where painting was carried out are

  Primary reformer.

  Silencers SP-71.

  101-F.

  R-111

  Air compressor, 101-JLP & 101-JHP

  Refrigeration compressor, 105-JLP & 105-JHP

  Synthesis gas compressor, 103-JLP & 103-JHP

  Boiler feed water pumps 104-J and 104-JA.

PRIMARY REFORMER 101-B RADIANT ZONE:

- Burner No. - 311 disconnected valve lever was rectified.
- Seven Nos damaged burner blocks 203, 304, 414, 502, 503, 703 & 803 were replaced by new one.
- Damaged insulation on bottom header were repaired.
- Passing naphtha needle valves were replaced
- All Primary air registers were made free.
- Tunnel burners were overhauled.
- Br No 402 naphtha valve gland leak was rectified.
- Br No 805,810,913,914 atomising steam line union leak was rectified.
- Br No 405,703,605,210,908 Naphtha isolation valve was rectified for passing.
- Lever for Foot valve of all burners were fixed properly for easy operation.
- Ceramic fibre module insulation on roof near burner No 8, 732, 733, 716, 720, 516, 518, 519, 415, 419, 420, 424, 431- 434, 319, 330 & 331 were damaged.

AUXILIARY BOILER, ITS BURNERS JOBS:

All the five Nos burners were removed from installtion.Preventive maintenance of all burners was carried out. The lube oil was flushed and the burners were reinstalled. The AG and Naphtha filters of all the burners were cleaned. All NDT as per RLA were carried out. External cleaning of tubes was done.

COPPUS TURBINE

- 101-JLOT: 101-JLOT bearing cooling water line union leakage was attended. Bearing cooling water line flushing. The TTV and governing valve were overhauled. Coupling was inspected and found OK. Governor oil was flushed. Governor drive coupling checked and found OK. The length of the linkage connecting the governing valve to the actuator, was reduced so as to keep the governing valve in opened condition during start-up. This was done to overcome the high starting torque that was needed by the turbine that forced to keep the valve in open condition, manually, during start-up. Bearing were replaced by new ones.
- 103-JSOPT. : Turbine trip valve and governing valve were overhauled. Bearing cooling water line was flushed. The OST assembly was replaced by new one. The new spring was later replaced by the old one as required tightness could not be achieved. The TTV pilot valve assembly was cleaned and reassembled. The governor oil oil was flushed. The OST of the turbine was carried out and trip speed of 3420 RPM was achieved.
- 2004-JT : Turbine trip valve and governing valve was overhauled.
- 112-JT : Bearing were found OK. Governor oil flushing and its drive coupling checked and found OK. Turbine trip valve and governing valve to be overhauled.

PM OF CRITICAL VALVE

The following gear operated valves and critical valves were roused. New grease was applied & the gear box boxed up

- 107-JT/JAT steam inlet valve
- 115-J/JA steam inlet valve.
- 116 JAT steam inlet and exhaust valve.
- 116-JA/JB suction valve.
- 118-J/JA/JB suction and discharge valve
- 121-J/JA suction valve and discharge valve
- 115-JA/JB steam inlet valve.
- 115 -HT hydraulic exhaust valve.
- LTS outlet vent valve at ground floor.
- 123-C BFW outlet valve near FRC-1
- MIC-22 & PIC-13 A/B upstream and downstream valve.
- FIC-1016 upstream and downstream valve.

- Common gear valve h-111 inlet at top platform
- R-112 CG circulator loop inlet and outlet valve.
- HIC-1004 upstream and downstream isolation valve.
- .PIC-1027 upstream isolation valve.
- Super heater both vent valve .
- 107-C vent valve.
- 102-EB outlet chain valve.
- 107 J/JA suction valve.
- 142-CA/CB BFW inlet and outlet valve.
- PRC-6 upstream isolation , PIC-5 upstream and downstream isolation valve, and 106-D inlet V -3 inlet isolation valve
- FRC-2 upstream & downstream both isolation valve.
- FRC-1 down stream isolation valve.
- 115- JA/JB minimum flow valve
- 104 J/JA steam inlet isolation valve.
- 2004 JAT inlet and exhust isolation valve.
- M.S battery limit isolation valve.

MISCELENOUS JOBS

- PRC-23 preventive maintenance.
- All plug valves greasing to be done.
- Naptha line isolation replacement.
- 103-J oil console newly fabricated breather pipe was installed on console.
- PC-2A/2B pumps suction ball valve overhauled and reoriented for easy access.
- 107-C IBD valve was rectified for passing
- Cleaning of 103-J oil console & charging by T-32 oil (Store code- 994010126000) : T-32 has higher oxidation stability with Ammonia and have been specially developed for centrifugal compressor handling NH_3. Hence Servo Prime 32 was replaced by Servo Prime T-32.
- All plug valve of synthesis loop were greased.
- H- 110: The main burner and pilot burner inlet lines were cleaned. The burner tips were also cleaned. The damaged air resister lever were replaced. Jammed air register were made free.
- H-111 : The main burner and pilot burner inlet lines were cleaned. The burner tips were also cleaned. The damaged air resister lever was replaced. Jammed air register were made free.
- 104JA,ARV/NRV were replaced by reconditioned ARV/NRV.
- 115JA/JB, 116 JA/JB ARV/NRV were overhauled and reinstalled.
- PRC-23 preventive maintenance was carried out.
- 103 AOP complete train was realigned. The suction line of the seal oil pump was re-oriented. On running heavy vibration and sound was observed at the lube oil pump end. Hence the lube oil pump was replaced by spare reconditioned one.

UP GRADATION OF RADIANT INSULATED WALL No. 3 & 4 OF PRIMARY REFORMER

Radiant Section of Primary Reformer at Kalol Unit is having 04 No. of Wall, from which Wall No. 1 & 2 were upgraded from old brick lining insulation to ceramic Fibre 'Z' section module in last Plant Turnaround March-April-2008. Remaining Wall No. 3 & 4 were upgraded from old brick lining insulation to Ceramic Fibre 'Z' Section Module. M/s Lloyds Insulations (India) Ltd, Mumbai was engaged vide WO No 20081140 dtd. 29.01.09 for supply and application of ceramic fibre Z section modules.

Details of Original Refractory Insulation

- Carbon steel Brick supporting wall : 6 mm thick
- Back Up insulation for Calcium Silicate : 50 mm thick
- ACE make "Porosint 500 SPL" Insulating Brick (equivalent to MK-23 Bricks) : 114 mm thick
- Total insulation thickness : **164 mm**

Details of Porosint 500 SPL Insulation Brick (equivalent to Mk-23)

GENERAL PROPERTIES	**VALUE**
Size	228 mm x 114 mm x 63 mm
Max. Service Temperature	1260 deg C
Bulk Density g/cm^3 (ASTM C 20)	0.55 max
Min cold Crushing Strength, kg/cm^2 (ASTM C 133)	15
Thermal Conductivity at 260 deg C Kcal/m/hr/^{0}C	0.14
Thermal Conductivity at 800 deg C Kcal/m/hr/^{0}C	0.18 max
Pyrometric Cone equivalent (ASTM C24)	23 / 1605 deg C Min
Chemical Composition	
Al_2O_3	40 min
SiO_2	48.50 (typ)
Fe_2O_3	1.0 % Max

Details of Upgraded insulation on Wall No. 3 & 4:- The following materials were used for the Up-gradation

- Hot face Lining & Back –up insulation

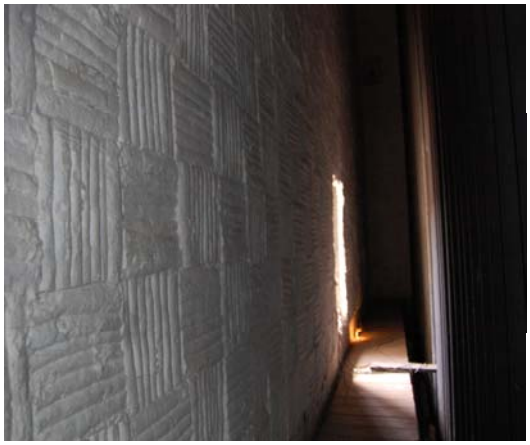
  Hot Face Lining : 225 mm thick Ceramic Fibre 'Z' Section Modules, 1425 ^{0}C, 160 kg/ m^3

Back-Up insulation: 25 mm thick Ceramic Fibre Blanket Insulation, 1260 ^{0}C, 128 Kg / m^{3}

Total thickness of insulation: 250 mm

- **Anchoring :** SS 304 grade Hardware was used for CF Module insulation. The studs were welded with stud welding gun and reinforced by Arc welding.
- **Peep Doors :** Vacuum Formed tailor made Ceramic fibre insulation with SS 304 anchors.

The Temperature survey was carried out on outside of wall of Primary Reformer after installation of CF 'Z' section Modules and found in the range of 90 deg C to 110 deg C.



CF Module Insulation on Wall No 3

CF Module Insulation Under Progress

Ceramic Fibre Module Insulation on Wall No 4

CATALYST REPLACEMENT

"UNIDENSE" Catalyst Loading

PRIMARY REFORMER, 101-B: Existing catalyst in Primary reformer catalyst tubes were replced with new during the Annual turnaround of the plant. Before opening the blinds, the spring hangers of all the tubes and those of the transfer line were locked. The top plugs of the catalyst tube were removed. The existing catalysts were removed using the vacuum blower. New catalyst was loaded using the UNIDENSE technology. Unidense technology provides faster loading and uniform catalyst density inside the tube and eliminates voids and pockets inside the tubes. The catalyst tubes were boxed up after replacement of the gaskets.

SECONDARY REFORMER, 103-D: Removed the whole catalyst from Secondary reformer, screened and reloaded the same catalyst. Scoop up the level by adding new catalyst.

The following activities were carried out for removal and loading of catalyst:

- Removal of Top nozzle
- Fabrication and installation of temporary platform for transferring the catalyst from crane to hoist. Catalyst was lifted in nylon bags and drums by crane to the plate form and shifted to the secondary reformer top and filled by electrical hoist.
- Box up of Air nozzle and checking catalyst level.

HIGH TEMPERATURE SHIFT CONVERTOR, 104-D1

- Existing catalyst was replaced with new one.
- Temporary arrangement was made at the top of the vessel for draining of the DM water required for bed cooling.
- The following activities were carried out for removal and loading of catalyst
- Removal of top manhole cover & top gratings
- Removal catalyst
- Modified bottom stool was fabricated and installed. This job was carried out by Technical department.
- Reloading of new catalyst/aluminum balls
- Box of screen and gratings
- Final box up of top man hole cover

SHULPUR ABSORBER, R-111: Existing catalyst was replaced with new one.

- The manhole was removed and reinstalled for removal and loading of new catalyst. New gasket was provided for the manhole.

LOW TEMPERATURE SHIFT CONVERTOR GUARD, LTG : Existing catalyst was replaced with new one. The manhole was removed and reinstalled for removal and loading of new catalyst. New gasket was provided for the manhole.

UREA PLANT

ROTATING EQUIPMENT

MAJOR OVERHAULING OF CO_2 COMPRESSOR LP CASE (K-1801-1)

LP compressor was taken for major overhauling. Previously it was carried out during Shut Down 2004. The Following jobs were done:

- Decoupled the LP case at both ends from Turbine & Gear box.
- DBSE of Turbine & LP case was 701.12 mm (max.) and LP case & Gear box was 646.46 mm (max.).
- Alignment of LP compressor with turbine and gear box was checked and found disturbed.
- Measured clearance between labyrinths and shaft and recorded (Ref- Table 1).
- 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.)
- Interference between bearing housing and bearing shell in turbine side was 0.06 mm and Gear box side 0.07 mm. (Allowable value: 0.03 ~ 0.09 mm).
- Thrust bearing was opened for inspection. Clearances value found within acceptable limits. (Ref Table-2.) Observed wax deposition on face of pads. Minor pittings were observed on the surface of pads. White metal was found removed at point locations in some of the pads. Same pads were used after lapping.
- Rotor position was measured.
- Axial float taken with inboard pads and without outboard pads : 2.75mm
- Axial float taken with outboard pads and without inboard pads : 2.68mm
- Total Axial float taken without inboard and outboard pads : 4.95mm
- Removed the stud bolts (M64) by using Hydraulic tools. Oil pressure was kept 670 to 700 kg/cm2 g.
- Casing was lifted by using jacking bolts. After that it was lifted by EOT crane and kept at Ground floor.
- Heavy scaling was observed on rotor blades, diaphragms and labyrinths.
- Removed rotor and kept on frame.
- Rotor run out : 0.01 mm to 0.05 mm
- Removed all labyrinths and diaphragms.
- Cleaning of all diaphragms was done by shotblasting.
- Gauss measurement of casing was done. Demagnetization of top half of casing near 3rd stage area was done since Gauss reading was above limit (18-25 gauss).

- Gauss measurement of welding joints of rotor, bearing pads, thrust collar, shaft journal & bearing housing were carried out by Inspection section and found within acceptable limit.
- Installed all diaphragms in the casing and labyrinths in the diaphragms.
- Due to scaling, it was unable to take the labyrinth clearences before removing it. Hence clearances were taken after cleaning. Balance labyrinth was found distorted in oval shape, replaced it with new one. Gas seal labyrinth clearances were checked and found within limit. Condition of all other labyrinths was good.
- Installed the rotor into the lower half casing.
- Applied birkosit on the mating surface of lower casing.
- Assembled the upper half casing with help of 4 nos. of guide bolts.
- Tightened casing by using hydraulic tools. Oil pressure was kept 650 kg/cm2 g.
- Alignment between LP Case & Turbine was corrected as per OEM reference values. Details are given in this report.
- LP case and Turbine was coupled at the required tightening torque 53.2 kgf.m (521.36 N.m). LP case and Gear box was coupled at required tightening torque 20 kgf.m (196 N.m)**.** Finally spacers between LP case & gearbox and LP case & turbine were assembled.

Table 1: Labyrinth Clearances Data Sheet of K-1801-1

Description		Design value (mm)	Max. Allowable (mm)		After O/H Clearance Value (mm)
A	1st stage Impeller eye labyrinth	0.57 ~ 0.86	1.02	A1	0.50, 0.45
		0.57 ~ 0.86	1.02	A2	0.50, 0.45
		0.57 ~ 0.86	1.02	A3	0.50, 0.45
		0.57 ~ 0.86	1.02	A4	0.50, 0.40
		0.57 ~ 0.86	1.02	A5	0.50, 0.45
B	2nd stage Impeller eye labyrinth	0.49 ~ 0.67	0.86	B1	0.40, 0.45
		0.49 ~ 0.67	0.86	B2	0.50, 0.45
		0.49 ~ 0.67	0.86	B3	0.45, 0.40
		0.49 ~ 0.67	0.86	B4	0.50, 0.45
		0.49 ~ 0.67	0.86	B5	0.50, 0.45
C	3rd stage Impeller eye labyrinth	0.48 ~ 0.66	0.85	C1	0.60, 0.60
		0.48 ~ 0.66	0.85	C2	0.60, 0.60
		0.48 ~ 0.66	0.85	C3	0.60, 0.60
		0.48 ~ 0.66	0.85	C4	0.60, 0.60
		0.48 ~ 0.66	0.85	C5	0.60, 0.60
D	4th stage Impeller eye labyrinth	0.32 ~ 0.48	0.62	D1	0.30, 0.25
		0.32 ~ 0.48	0.62	D2	0.30, 0.30
		0.32 ~ 0.48	0.62	D3	0.30, 0.30
		0.32 ~ 0.48	0.62	D4	0.30, 0.25
		0.32 ~ 0.48	0.62	D5	0.30, 0.30

E	5th stage Impeller eye labyrinth	0.33 ~ 0.48	0.63	E1	0.25, 0.25
		0.33 ~ 0.48	0.63	E2	0.25, 0.30
		0.33 ~ 0.48	0.63	E3	0.30, 0.30
		0.33 ~ 0.48	0.63	E4	0.30, 0.30
		0.33 ~ 0.48	0.63	E5	0.30, 0.30
F	6th stage Impeller eye labyrinth	0.27 ~ 0.41	0.54	F1	0.40, 0.35
		0.27 ~ 0.41	0.54	F2	0.35, 0.35
		0.27 ~ 0.41	0.54	F3	0.35, 0.35
		0.27 ~ 0.41	0.54	F4	0.40, 0.30
		0.27 ~ 0.41	0.54	F5	0.40, 0.35
G	7th stage Impeller eye labyrinth	0.26 ~ 0.40	0.53	G1	0.40, 0.40
		0.26 ~ 0.40	0.53	G2	0.40, 0.40
		0.26 ~ 0.40	0.53	G3	0.40, 0.35
		0.26 ~ 0.40	0.53	G4	0.40, 0.40
		0.26 ~ 0.40	0.53	G5	0.40, 0.35
H	1st inter stage labyrinth	0.21 ~ 0.52	0.62		0.15, 0.15
I	2nd inter stage labyrinth	0.21 ~ 0.53	0.63		0.30, 0.20
J	4th inter stage labyrinth	0.15 ~ 0.38	0.46		0.15, 0.10
K	5th inter stage labyrinth	0.15 ~ 0.38	0.46		0.10, 0.15
L	6th inter stage labyrinth	0.15 ~ 0.40	0.49		0.15, 0.15
M	Balance Drum labyrinth	0.13 ~ 0.43	0.52		0.15, 0.10 (New)
N	Gas Seal labyrinth (Turbine Side)	0.13 ~ 0.37	0.43		0.19
O	Gas Seal labyrinth (GB Side) (D)	0.26 ~ 0.74	0.86		0.38
P	Oil Seal labyrinth (Turbine Side) (D)	0.26 ~ 0.70	0.82		0.25
Q	Oil Seal labyrinth (GB Side)	0.15 ~ 0.24	0.3		0.10, 0.10

(D - Diametral)

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

Bearing Description		**Before O/H (mm)**	**Design value (mm)**	**After O/H (mm)**
S	**Journal bearing clearance on Turbine side**	0.17	0.11 ~ 0.15	0.17
T	**Journal bearing clearance on Gear Box side**	0.17	0.11 ~ 0.15	0.17
U	**Axial Thrust**	0.30	0.28 ~ 0.38	0.34
Observations	Heavy Oil/wax deposition found on thrust pads (active side) and minor deposits found in journal bearings.			

Table 3: Consumed Spares

Sr. No.	Item code	Description	Qty.
1	122010165600	Fluid Packing , Silicon (8-92016) for Instrument probe wire	1
2	122010124730	Metal Gasket (8-92005), Size : 50mm OD X 41mm ID X 2mm Thk	5
3	1220101341C0	Balancing Labyrinth, Part No. 553-01 (1 Set = 2 pcs)	1

MINOR OVERHAULING OF CO_2 COMPRESSOR HP CASE (K-1801-2)

- Decoupled the HP case from Gear box
- DBSE of HP case & GB was measured- 310.17mm (max.).
- 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-4.)
- Journal bearing pads on Free end side were opened for inspection. Clearance values found within acceptable limit. (Clearance values measured are given in Table-4).
- 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-4.)
- 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 HP-Gearbox was corrected as per OEM reference values.
- HP case and Gear Box was coupled at the required tightening torque 9.7 kgf.m (95.06 N.m).

Table 4: Bearing Clearance (Diametrical Clearance) Details for HP case

Description	Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on Free end	0.13	0.11 to 0.14	0.13
Journal bearing clearance on Gear Box side	0.15	0.11 to 0.14	0.15
Thrust bearing clearance	0.31	0.25 to 0.35	0.30
Observations	Minor Oil/wax deposition found on journal and thrust pads in amount.		

Table 5: Consumed Spares

Sr. No.	Item code	Description	Qty.
1	122010224730	HP Case K-1801/2 Non Asbestos Gasket	2
2	122010224750	HP Case K-1801/2 Non Asbestos Gasket	1
3	122010224760	HP Case K-1801/2 Non Asbestos Gasket	1
4	122010224770	HP Case K-1801/2 Non Asbestos Gasket	1

MINOR OVERHAULING OF CO_2 COMPRESSOR DRIVE TURBINE (Q-1801)

- Journal bearing pads on free end were opened for inspection. Found clearance values within acceptable limit. (Ref Table-6).
- Journal bearing pads on LP case side were opened for inspection. Clearances values found within acceptable limit. (Ref Table-6).
- Thrust bearing was opened for inspection. Thickness of the thrust pad was checked and clearances value found within acceptable limits. (Ref Table-6)
- Gauss measurement of Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit except LP case side bearing pads. After demagnetization, gauss value came down 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 was corrected as per OEM reference values.
- The Coupling spacer between LP casing & Turbine was assembled.
- Servo cylinder of 60 ata steam control valve was taken for maintenance to attend minor oil leakage from the sealing gasket of servo cylinder. Dismantled the servo cylinder and replaced sealing gasket (POS 101) and sealing bush (POS 100) with new one.

Table 6: Bearing clearance for Turbine

Description		Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on free end		0.22	0.18 to 0.31	0.22
Journal bearing clearance on LP side		0.34	0.24 to 0.35	0.34
Thrust bearing clearance		0.27	0.25 to 0.35	0.25
Observations	Oil/wax deposition was not found on Bearing pads & thrust pads.			

Table 7: Consumed Spares

Sr. No.	Item code	Description	Qty.
1	122026151901	Valve Spindle (Reconditioned spindle supplied by M/s Man Turbo , Vadodara) , POS 21, 60 ata steam Control valve of Q-1801	1
2	122024647800	Sealing Bushing, POS 100, Servo Cylinder for 60 ata Steam Control Valve of Q-1801	1
3	122024647810	Sealing Set (O-ring, top & Bottom), Pos 101, Servo Cylinder for 60 ata Steam Control Valve of Q-1801.	2
4	122024639510	O-Ring (40 X 3), POS 16, Servo Cylinder for 60 ata Steam Control Valve of Q-1801	1
5	122024045020	Retaining Ring, Pos 107, Servo Cylinder for 60 ata Steam Control Valve of Q-1801.	2
6	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
7	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

MAJOR OVERHAULING OF GEAR BOX M-1801

High-speed Pinion Shaft and Bearings:

- Both Pinion shaft bearings (Offset Halves Type) were opened for inspection. Clearance values found within limit. (Clearance values were measured as given in Table. 8)
- 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.

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-8).
- In some portion of journal bearing, white metal was found peeled off. Hence ultrasonic testing of both journal bearing was done. Internal crack was found in LP side bearing. Both bearings were replaced with new one.
- 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 ok.

Table 8: Bearing clearance for Gear Box

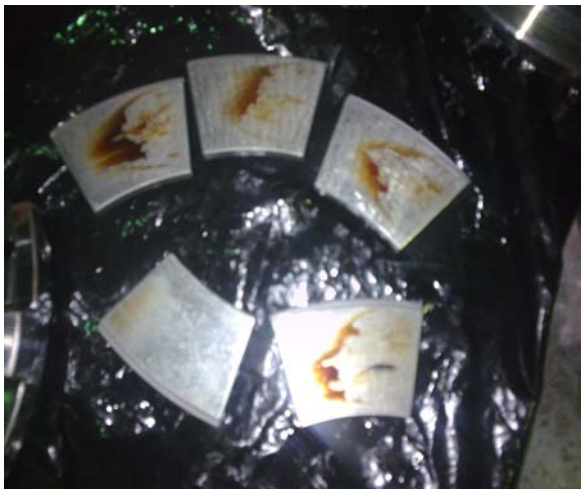
Description		Before O/H (mm)	Design Value (mm)	After O/H (mm)
Low speed shaft	**Journal bearing clearance on LP side**	0.15	0.125 to 0.185	0.15 (new)
	Journal bearing clearance on HP side	0.17	0.125 to 0.185	0.17 (new)
	Thrust bearing clearance	0.40	0.38 to 0.61	0.42
High speed shaft	**Journal bearing clearance on LP side**	0.24	0.15 to 0.21	0.24
	Journal bearing clearance on HP side	0.22	0.15 to 0.21	0.22
Gear backlash		0.50	0.383 to 0.608	0.50
Observations	Oil/wax deposition was found on high speed bearing and low speed bearing.			

Table 9: Consumed Spares

Sr. No.	Item code	Description	Qty.
1	122010333201	Journal bearing , POS 6, for Low speed shaft	1
2	122010333211	Journal bearing , POS 7, for Low speed shaft	1

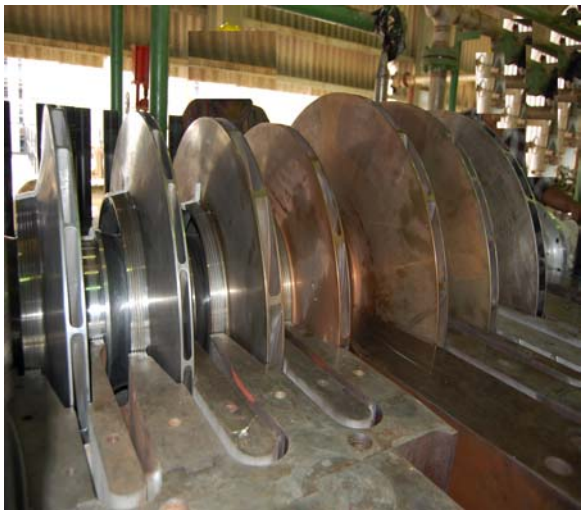
Hitachi Compressor LP Case and Gearbox Overhauling – SD-2009

GB high speed shaft Journal bearing (Free end) with blackish layer deposits.



LP Compressor thrust pads with blackish layer deposits.

LP Compressor bottom casing after cleaning



LP Compressor rotor kept on bottom casing

LP Compressor rotor placed in position

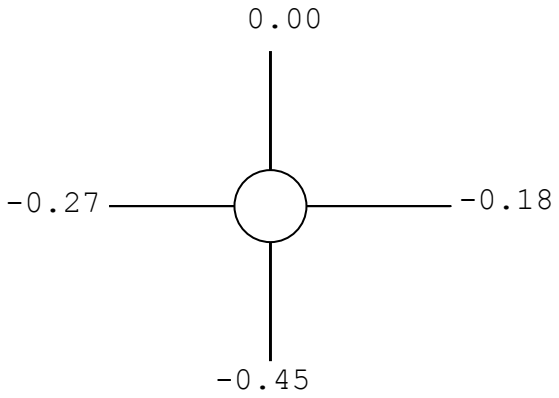
Boxing up of top casing of LP Compressor

ALIGNMENT READINGS: GEAR BOX TO LP COMPRESSOR:

Dial on LP Compressor Coupling
All values are in mm

Before PM:

RADIAL



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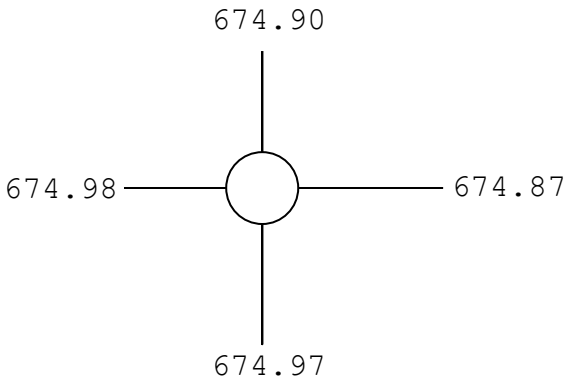

Protocol Value

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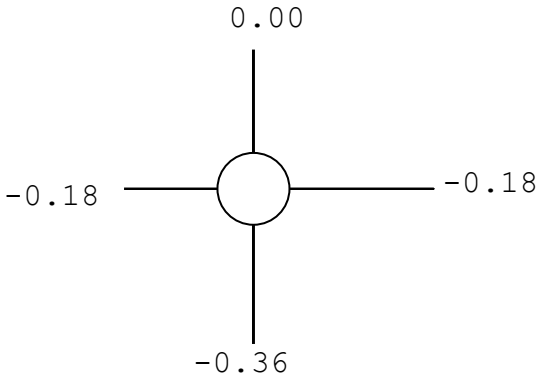

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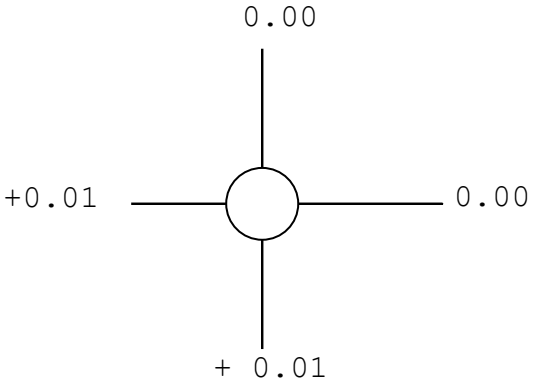

After PM

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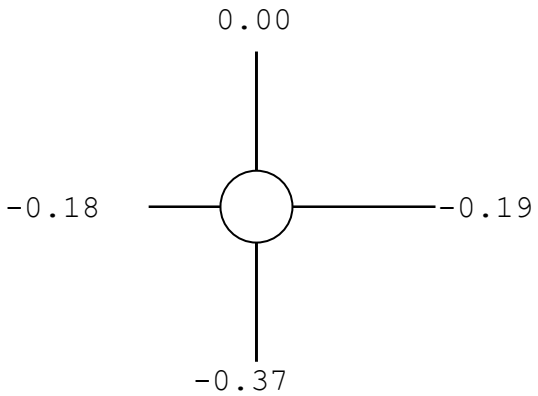

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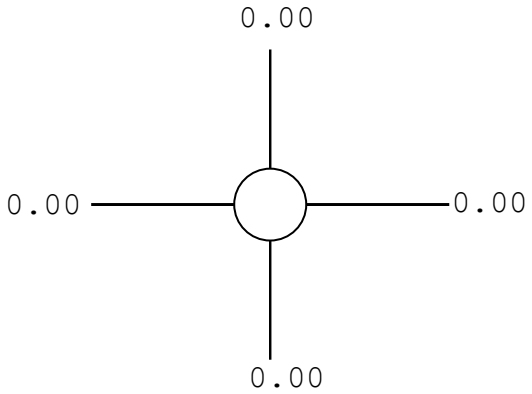
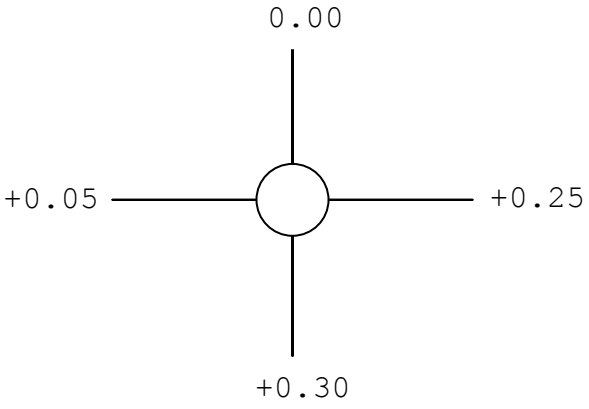


ALIGNMENT READINGS: GEAR BOX TO HP COMPRESSOR:

Dial on HP Compressor Coupling
All values are in mm

Before PM

RADIAL



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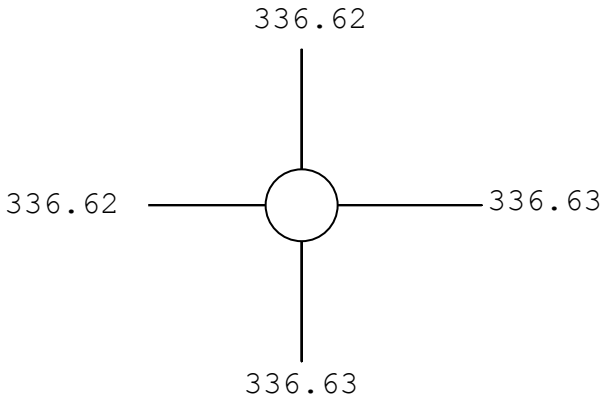

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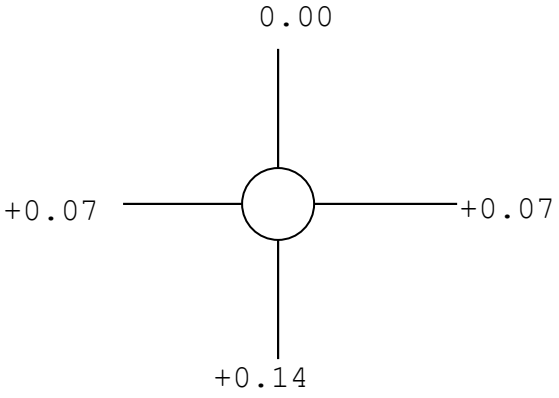

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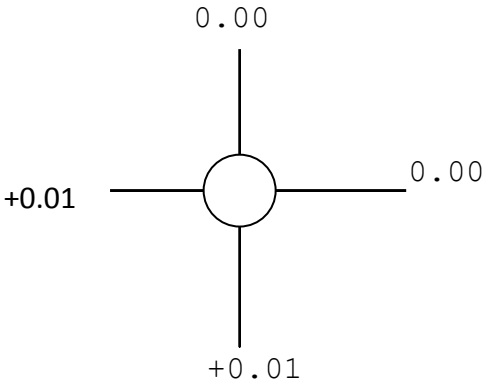

After PM

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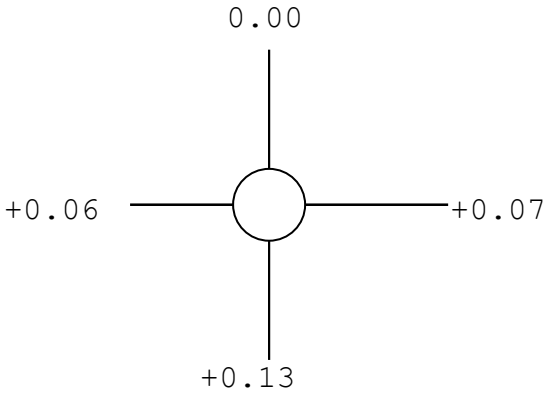

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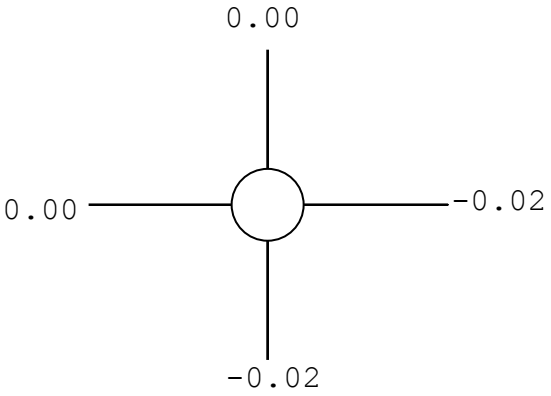
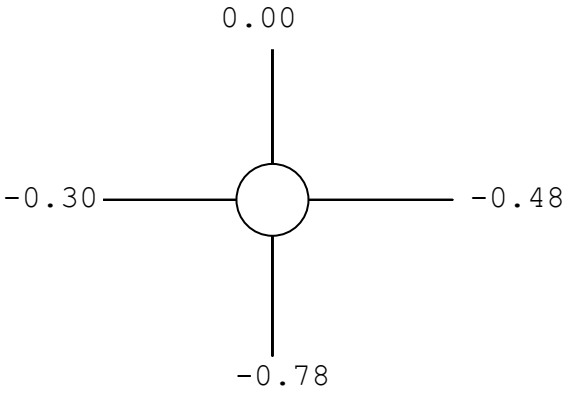


ALIGNMENT READINGS: TURBINE TO LP COMPRESSOR:

Dial on LP Compressor Coupling
All values are in mm

Before PM

RADIAL



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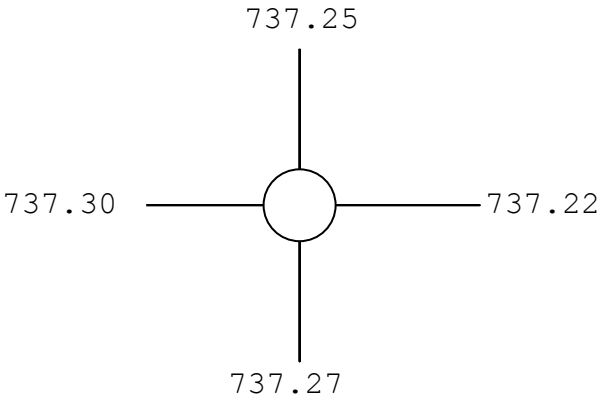
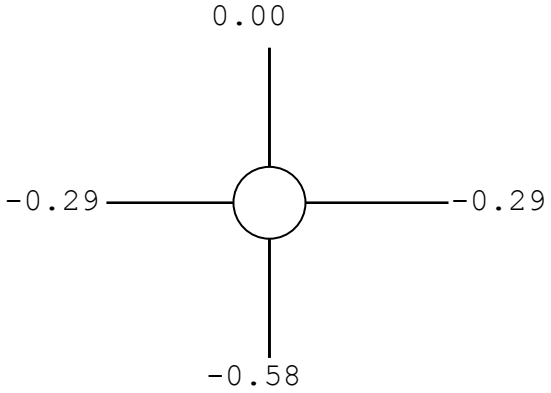


Protocol Values

RADIAL



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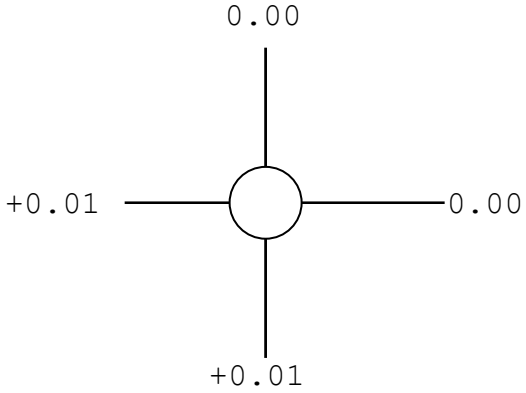

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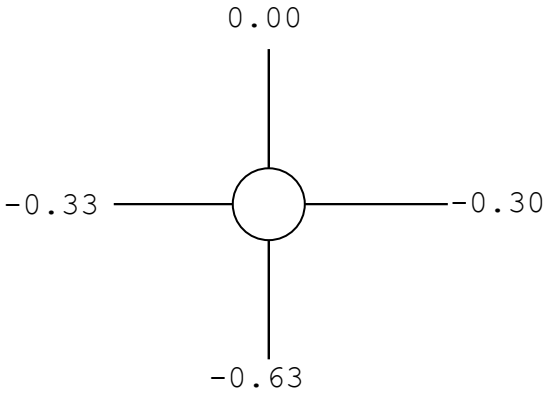

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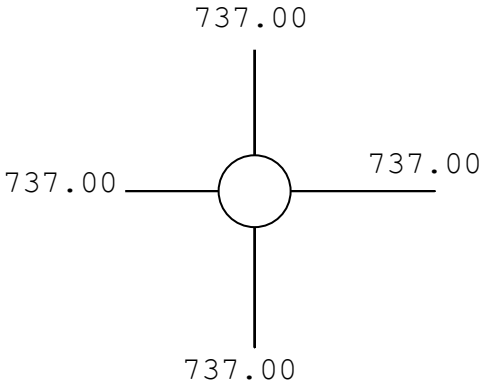


HP VESSELS

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 by production department and getting clearance, the bottom manhole 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.
- The ferrules were fixed in position with new PTFE gaskets (2700 nos).
- After the bottom manhole was boxed up, pressure drop measurement was carried out by production department for each tube and the same was found within limit.
- Eddy current testing was carried out by Inspection Department. No repair work was required to be carried out.
- Exchanger was thoroughly cleaned with compressed air and then with DM water.
- Top and bottom cover was boxed up with new “Kempchen” gasket (839 mm OD x 800 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelope.
- Tightening pressure for top and bottom cover.

1st tightening round	300 kg/cm2
2nd tightening round	600 kg/cm2
3rd tightening round	900 kg/cm2
Final tightening round /checking round	900 kg/cm2

HP Condenser (H-1202)

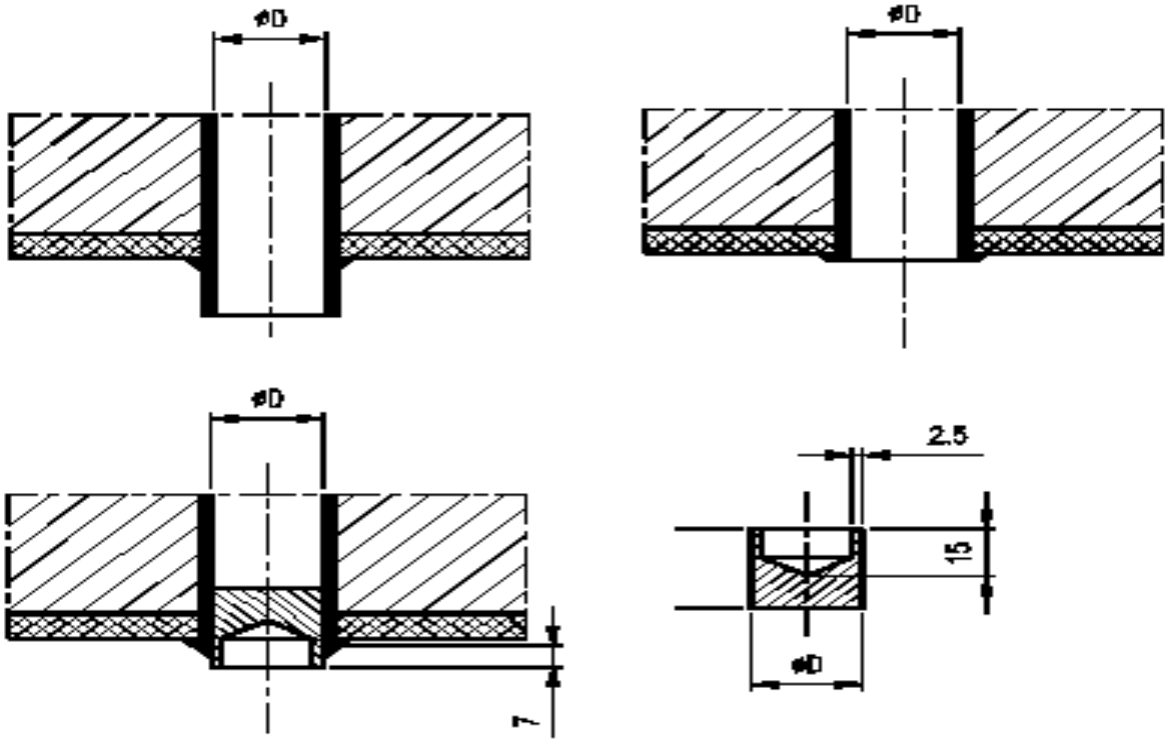
- Top flange of Off gas lines was opened.
- Bottom flange (H-1202 to V-1201) was opened.
- Top cover and bottom cover was opened using bolt tensioner at 700 kg/cm^2.
- Eddy current testing of tubes was carried out. 5 Nos. tubes were found to be **defective. Hence it was decided to plug these tubes.(Refer Drg attached).**
  Plug size: OD: 20mm, Height: 25mm, MOC: 2RE69

Following tube plugging procedure recommended by M/s Stamicarbon was followed. Procedure carried out for Plugging top tube sheet was similar to that of bottom plugging procedure, which is given below:

Tubesheet Plugging Procedure

- Grind and remove the tube end down until 50% of the tube to tubesheet weld metal is removed.
- At top end, puncture the tube. This is required to create a positive leak in the affected tube.
- Clean the tube inside by reaming or by grinding at the location where the plug will be positioned.
- Determine the inner tube diameter.
- Machine the plugs, material quality equal to material of heat exchanger tube
- Clean and degrease the plug and the inner tube hole.
- Insert the plug.
- Protect the surrounding tube ends very carefully with help of the old PTFE bushing.
- Weld the plug in two layers, GTAW (material quality filler wire equal to material of heat exchanger tube; rod diameter 1.2 mm to 2.0 mm); start / stop points staggered to each other.
- After each layer of welding perform a penetrant test and a ferrite check.
- Finally weld was cleaned and passivated by washing with 10 % HNO3 and rinsing with DM water.

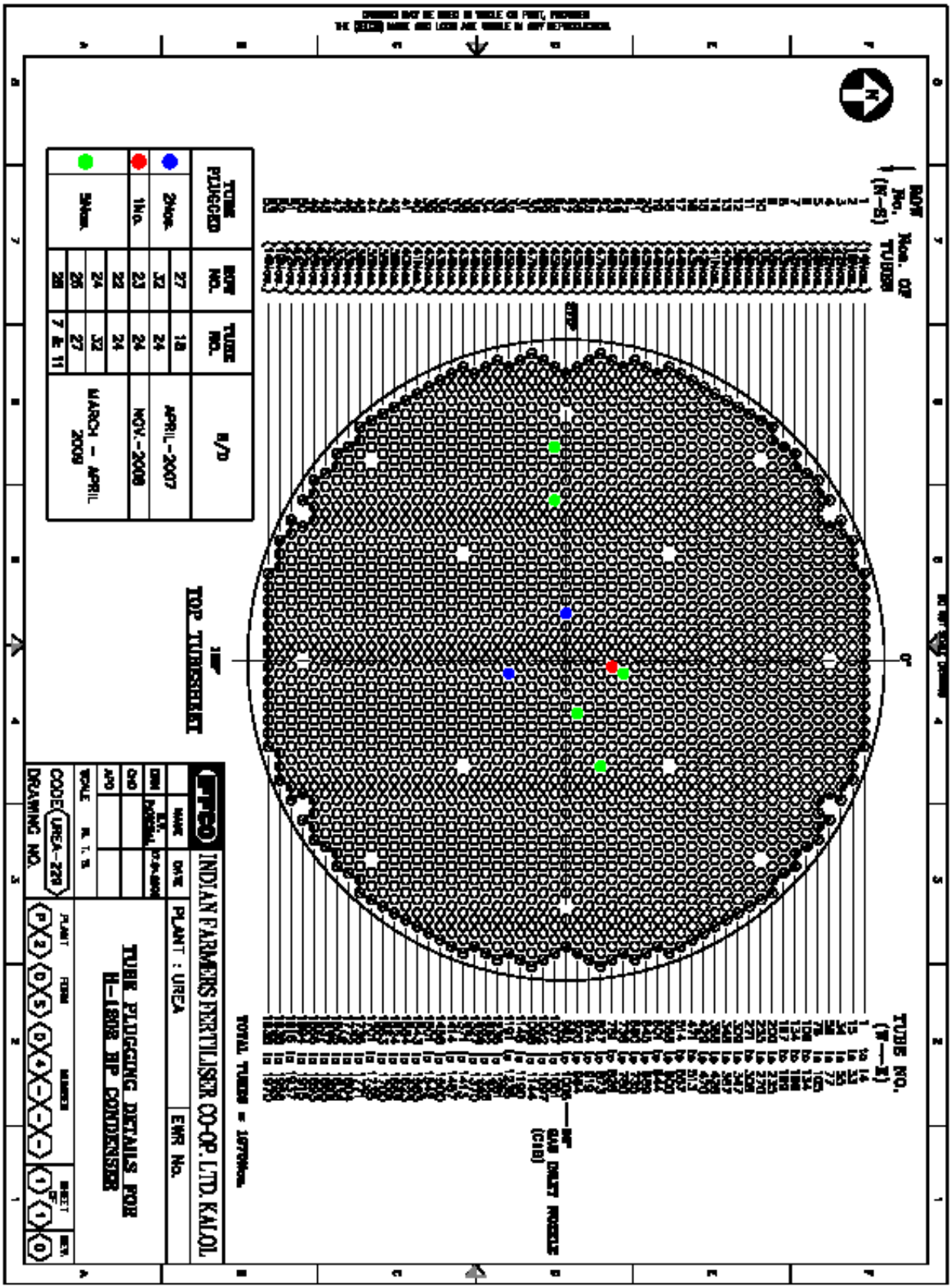
BOTTOM TUBE PLUGING SKETCH OF HP VESSELS SUGGESTED BY S.C



After getting clearance from Production, the segments and basket was boxed up after loading raschig rings in the basket. The partition plates on basket were boxed up.

- Top and bottom cover Boxed up of with new “Kempchen” gasket (839 mm OD x 800 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelop.
- Tightening pressure for top and bottom cover

1st tightening round	300 kg/cm2
2nd tightening round	500 kg/cm2
3rd tightening round	700 kg/cm2
Final tightening round /checking round	700 kg/cm2



HP Scrubber H-1203

The top Dome of HP Scrubber (H-1203) was opened to check for any choking as per the requirement of Production Department. The bolts were opened using Hydratight Sweeney make bolt tensioner at hydraulic pressure of 700 kg /cm2. The bolt tensioner was driven by air operated "Magnus" UK, make hydraulic pump. The top dome was shifted to platform using monorail hoist and 2 nos. 10 T chain blocks.

Top Shell

- Shell internal surface was found brownish black in coloration.
- Scratch marks were found on the inside surface of shell liner.
- CO_2 inlet nozzle flange (3/4"NB) located at west side was found in satisfactory condition.
- CO_2 inlet line in South was found intact with its supports.
- Condition of liquid inlet and gas outlet pipe found satisfactory.
- Shell liner weld joint below the diaphragm plate has 05 nos. corrosion cavities. Pin holes were observed in the diaphragm plate bottom side weld. The corrosion cavities and pinholes were repaired using TIG welding method and 25-22-2 LMn filler wires. The weld repaired areas were passivated and washed with DM water.
- Diaphragm was opened and Teflon gaskets and O-ring were replaced with new one. Nuts of diaphragm were also replaced with new one.

Bottom Shell

- Visual condition of the tube bundle was found satisfactory.
- Some Nuts of the Diaphragm ring were found lying on the first baffle plate.
- CO_2 inlet nozzle flange (3/4"NB) located at west side found in satisfactory condition.

No Choking was observed. After clearance from production department, the top dome was boxed up using new "Kempchen" gasket (952 mm OD x 904 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelop.

- Tightening pressure for top dome.

1st tightening round	300 kg/cm2
2nd tightening round	500 kg/cm2
3rd tightening round	700 kg/cm2
Final tightening round /checking round	700 kg/cm2

Autoclave V-1201

Repair of Liner weld joints of Autoclave

During Annual Turnaround- April 2008, it was observed that the surface condition of welds of Vessel liner have become roughened over a period of more then 35 years of service. These welds are normally subjected to visual inspection only and no other NDT is carried out due to very rough surface having deep pores / surface cavities having depth of approximately 0.5 to 1.0 mm.

After taking advice from M/s Stamicarbon, it was decided to carry out repair and re-welding of one circumferential and two longitudinal weld joints of liner during Shutdown-2009 on trial basis. WO was Placed on M/s Ganesh Engineering, Ahmedabad (WO No.:20081079 dtd. 30/12/09) for execution of the welding job.

- Top cover was removed using bolt tensioner at 700 kg/cm2
- Inspection was carried out by Inspection Department and it was decided to carry out repair job on liner welds of 1st and 3rd Compartment which was most affected by corrosion.
- At first a small weld area of the 1st compartment was taken for repair to check whether any difficulties occur during the welding job. It was found satisfactory and hence decided to carry out repair jobs.

The following repair procedure was followed:

- A small segment of old weld was kept as reference to compare with the new weld.
- 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 neglected.
- 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 were the width was increased due to removal of corroded portion, an additional layer of welding was applied.
- It was ensured that no area was kept 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.

Note:

- 130 Nos. Filler wire, Size – 2.40 dia X 1000 mm lg was used for the welding job. (Aprrox. liner weld length – 15.02 m)
- Approximate 0.6 Kg filler wire is required for welding 1 m, considering 3 layers of weld deposit.

Repairing jobs as per Inspection Report

- **Compartment No.: 2**

  Welding was done to remove corrosion cavity on top edge of C-seam in NW direction.

- **Compartment No.: 3**

  Welding was done to remove 01 no. pinhole 6mm deep on south side cleat weld.

- **Compartment No.: 4**

  Welding was done to remove 3 nos. corrosion cavity on liner parent metal.

- **Compartment No.: 6**

  - Liquid box left side cleat was observed corroded and cavity observed in weld. Hence cleat was replaced with new one.
  - Liquid box right side cleat was found discolored / blackish and weld was corroded. Hence cleat was replaced with new one.

- **Compartment No.: 8**

  Welding was done to remove 2 nos. crevice/corrosion cavities on upper C seam of Insert liner.

- **Compartment No.: 12**

  - Welding was done at down comer nozzle with dish end liner weld joint edges which were exposed. 1 no. pinhole on HAZ was also repaired.
  - DP of liner weld joints was carried out. Porosity was observed at three locations which were repaired.

No repair work was required in other compartments.

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

- Tightening pressure for top cover.

1st tightening round	300 kg/cm2
2nd tightening round	500 kg/cm2
3rd tightening round	700 kg/cm2
Final tightening round /checking round	700 kg/cm2

LP Vessels and Tanks:

LP Vessels and Tanks were inspected by inspection department. No repair was required in following LP vessels and tanks on the basis of inspection report.

1.	V-1102	**7.**	V-1813
2.	V-1103	**8.**	T-1301
3.	V-1206	**9.**	T-1401
4.	V-1502	**10.**	T-1301A
5.	V-1811	**11.**	T-1401A
6.	V-1812	**12.**	T-1501

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

1. **V-1101** :

   3 nos. of demister pads were lifted from their position. The same were repositioned.

2. **V-1202** :

   Damaged Spray breaker was replaced with “Hi-Pack Mass Transfer Products, Mumbai” make spray breaker.

3. **V-1203** :

   V-1203 was opened and it was observed that the bottom grid was displaced and the pall rings were found displaced. This might have occurred due to explosion in V-1203. This has been observed whenever; the vessel was opened in the past during shutdown. To prevent the bottom grid displacing from its position and also to reduce the effect of explosion, the following modifications were carried out.

   Sketch:

   - Size of handhole (A2B) was increased from 200mm NB to 450 mm NB for man entry with 18” NB SS 304 L pipe. It was welded with reinforce pads. Air test of the weld was carried out (Air Pressure- 0.5 Kg/cm2) and found OK.
   - Cover of Bottom manhole was used for new manhole (A2B) and new cover (Plain) was fabricated and provided for bottom manhole. Cover of Bottom manhole was having box welded to it which will prevent the pall rings from occupying the free space.
   - For proper clamping of bottom grid, a ring was provided above bottom grid and provision for clamping the same was given.
   - Gas inlet C1 nozzle was extended by providing 8” sch10 up to center line of V-1203 and the end were cut at an angle so that it will prevent the gas from impinging on the bottom grid at high velocity.

4. **V-1301** :

   Loose clamp of the tray was tightened.

5. **V-1351** :

   2 nos of stem inlet flange bolts were tightened. Clamping bolts with washer were provided for inlet pipe to shell.

6. **V-1352** :

   Inlet flange (1-1/2”) bolts were tightened.

7. **V-1423** :

   Loose demister pad was refixed.

8. **V-1501** :

   All the internals were found intact in position. Demister pads were found intact in position. Condition of all weld joints was found satisfactory. Steam drum loop was hydraulically tested at 11 kg/cm2 on 30/04/09 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 7.5 kg/cm2 g as per IBR guide line.

9. **V-1503** :

   1 no. of nut for U-clamp of south side inlet steam header was provided

CLEANING AND HYDROJETTING OF HEAT EXCHANGERS:

The Hydrojetting job was awarded to M/s Delux 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)
- Flash tank condenser (H-1421)
- First Evaporator (H-1422) with DM water.
- First Evaporator condenser (H-1423)
- Second Evaporator (H1424) with D.M. water : Urea gets deposited at the manhole opening of the exchanger. To avoid this, a box was welded to the manhole cover so that it covers the opening and this will prevent the urea deposition.
- 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 condenser (H-1352)
- Pre-evaporator condenser (H-1419)
- CCS - II cooler (H-1207)

Tube Bundle Pull-out :

- 2^{nd} inter stage cooler of Hitachi Compressor Train (H-1812)
- 3^{rd} Inter stage cooler of Hitachi Compressor Train (H-1813)
- Circulation Cooler of LP Absorber V-1203 (H-1209)

Hydrotest of LP Carbamate Condenser (H-1205):

Hydrotest of H-1205 was done to detect tube leakage. It is U-tube type heat exchanger. Blinding was done on following nozzles:

- Carbamate solution outlet nozzle (8” x 150#)
- Carbamate solution inlet nozzle (8” x 150#)
- NH3/CO2/H2O inlet nozzle (18” x 150)
- Liquid NH3 inlet nozzle (1” x 300#)
- Carbamate inlet nozzle (2” x 1500#)

Hydrotest was done without dismantling top cover. Water was filled in shell side. Shell vent (C11) was used to remove air. NH3 solution inlet nozzle (1-1/2” x 150#) was used to pressurize the water. Hydrotest test pressure was kept 11.0 kg /cm2 g for 30 minutes. No pressure drop was observed. Opened the channel drain (C-10) for observing tube leakage. Also, tube sheet face was examined through condensate line openings available in top cover. No tube leakage found.

Hydrotest of Additional LP Carbamate Condenser (H-1205 A)

Hydrotest of H-1205 A was done to detect the tube leakage. The exchanger was opened for first time. It is a fixed tube sheet and straight tube type heat exchanger. Kobelco crane was used to remove the inlet line & top dome of heat exchanger. Support of outlet line was cut for making space for removal of bottom dome. Then bottom dome was removed by using chain block. Blinding of inlet nozzle (18" x 150#) and outlet nozzle (18" x 150#) of shell side was done. Drain valve (1-1/2" x 150#) of shell was used for pressurizing the fluid and vent valve (1-1/2" x 150#) was used to remove air. Hydrotest Pressure was kept 10.5 kg/cm2 g. 1 no of tube was found leaking. It was Plugged from both side. Plug was seal welded with the tube.

Plug size: $D_{max.}$: 22.5mm, $D_{min.}$: 18.5mm, H: 35.5mm, MOC : SS 316L

After plugging, hydrotest was performed again, No leakage was observed.

Hydrotest of Flash tank condenser (H-1421)

Hydrotest of H-1421 was done to detect the suspected tube leakage. It is U-tube type heat exchanger. Tightened the test ring on tube sheet. Blinding was done on following nozzles:

- NH3/CO2/H2O inlet nozzle (14" x 150#)
- Inerts outlet nozzle (3" x 150#)
- Liquid outlet nozzle (4" x 150#)

Drain valve (3/4" x 150#) of shell was used for pressurizing the fluid and vent valve (3/4" x 150#) was used to remove the air. Hydrotest test pressure was kept 1.8 kg /cm2 g. No tube leakage was found.

Retubing of 2nd Inter Stage Cooler of Hitachi CO2 Compressor (H-1812)

The heat exchanger was removed from foundation and kept on ground floor. Carbamate deposits were observed in the tubes. Eddy current test was done to assess the condition of tube. Total 26 nos of tubes were found defective. Retubing of all defective tubes was done by M/s S. R. Engineering, Vadodara against WO 20090066 dated 23-04-2009. Blinding of inlet nozzle (8" x 150#) and outlet nozzle (8" x 150#) of shell side was done. 2 nos of isolation valves (3/4" x 150#) were provided in inlet and outlet nozzle for venting and pressurizing purpose. Hydrotest pressure was kept 12 kg/cm2 g. No tube leakage found. Heat exchanger was kept on the foundation & boxed up.

Retubing of 3rd Inter Stage Cooler of Hitachi CO2 Compressor (H-1813)

The heat exchanger was removed from foundation and kept on ground floor. Carbamate deposits were observed in the tubes. Eddy current test was done to detect the condition of tube. Total 15 nos of tubes were found defective after eddy current test. Total 25 nos of tubes were to be retubed including 10 nos. of plugged tubes. However the upper half of tube bundle was filled with scaling / deposits. Party was unable to drill and remove the tubes. Hence all upper half tubes (92 nos.) of heat exchanger were cut and retubed. The job was done by M/s S. R. Engineering, Vadodara against WO 20090066 dated 23-04-2009. Blinding of inlet nozzle (8" x 150#) and outlet nozzle (8" x 150#) of shell side was done. 2 nos of isolation valves (3/4" x 150#) were provided in inlet and outlet nozzle for venting and pressurizing purpose. Hydrotest pressure was kept 12 kg/cm2 g. No tube leakage found. Heat exchanger was kept on the foundation & boxed up.

Tube Pluging in H-1811

Eddy current testing was done to detect the tube condition. 1 no. tube was found defective which was plugged.
Plug size: $D_{max.}$: 16.5mm, $D_{min.}$: 15mm, H : 31.5mm , MOC : SS 304 L

RELIEF VALVE OVERHAULING AND TESTING:

Following RV's were removed, overhauled and tested on valve test bench by M/s Tyco Valves & Controls India Pvt. Ltd., Vadodara against W. O. No. 20081344 dated 06-03-2009

Sr. No.	RV No.	Description	Set Pressure Kg/cm2g	Reset Pressure Kg/cm2g
1	RV-1201 A	V-1201 off gas line	165	150
2	RV-1201 B	V-1201 off gas line	65	150
3	RV-1201 C	V-1201 off gas line	165	148
4	RV-1205	P-1201 A discharge	165	148
5	RV-1206	P-1201 B discharge	165	148
6	RV-1208	P-1201 C discharge	165	148
7	RV-1103 A	P-1102 A discharge	150	140
8	RV-1103 B	P-1102 B discharge	150	135
9	RV-1103 C	P-1102 C discharge	150	135
10	RV-1181	K-1801 final discharge	177	165
11	RV-1903	K-1801 3rd stage discharge	111	108
12	RV-1202A	V-1202 off gas line LP System	6	5.6
13	RV-1202B	V-1202 off gas line LP System	5.8	5.4
14	RV-1202C	V-1202 off gas line LP System	6	5.5
15	RV-1203	P-1201 A Suction line	8.5	7.8
16	RV-1204	P-1201 B Suction line	8.5	7.0
17	RV-1207	P-1201 C Suction line	8.5	7.4
18	RV-1101A	Liquid ammonia line from H-1102 to V-1102	31	28.5
19	RV-1101B	Liquid ammonia line from H-1102 to V-1102	31	29
20	RV-1102 A	Ammonia Suc. Vessel (V-1103)	31	29
21	RV-1102 B	Ammonia Suc. Vessel (V-1103)	31	29
22	RV-1108 A	Cold ammonia line from Amm storage tank to H-1102	31	29
23	RV-1108 B	Cold ammonia line from Amm storage tank to H-1102	31	29
24	RV-1106 A	Liquid amm, line from amm. Plant to amm. filter.	31	29

25	RV-1106 B	Liquid amm, line from amm. Plant to amm. filter.	31	29
26	RV-1107 A	Liquid anmmonia line(hot) before ammonia filter	31	29
27	RV-1107 B	Liquid anmmonia line(hot) before ammonia filter	31	28.5
28	RV-1110 A	Liquid ammonia line from atm. Amm.storage tank to H-1102	31	28.5
29	RV-1110 B	Liquid ammonia line from atm. Amm. storage tank to H-1102	31	29
30	RV-1901	1st stage discharge of K-1801.	7.2	6.8
31	RV-1902	2nd stage discharge of K-1801	28	27
32	RV-1503	23 ata Steam	25	23
33	RV-1504	9 ata Steam Drum	12	11.3
34	RV-1129 A	4 ata Steam Header	6	5.6
35	RV-1129 B	4 ata Steam Header	6	5.8
36	RV-1501	4 ata Steam Drum	7.5	7.2
37	RV-1502	4 ata Steam Drum	7.5	7.2
38	RV-1506	4 ata Steam Main	6	5.5
39	RV-1209	V-1203 Vessel	10	9
40	RV-1351	RV of V-1351	24	23
41	RV-1352	RV of V-1352	6	5.4
42	RV-1301	RV of V-1301	6	5.9
43	RV-1184 (CCS-I)	H-1102 outlet NH3 outlet	6	5.4
44	RV-1221 (CCS-II)	P-1204 disch. To H-1203	16	15
45	RV-1913	Ejector system of Q-1801	0.20	0.20
46	RV-1914	Ejector system of Q-1801	0.20	0.19
47	RV-1916	23 ata Steam extraction	27.5	26
48	RV-1917	4 ata Steam exhaust	4	3.6
49	RV-1351 A	RV of P-1351 A	10	9
50	RV-1351 B	RV of P-1351 B	10	9
51	RV-1130	24 ata steam header	26	23
52	RV-1904	H-1811 1st stage gas cooler	7	6.4
53	RV-1905	H-1812 2nd stage gas cooler	7	6
54	RV-1906	H-1813 3rd stage gas cooler	7	6
55	RV-1224	C.W from utilities	6	5.4
56	RV-NH3	RV To NH3 Ammonia Plant	85	71

OVERHAULING OF PRILL TOWER SCRAPER (M-1402)

Before Shut down, there was repeated failure of Fluid coupling of scraper and abnormal sound was once observed from M-1402-1 GB. Hence it was decided to replace this Gear Box and carry out overhauling of Scrapper. Both the Gear box's were in service since inception of the Plant. Scraper overhauling was carried out once during 1986. The job was started on 18/03/09 and completed by 27/03/09. Following activities were carried out during Shut down.

Dismantling of Scrapper

- Removed Aluminum sheet above scraper.
- Shifted lifting rack inside Prill tower and installed derrick
- Using derrick, lifting beam, 2 nos. Mono rail (3 T Capacity) and 2 nos. Chain blocks (5 T) were erected above scraper.
- Measured and noted down the gap between floor and bottom of scraper.. (Recommended- 200 mm)
- Measured and noted down the gap between scraper end and wall (Recommended- 50 mm)
- Measured and noted down clearance between scraper blades (#52) and floor (Recommended- 15-20 mm)
- Marked the position of scraper before dismantling. Scraper arms were to be assembled at the same position.
- Opened the bolts (#56/57/58) of both side scraper arms (#50) and kept the scraper arms crosswise by derrick.
- Removed the ring clamp (#70, in 2 pieces) by opening bolt (#71)
- Removed the Neoprene band (#72), checked the fitting position & measured the height.
- Opened bolt and nut (#77 & 78) of split ring (#76)
- Removed the reamed bolt – 4 Nos. of flange (#74 & 75) and marked the position.
- The surface above split cover (#73) was covered with araldite. Araldite was removed to access the counter sunk bolts (#80) of split cover.
- Opened the counter sunk bolts (#80) (M 12 X 25 mm lg) from split cover (split cover is in two half)
- Split cover was removed(#73) after lifting split ring (#76) by pin.
- Then Split ring was removed.
- Opened top bolt (# 68) between scraper and Gear wheel (M-24 x 70 mm long -40 Nos.)
- Lifted scrapper (#51) & shifted side ways using monorail.
- Measured and noted down clearance between gear wheel and bottom plate
- Gear Box was run and gear wheel (#66) was checked for any play in gear wheel / spur gear (#63), any abnormal sound & looseness of gear with shaft. It was found in good condition. Hence Gear wheel was not dismantled.
- After Stopping motor oil was drained from main gear box and both gear boxes.

- It was observed that teeth of pinion of M-1402-1 were damaged. Hence it was decided to replace M-1402-1 Gear box with spare GB. Pinion of M-1402-2 was in good condition.
- Checked and noted down backlash between gear and gear wheel.
- Seating surface of gear wheel was cleaned.
- Removed pulley of gear box M-1402-1.
- Removed both fluid coupling & motor.
- Opened bolt of gear box M-1402-1 (#.7 & 8)
- As per procedure, the GB is to be removed by providing eye bolt M 25 (#85) on shaft of gear box from top.
- However it was decided to remove and install M-1402-1 by the rigging arrangement at bottom. This was decided to ensure that the GB may be replaced from bottom, without lifting of Scraper in case of any emergency due to failure of Gear box.
- Before shut down, rigging arrangement was made for lifting and shifting of GB to and from bottom of scraper.
- Lifting lugs were welded at bottom plate of Main Gear box for removal and installation of both Gear Box's.
- Removed bolt (#7 & 8) and gear box (M-1402-1) was lowered
- Air connection to scraper was checked

  Note: – Air supply (7 Kg/cm2) is provided through regulator at 1 Kg/cm2. Pressure regulator is provided to prevent over pressurizing the system. The system was checked by Electrical / Instrumentation Dept.

Assembly of Scrapper Arm

- Installed spare gear box (#62) issued from Stores.
- The Gear Box was shifted to bottom of Scraper using Hook Chuk and chain block.
- It was lifted and positioned by providing chain block on lifting lugs.
- Hylomer was provided on the seating surface and bolts (#7) with spring washer (#8) was tightened.
- Oil was filled in M-1401-1 & 2 GB.
- Main gearbox was cleaned and oil was filled.
- Installed reconditioned fluid couplings and motors with new "V" belts.
- Gearbox was run and checked for any oil leakages and functioning of Gear wheel.It was found OK.
- Oil was drained and scraper arm (51) was installed.
- Scraper arms were assembled at the same position at which it was dismantled.
- Hylomer was applied on seating surface of gear wheel.
- Bolts (# 68) were fastened after applying Loctite. While fastening the bolts scraper arm was turned to check the smooth running of the arm.
- Installed split ring (#76) and brought the ring in upward position by 8 pins dia 5 mm.

- Installed split cover (#73) with packing (#79) on horizontal face and hylomer between vertical flanges.
- Bolts (74) and 70 countersunk bolts (#80) were provided and tightened.
- Split ring was lowered (#76) and bolts (#77) were fastened.
- Neoprene band (#72) was provided and its end was joined by cold Rubber compound and ring-clamp (70) was fitted.
- Scraper end parts (#50) were installed and bottom and side gap were measured
- Checked scraper blades (52) clearance between scraper blades and floor 15-20 mm. One no scraper blade which was bent, was replaced with new one.
- Connected air supply to labyrinth
- Scraper was run for approx 2 hrs. for checking oil tightness of flanges, temperature of gear boxes and couplings etc. Found OK
- Aluminum sheet was provided above scraper

Clearences of Prill Tower Scraper (Ref Drg No.: P2-CS-17051):

Sr. No.	Description	Before (mm)	After (mm)	Remarks
1	Distance of Pinion end with Gear Wheel top M-1402-1 &2 (A)	5.15	5.15	
2	Back lash, M-1402-1	1.50	1.10	GB with Pinion replaced
3	Back lash, M-1402-2	1.10	1.10	
4	Clearance between gear wheel and bottom plate (B)	8.76	8.88	

The following spares were consumed :

Sr. No	Description	Store Code / Size
1	Gear Box Complete with Pinion of M-1402-1	124030125100
2	Fluid Coupling -2 nos.	
3	V-belts – 2Nos.	
4	Bolt with Nut & Washer Scraper, ((#56/57/58) - Qty- 52 Nos.	M24 X 75 mm lg X 50 thread lg with one nut and Washer, (SS 304)
5	Bolt with Nut of Split ring (#77 & 78), Qty- 12 Nos.	M12 X 35 mm lg, CS High tensile Grade
6	Reamed Bolt with Nut (#74 & 75,) Qty- 4 Nos.	Size-½ " UNF X 1.5" lg , 20 TPI X CS High tensile Grade
7	Counter sunk screw of Guard plate (#80) - Qty- 70 Nos.	M 12 X 25 mm lg x Allen head screw, SS 304
8	Top bolt (# 68) between scraper and Gear wheel -40 Nos	M-24 x 70 mm long
9	Neoprene Band (#72)	4" width x 16'4" lg X 5.5 mm thk
10	Neoprene Packing (#79)	124030165600
11	Scraper Blade (#52), 1 no	124030105000

Lifting arrangement for Scraper

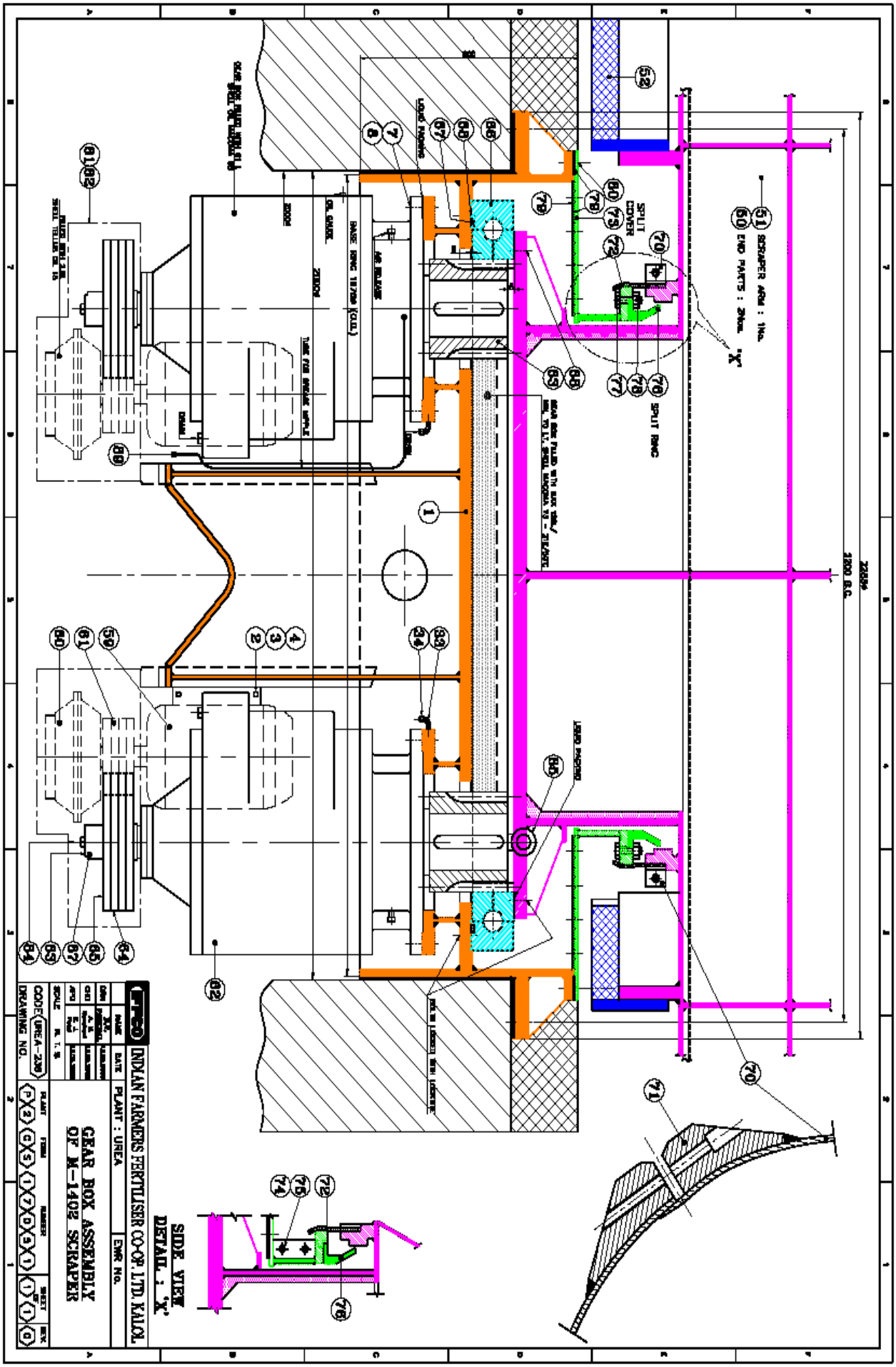
Gear Wheel and Spur gears

Spur gear engaged with Gear Wheel

Gearbox is being removed as viewed from scraper floor

Gearbox is being removed from bottom

New spare GB being lifted to position


INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
PLANT : UREA
GEAR BOX ASSEMBLY OF M-1402 SCRAPER
SIDE VIEW
DETAIL : 'X'
SCRAPER ARM : 1No.
END PARTS : 2Nos.
SPLIT COVER
SPLIT RING
LIQUID PACKING

Prill Tower ID Fan K-1401-1/2/3/4

Top cover of bearing housing of K-1401-1/3 were opened and inspected. Cooper split bearing condition was found satisfactory and hence boxed up after providing new grease. “SKF” make double row self aligning spherical roller bearings (22220 EK) of K-1401-2/4 were replaced with “Cooper” make split type cylindrical roller bearings (Model No. : 01EBCP - 308 GR S1 SRS Fixed Type & Model No. : 01EBCP - 308 EX S1 SRS Free Type) to reduce maintenance time. Belts (SPC-4000) of all ID fans were replaced with new one. All internal and external surfaces were cleaned and painting was carried out with 1 coat of epoxy primer and 2 coats of epoxy paint.

Inlet Air Fan (K-1701):

Bearings of K-1701 were opened and inspected. Bearing condition was found satisfactory and hence boxed up. Fan blades were found corroded badly. At one location of fan blade, a hole was observed. 2 mm CS Plate was welded at this location. Cleaning of blade was done by shot blasting. Loctite compound (“Nordback” 40697, Chemical resistant coating) was applied on all fan blades and plate at North end. The application was carried out by M/s Loctite, Ahmedabad. Balancing of Fan blades of K-1701 was done before Startup. 2.80 kg weight was added to pulley. Radial vibration level was reduced from 276 micron to 47 micron. All 8 nos. of V-belts (SPC-6300) were replaced with new ones. Finally alignment was checked and corrected.

Painting of structure of fan was carried out after Sand blasting. The job was done by M/s B Chauhan.

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. Vibration levels were measured and found to be normal.

Fluidized Bed Cooler, Dust Silos & Cyclone Separator:

Fluidized bed cooler, dust Silos and cyclone separators were opened for inspection. Some locking nuts of fluidized bed cooler found missing and in loose condition. New locking nuts were provided and tightened the loose locking nuts. To strengthen the loose teflon sheet, additional bolts were provided inside the dust silo no. 1 and 3. After inspection and cleaning of fluidized bed cooler, dust silos and cyclone separators the same were boxed up.

Conveyor System:

Link Conveyor (M-1419):

Belt condition was found satisfactory. New coupling bush was 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 replaced with reconditioned one. New coupling bush was provided. Brush pulley was replaced with new one. Damaged carrying rollers and return rollers were replaced with reconditioned one. Alignment was checked and corrected.

Dust Conveyor System (M-1702):

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

Bucket Change Over Mechanism (M-1401 A/B):

Bearing condition was found satisfactory. Condition of Both timing pulleys and toothed belts for Prill bucket and motor were found satisfactory. Grease (Servo Gem-2) was provided. Shaft condition for both Prill bucket was found satisfactory.

NRV Inspection

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

- CO_2 to H-1201
- NH_3 to H-1202
- NH_3 to V-1201
- Carbamate to H-1202
- Carbamate to H-1203
- CO_2 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
- NH_3 water to V-1352
- CO_2 to 1st Desorber V-1352
- P-1351 A/B discharge
- Final discharge of K-1801 to H-1201
- NH3 water to V-1203 top
- NH3 water to V-1207
- CO2 to Hydrolyser

FABRICATION JOBS:

The following major fabrication jobs were carried out in Urea Plant during Shutdown -2009:

Compressor Area

- Rubber bellow, check valve and diaphragm valve of K-1102 A & C discharge line were replaced with new one. Discharge line spool piece of K-1102 C was also replaced which was having pin hole.
- I/V (GAV, 4" x #150) was provided upstream of FRCV-1102 (Air valve) to isolate the valve for maintenance.
- Elbow (¾ " X 3000# SW) of CO2 drain of H-1813 bypass line was replaced (Thk Report)
- Nipple with I/V was provided for provision of hydrotest of H-1812 & H-1813 on CW inlet and outlet nozzle (Total 4 nos., ¾" x 150#)
- Q-1814 Steam (23 ATA) drain I/V replaced- (GAV-¾ " 800#)
- Q-1814 I/V Exhaust drain I/V replaced. (GAV-¾ " 800#)
- Tapping of 3" line with 3" #150 Flanged valve was provided for diverting surface condensate to spray cooler sump

Ground Floor

- Suction strainer was provided for P-1106 A
- HPF to unloading line first I/V Valve replaced (1" #1500 BEL Valve) due to bonnet leakage.
- Valve body of drain I/V (sample) of H-1201 was replaced.(BEL Vlave, ½ ", #1500)
- Cooling water return header flow meter (FI-1141) tapping was shifted from existing location to the point where cooling water return header joints to main return header.(Modification Job)
- Elbow of bypass line of MOV- 1201 of CO2 to stripper was replaced. (Thk Report). LR Elbow was made from 1 ½ " x Sch 80 pipe
- V-1202 drain line condensate flushing point was provided.
- Ball valve was provided at P-1408 cond. Flushing line.(1" #150)
- Ammonia drain line header and I/V at ground floor near P-1102 B was replaced.
- Condensate header near T-1701 was replaced
- Unwanted line at P-1502 common suction was removed.

1st Floor

- NC ratio meter sample line from V-1201 to H-1201 pipe line to NC ratio meter console was replaced. Thickness reduction of this pipe line was reported during inspection in SD-2008.(½ " Sch 80 SS 316 LN pipe)
- Elbow of common discharge line of P-1305 A/B was replaced (2" Sch 80) as per inspection report.
- FS-1101 (OLD FS) d/s 1st Isolation Valve which was passing was replaced with Flanged Valve(6" X # 300). Lapping of 2nd Isolation Valve was done which was passing.
- SE-1523 Condensate header line elbow – 2 nos. were replaced. (Thk report)
- Condensate header near V-1202 which was badly corroded was replaced.
- I/V was provided for H-1427 CW inlet line.
- Proper support was provided for 4 Ata R.V. & 45° elbow and grill was provided at outlet for 3 nos. RV near control room

3rd Floor

- Fabrication job was done to relocate CO2 flow meter orifice (FICT-1202) from Ground floor to Autoclave bottom (3rd floor) to avoid chocking and improve accessibility to orifice for operation ease as per production requirement. This was carried out as per the EWR No. U-239 dtd 02/07/08.
- New HP flushing connection was also provided to FICT-1202 at 3rd floor. The CO2 line was fabricated from 1" X 160 Sch pipe. The HP flush line was fabricated from 1" Sch 80 SS 316 L pipe.
- A small length of Common ejector Off gas line to H-1206 line which was having pinhole leak (Near H-1421) was replaced. (3" x 10 Sch X SS 304L)
- 23 ata to 9 ata condensate line flange which was fermanited was replaced.(4" x 150#, WNRF)
- Portion of H-1424 steam tracing line was replaced which was having pin hole leak.
- H-1424 off gas line steam tracing line I/V was replaced (Fermanited)
- 9 ata passivation I/V replaced (2", #150)
- 9 ata steam Drum BFW Make up I/V Re-routed for Easy and safe operation. (GAV, 1" x 800#)
- Provision for Condensate flushing was provided to up stream of bypass I/V of Pre-evaporator.
- 9ata steam to V-1201 I/V. (Passivation) was replaced (fermanited)
- H-1424 steam tracing condensate traps o/l was connected to header.

3 ½ Floor

- HPF to FICV-1204 1st I/V and bleeder valve was replaced (½ ", #1500 & 1", #1500 BEL Valves)
- A small length of HICV-1202 Steam tracing jacket line which was having pin hole was replaced

5th Floor

- A portion of line from V-1203 to H-1209 was replaced along with trunnion support at 5th Floor. Additional trunnion support was also provided at 3 ½ floor. A portion of this line which was bent at 3rd floor was also replaced.
- Monorail beam above V-1201 was replaced.

6th Floor

- Modification jobs were carried out in V-1203 . Details are given along with LP Vessel jobs.
- Valve body of I/V of PRCV-1201 replaced. (1", #1500 BEL Valves)
- Spring hanger support of steam injection line of RV-1201 which was corroded and hanging in position was replaced with new one.

PT Top

- Valve body of I/V of PRCV-1201 replaced (3", # 1500 Bel Valve) H-1203 to V-1203 Off gas line steam tracing line was positioned close to main line for proper heating of gas line.
- HICV-1202 Jacket Steam line leak at PT Top was attended
- PRCV-1201 Steam tracing line One no valve and trap was replaced.
- Steam injection to Melt return line I/V which was furmanited was replaced. (Prill Bucket Room)
- Damaged grills of scrubber platform were replaced.

PCS area

- One no. blade of ID Fan K-1701 impeller was found corroded badly. At one location of fan blade, a hole was observed. 2 mm CS Plate was welded at this location.
- K-1702 U/S Duct corroded portion was repaired by providing patch plate.

Hydrolyser Area

- H-1351 A inlet line drain I/v d/s elbow pin-hole was repaired.
- PICV-1353 & PRCV-1202 bypass I/V replaced.

Gland Leak Job:

Following gland leak jobs were attended departmentally.

- HPF to unloading line first i/v gland leak
- Steam tracing i/v gland leak on V-1424 off gas line
- HPF to autoclave unloading ling 1st i/v gland leak.
- LICV-1281 c/v bypass i/v gland leak.

Following gland leak jobs were attended by M/s Amrutha Engineering, New Panvel against PO. 20080860 dated 24-11-2008.

- P-1304 A/B discharge & minimum flow line i/v gland leak
- P-1304 A/B discharge to FIC-1203 u/s i/v gland leak.
- Steam Tracing i/v gland leak near LRCV-1421 control valve
- Steam tracing i/v gland leak (return header) near LRCV-1421 at bucket room.
- FICV-1351 discharge i/v gland leak.
- P-1210 A/B discharge i/v gland leak.
- H-1210 O/L plug and i/v gland leak
- H-1205 bottom drain i/v gland leak.
- H-1427 to H-1421 (FI-1435) u/s i/v gland leak
- H-1427 to V-1423 (FI-1436) i/v gland leak
- P-1426 A/B suction and discharge i/v gland leak
- P-1305 A/B suction and discharge i/v gland leak
- 23 ata steam drum i/v gland leak
- P-1302 C/D suction i/v gland leak.
- P-1302 C/D bypass i/v gland leak

Modification Jobs in Prill Tower Belt Conveyors (M-1403-1 & M-1403-2):

During annual SD-2008, single part Prill tower belt conveyor was modified to three part belt conveyor. There was persistent problem of spillage of Urea from middle conveyor (M-1403-1) and PCS side conveyor (M-1403-2). Following problems were identified in the Conveyor system:

M-1403-1

- Belt Centre was not in alignment with respect to Center of Pulleys & rollers.
- Off center running of middle conveyor belt leading to spillage.
- Sagging of Belt at return side.
- Return belt was rubbing with channel structure.
- Spillage of urea at discharge chute.
- Spillage of Urea from Skirt blocks.
- Leakage of urea from hopper inspection windows.
- Removal of urea lumps from inspection windows during Prill shut-down is difficult because it was positioned at higher elevation.
- Belt tightening in running condition is not possible since the discharge chute is welded to structure which restricted the movement of Pulley.
- Angle of Carrying roller frame at end is 10 Deg, due to which, urea prills got spread at ends and resulted in spillage.

M-1403-2

- Belt Centre was not in alignment with respect to Center of Pulleys & rollers.
- Failure of tensioning pulley and rollers, provided at return end.

To rectify these problems, contract was awarded to M/s Rajasthan Construction Company, Anand vide PO No. 20081556 dated 13-03-2009 for Fabrication Jobs.

Following activities were carried out.

- Removed the existing rubber skirt block with skirt plate of M-1403-1.
- Removed the discharge chute of M-1403-1 from head pulley side and tail pulley side.
- Cut the existing conveyor belt (800 mm wide, 5 ply & HRT1) of M-1403-1 and M-1403-2.
- Tensioning pulley arrangement of M-1403-2 was removed.
- Alignment of head pulley, tail pulley, carrying rollers, return rollers and stringers of M-1403-1 was checked with respect of center line of SS feed hopper using piano wire. Center of Head pulley and tail pulley was found 20 mm towards north side and 30 mm towards south side respectively. All carrying rollers were found misaligned from min. 5 mm to max. 20 mm. Center of Stringer was also found misaligned maximum 18 mm. Return rollers were also found min 5 mm to max 10 mm misaligned.
- Alignment of head pulley, tail pulley, carrying rollers, return rollers and stringers of M-1403-2 was checked. All carrying rollers were found misaligned from 5 mm to max 25 mm and all return rollers were found misaligned from 5 mm to 10 mm. center of tail pulley of M-1403-2 was found 25 mm north with center of tail pulley of M-1403-1.

- 850 mm wide belt was to be erected in M-1403-1 and M-1403-2 in place of existing 800 mm wide belt. Available space between leg supports of M-1403-1 was 920 mm for existing 800 mm wide belt. All leg supports were displaced by 25 mm outwards to increase the available space to 970 mm for smooth running of belt in return side.
- To correct the alignment, shifted shaft of head pulley for M-1403-1, 20 mm towards south side and tail pulley 30 mm towards north side by opening the plummer block bearings (SNH-518). Both shafts were moved without changing the position of plummer block bearings.
- All carrying rollers and return rollers of both conveyors were aligned by using smaller size bolts ½" in place of bolts of 5/8" and enlarging the bolt slots for frame of carrying rollers and J- bracket of return rollers. Leveling of all carrying rollers and return rollers for both conveyors was checked and corrected using water level.
- For proper positioning of new "Kaveri" make rubber skirt block in M-1403-1, 1 meter piece of new belt was cut and placed above the carrying rollers. Then SS plate was welded with SS feed hopper keeping 5 mm gap between rubber skirt and sample piece of belt. All other SS Plates were welded taking this as reference. SS plates were welded upto centre line of Pulley at both ends for provision of additional rubber skirt blocks
- Replaced both head pulley bearings ("NTN" make pillow block cast housing set screw type, UCPX15, Store code-996120215010) of M-1403-2 with new one.
- Tail pulley of M-1403-2 was extended 300 mm downwards for minimizing the spillage from the discharge chute of M-1403-1.
- Damaged Impact rollers of M-1403-1 & 2 were replaced with new impact rollers ("Siddharth" make, store code – 124140145720)
- All return rollers ("Pratik" make, store code–124140145730) of M-1403-1 and M-1403-2 were replaced with new one.
- 10º Carrying roller frame at PCS end was replaced with 20º carrying roller frame to reduce spillage of Urea. At present angle of carrying roller frames installed in the conveyor is 35º along its length and two nos 20º frames at PCS end and one no. 20º and 10º at other end.
- For erecting new belt ("Nirlon" make, 850 mm wide, N/N Rating 630/4, 4 ply, grade HRT2, 3mm top and 1.5mm bottom cover, store code-124140104600) in M-1403-1 and M-1403-2, length was measured. Length for M-1403-1 and M-1403-2 was found 36.6 m and 15.80 m with keeping screw take-up at minimum side. For joint preparation, 21" was added later in actual length.
- Due to the limited space for erecting the new belt in M-1403-1, 5 nos. of carrying rollers of tail pulley side with tail pulley and bolted structure were removed. Vulcanizing of belt was done on the floor. After vulcanizing all 5 nos. carrying rollers was installed. Tail pulley of M-1403-1 was replaced with new one (workshop made).
- For vulcanizing of belt for M-1403-2, head pulley was shifted maximum towards tail pulley side. 3 nos of impact rollers were removed. Finally vulcanizing of belt was done near tail pulley.
- For easy removal of head pulley of M-1403-2, 2 nos of channel structure were made bolted with channel support of head pulley. Near north side head pulley bearing, some portion of concrete structure was removed so that bearing can be replaced without removing the pulley.

- Modified discharge chute of M-1403-1 towards M-1403-2 side consisting of primary & secondary skirting was fabricated to minimize the spillage. Back plate of discharge chute was bolted with screw take-up so that belt tightening is possible in running condition.
- Shifted the 3 nos inspection windows downward for easy access and removal of urea lumps during prill shut-down.
- To prevent the leakage from inspection window, 25 mm wide and 3 mm thick foam strips were provided.
- Strengthened the channel supports for stringers of M-1403-1 by providing 50 mm angle bracings.
- 1 no. return roller was provided in M-1403-2 in the place of tensioning pulley.
- 4 nos. of guide roller were provided in return side of M-1403-1 to protect the belt from rubbing with channel leg support in case of off-center running of belt.
- M/s PBL agreed to supply new 7.5 HP geared motor in place of 5 HP gearbox. The Geared motor was installed after fabricating foundation for same.

Details of Geared Motor:

Type	:	M082028BMCG1A5.54A
Sr. No.	:	M015872
Input kw	:	5.5
Ratio	:	28.64
RPM	:	51

- All the plummer block bearings for head pulley and tail pulley of M-1403-1/2/3 were checked, found satisfactory.

After completion of all fabrication and erection jobs, both conveyors were tested at no-load condition. M-1403-1 was tested for forward and reversible direction. Found satisfactory. Current for load and no-load condition was measured and recorded.

	M-1403-1		**M-1403-2**	**M-1403-3**
	Forward	**Reverse**		
No-load condition	5.6 ~ 6.5 A	4.7 ~ 5.4 A	4.2 A	3.4 A
At 102% Prill load	6.0	-	4.0 ~ 4.2	-

OFFSITE & UTILITY PLANT

P.M. OF COOLING WATER PUMP (P-4401/A)

- Coupling between the Pump and G.B. was decoupled.
- Both the Journal Bearings were checked and found OK.
- The clearances were checked & following are the readings:

Sr. No.	Description	Design Value	Actual Value
1	Total Float of the pump	10 mm	8.0 mm
2	Radial bearing Clearance coupling end	0.20 mm	0.20 mm
3	Radial bearing Clearance free end	0.20 mm	0.22mm

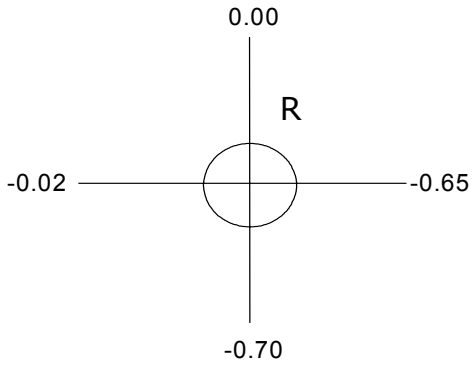
- Both side glands of pump were partially repacked with 25 mm PTFE packing.
- Coupling of pump with gear box was cleaned, checked and found O.K.
- Alignment between pump and gear-box were checked, greasing done & box-up the coupling.

P.M. OF ELLIOTT TURBINE Q-4411

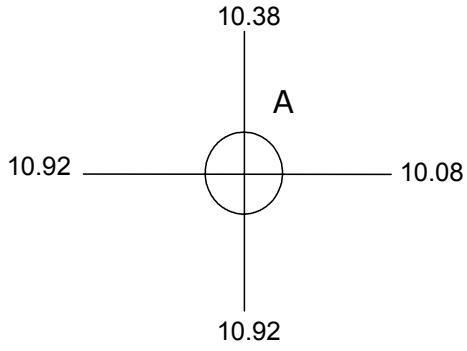
- Coupling between the Turbine and G.B. was decoupled.
- DP test & Gauss measurement of both the Journal Bearings and Thrust Bearing Pads was done and found OK.
- Governor was removed from its position, cleaned & fresh oil was charged (SERVO-PRIME 32).
- Oil console was drained; cleaned and fresh oil charged (SERVO-PRIME 32) Approximately 620 liters of Oil was used.
- 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.
- The clearances were checked & following are the readings:

Sr. No.	Description	Actual Value
1	Axial Float of the Rotor	0.33 mm
	Axial Float of the Rotor (without cover)	0.46 mm
	Axial Float of the Rotor (without Thrust pad & after both side bottom half provided)	1.95 mm
2	Radial bearing Clearance Coupling end	0.28 mm
3	Radial bearing Clearance Governor end	0.23 mm
4	Oil Guard Clearance both side	0.12 mm

Gear Box to Cooling Water Pump Alignment readings:

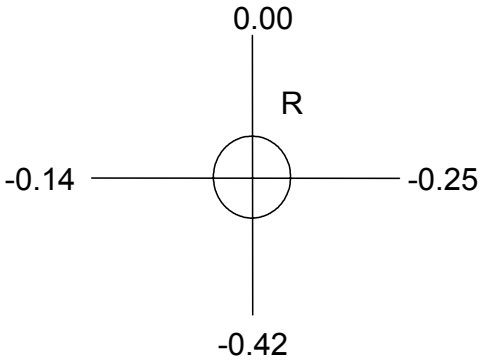


By Dial Gauge



By Slip Gauge

Turbine to Gear Box Alignment readings:



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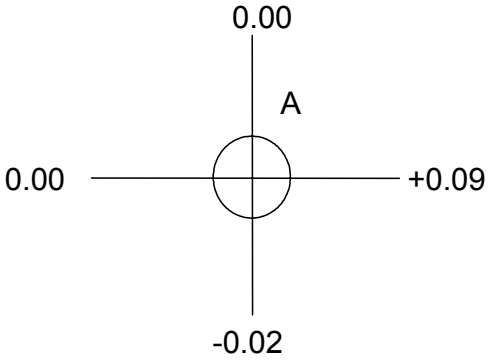


By Dial Gauge

P.M. OF COOLING WATER PUMP (P- 4401/B)

- Coupling between the pump and motor was decoupled.
- The journal bearings were opened & cleaned.
- The coupling side & rear side journal bearing were found OK.
- Both side glands were repacked.
- All lube oil lines disconnected & cleaned all strainers.
- The clearances were checked & following are the readings:

Sr.No	Description	Design Value	Actual Value
1	Front end bearing Clearance	0.20 mm	0.20 mm
2	Rear end bearing Clearance	0.20 mm	0.22 mm

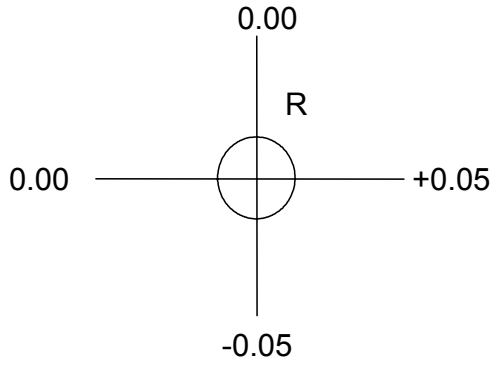
P.M. OF COOLING WATER PUMP (P-4401/C)

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were opened, cleaned & checked. Inboard Bearing was found OK but in Outboard Bearing White Metal was found damaged, so replaced it by new one. Blue match checked.
- The clearances were checked & following are the readings:

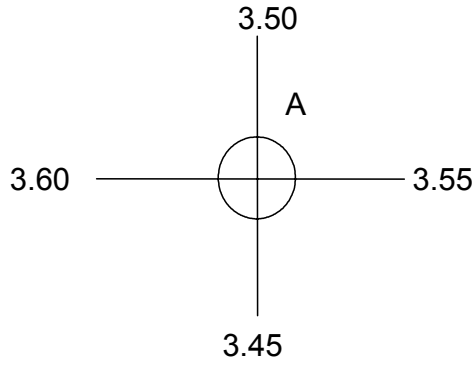
Sr. No.	Description	Design Value	Actual Value
1	Radial bearing Clearance coupling end	0.20 mm	0.21 mm
2	Radial bearing Clearance free end	0.20 mm	0.22 mm

- Both side Gland packing replaced
- Oil filter cleaned
- Alignment between pump and motor was checked, greasing done & box-up the coupling.

Pump to Motor Alignment Readings are:



By Dial Gauge



By Slip Gauge

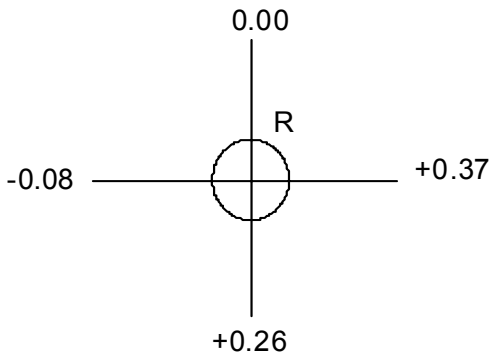
P.M. OF COOLING WATER PUMP (P-4402)

- Coupling between the pump and motor was decoupled.
- Both the bearing housing was flushed with oil & fresh oil (SERVO-PRIME 68) charged.
- Both the journal bearings were checked & found OK.
- The clearances were checked & following are the readings:

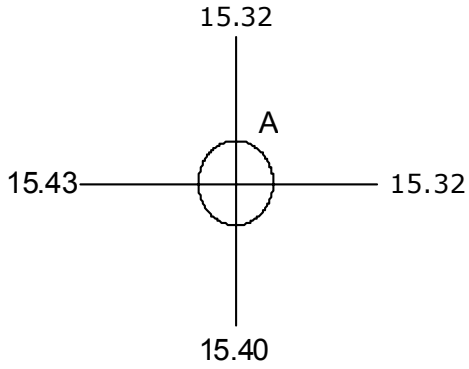
Sr. No.	Description	Design Value	Actual Value
1	Front bearing clearance	0.20 mm	0.24 mm
2	Rear end bearing Clearance	0.20 mm	0.21 mm

- Radiator cooling water line opened and box-up after cleaning of radiator.
- Oil leakage from side cover was attended by rethreading bottom housing for 14mm stud, pitch 1.5mm.

- Checked the alignment between pump & motor and following are the readings:



By Dial Gauge



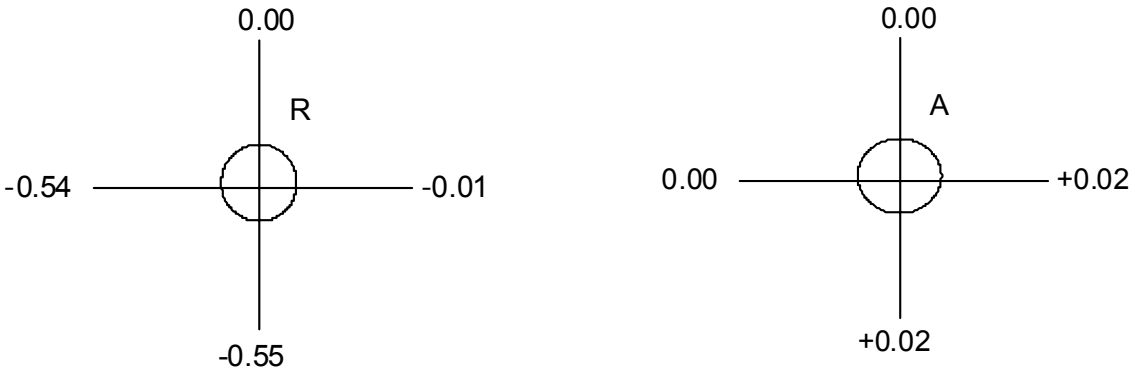
By Feeler Gauge

P.M. OF B.F.W PUMP TURBINE Q - 5111:

- Coupling between the pump and turbine was decoupled.
- Cleaned the Radial & Thrust bearings.
- Dimensional Inspection, DP test & Gauss measurement of Journal bearings & Thrust Bearing pads were done. Results were found satisfactory.
- Checked the radial clearances of journal bearings using lead wire.
- Re-assembled both the Journal bearings & Thrust Bearing
- Oil glands were removed, cleaned, checked its dimensions & re-assembled. After assembling, clearances were checked.
- Coupled pump & turbine. Alignment readings were checked.
- The oil cooler covers were opened and hydro-jetting was carried out.
- Suction filter of the MOP & AOP was cleaned.
- The Oil console was cleaned and fresh oil (Servo Prime-68) was charged.
- Disconnected Governor Oil lines & flushed oil. Fresh oil recharged.
- Re-assembled all oil lines.
- New MAGNA Make **OMEGA-85** Grease provided on Coupling.
- The clerances readings are:

Sr. No.	Description	Actual Value
1	Axial Thrust	0.31 mm
2	Front end bearing clearance	0.24 mm
3	Rear end bearing Clearance	0.19 mm
4	Front Oil Gland	0.14 mm
5	Rear Oil Gland	0.18 mm
6	Thrust bearing Oil seal front side	0.13/0.14 mm
7	Thrust bearing Oil seal rear side	0.12/0.12 mm

Alignment Readings: Pump to Turbine



P.M. OF BFW PUMP P- 5111:

- Bearing top halves were removed.
- Cleaned the Radial & Thrust bearings.
- Dimensional Inspection, DP test & Gauss measurement of Journal Bearings & Thrust Bearing pads were done. Results were found satisfactory.
- Thrust bearing pads thickness were measured

Pad No.	Pad Thickness MM	
	Active Side	Non-Active Side
1	22.80	22.18
2	22.81	22.18
3	22.20	22.18
4	22.19	22.20
5	22.21	22.20
6	22.22	22.20

- Checked the radial clearances of journal bearings using lead wire.
- Re-assembled both the Journal bearings & Thrust Bearing.
- Oil filter was removed, cleaned and re-installed.
- Oil cooler was opened and cleaned by Hydro jetting.
- Oil of the console was drained, cleaned and boxed up.
- BFW suction strainer was cleaned and assembled.
- The clearances were checked & following are the readings.

Sr. No.	Description	Actual Value(MM)
1	Axial Thrust	0.24 mm
2	Front end bearing clearance	0.14 mm
3	Rear end bearing Clearance	0.15 mm

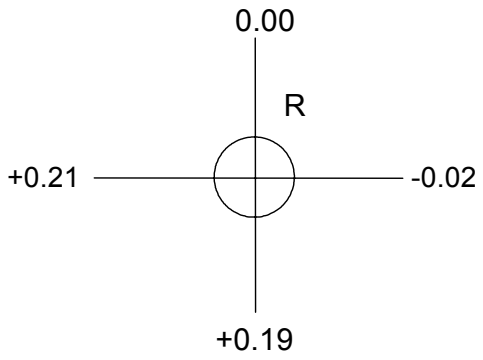
P.M. OF F.D. FAN TURBINE Q-5113 & FD FAN K-5113

- Decoupled Fan from Turbine.
- Removed oil lines & Governor
- Gearbox cover was opened and checked the condition of Gears. The same was cleaned; DP test was carried out and assembled back.
- Backlash between gear wheel to pinion was checked.
- Cleaned the Radial bearings.
- Dimensional Inspection, DP test & Gauss measurement of Journal bearings were done. Results were found satisfactory.
- Main oil console was cleaned and recharged with new oil (SERVO PRIME 68).
- MOP was removed from its position, cleaned & Backlash measured which was found 0.15mm. Coupling Bush of MOP was replaced.
- Oil cooler was opened and cleaned by Hydro jetting.
- Cleaned Duplex oil filter & replaced 'O-Ring'.
- The air dampers were attended for proper working. The Fan inlet air mesh screen was changed.
- Between turbine and fan coupling rubber pads were replaced.
- The clutch oil (Servo Trans fluid-A) was replaced.
- The clearances were checked & following are the readings

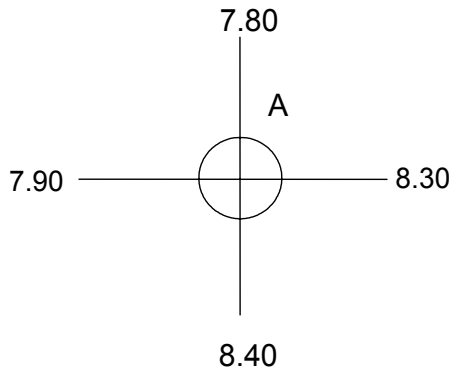
Sr. No.	Description	Actual Value(MM)
1.	Pinion bearing clearance front end	0.13
2.	Pinion bearing clearance rear end	0.16
3.	Fan roller bearing clearance front end	0.15
4.	Fan roller bearing clearance rear end	0.15
5.	Pinion Thrust Float	0.12
6.	Gear Wheel Thrust Float	0.22
7.	Backlash between pinion & gear wheel	0.15

Alignment between Gear-Box & FD Fan:

Clamp on Fan & Dial on Gear Box



By Dial Gauge



By Slip Gauge

BHEL BOILER JOBS (F-5111)

Replacement of Superheater Coils & its Associated Headers

IFFCO KALOL is operating a Boiler of BHEL Make, Reg. No GT-2068, 80 T/H Capacity to fulfill its requirement of steam since 1982. RLA study was carried out in 2005, to know the health of the boiler. RLA study report showed damage in Primary & Secondary Superheater Coils (Microstructure showed Spheroidization Level-4(SL-IV) & reduction in % elongation). Primary Superheater Outlet Header & De-superheater Top Elbow portion Microstructure showed Linked Creep pores CP-II, Secondary Superheater Outlet Header Microstructure showed Spheroidization Level-4(SL-IV) & predicted Low Remaining Useful Life of Primary Superheater Inlet & Outlet Header, De-superheater Header & Secondary Superheater Inlet & Outlet Header.

Replacement of Primary & Secondary Superheater Coils (36 + 2 nos. Steam cooled Spacer front assy. & 34 + 2 nos. Steam cooled Spacer rear assy. respectively), Primary Superheater Inlet & Outlet Header, De-superheater Header & Secondary Superheater Inlet & Outlet Header was carried out during Annual Turnaround-2009. The following activities were carried out to accomplish the job:

- Welder Qualification Test & Job Repair Test was carried out to become familiar with the job prior to actual job undertaken. See Fig. 1 & Fig. 2.
- Permission from IBR Office for carrying out replacement work was taken.
- Ground Inspection of Pressure parts was carried out by IBR Authority.
- DP test of Bevel Edges of all Headers & Coils was performed to check any parent metal defect.
- Cleaned all Superheater Headers & Coils by air & sponge. See Fig. 3
- Prepared Clamp for Fit-up of Superheater Coils with stubs attached on headers. See Fig. 19
- Locked Steam Drum outlet saturated steam line & superheated steam Main outlet line to restrict its movement in 360 deg. after cooling of furnace (to prevent development of thermal stress) by providing suitable structural support.
- Removed all Structures & Piping which were fouling to carry out Rigging Jobs.
- Removed Insulation from the Main steam lines, Superheater Headers, Furnace Rear Wall etc. After removal of insulation from Furnace Rear Wall, it was found that refractory was covered in two boxes of 6.0 mm thick MS Plate & provided only around the area from where PSH & SSH coils Inlet & Outlet end were coming out. See Fig. 10
- The Whole furnace is sealed by tubes & straight fins except the areas from where the PSH & SSH coils are coming out for interconnection with PSH & SSH inlet & outlet headers. The sealing arrangement in these areas is Castable Refractory + Refractory Bricks + Sealing Plate (seal welded with SH coils). Sealing Plate was seal welded with cover plate forming a box cover over the refractory.
- Thermocouples are installed on PSH & SSH outlet header for measuring Metal Temperature. Before removal of SH coils, location of Thermocouple Pad & its clamp were measured & recorded by taking PSH & SSH outlet header as Reference point for measurement. See Fig. 5

- Removed instrument probes from Thermo-wells installed at top & bottom spool piece of De-superheater header & thermocouples from PSH & SSH outlet arms.
- Cut all the drains & vents of Superheater headers & joint of BFW line to spray nozzle of De-superheater.
- A Plate of 25mm thick was placed at the bottom & fixed for reference marking of location & orientation of headers. See Fig. 4
- Vertical dimensions of headers were transferred to a column by Transparent PVC Water level tube. Location & orientation of all headers were marked on Horizontal Plate by Plumb method. See Fig. 7 & Fig. 8
- Removed all Superheater headers one by one manually i.e. SHH1, SHH2, DSH, SHH3 & SHH4 after disconnecting it from corresponding SH coils by Oxy-Acetylene Gas cutting & rigged out with the help of chain pulley blocks. To make furnace opening for removal of SH coils, we made another cut on all the PSH & SSH coils inlet & outlet end from inside the furnace leaving coil piece which was seal welded with the seal plate.
- Cut the cover plate (seal welded with the seal plate) & Seal plate of refractory box by Oxy-Acetylene Gas cutting in no. of pieces for refractory removal of SSH Coil box. After removal of the cover plate, the refractory was broken & removed from the adjoining area of SSH coils along with SH coil pieces. There was a bank tube in between the SSH inlet & outlet arms. Therefore, precautions were taken during refractory removal for any possible damage to the bank tube. In Parallel, cover plate & refractory was removed along with PSH coil pieces from PSH box. **As per the drawing there was a bank tube in between the PSH inlet & outlet arms, but in actual no any bank tube was found on site.**
- Since the 33” burner replacement work was in progress & burner was removed from its position for replacement, leaving an opening called burner throat opening in the furnace, therefore, we grab the opportunity, made a cut on all the PSH coils inlet & outlet arm from inside the furnace & removed all the PSH coils (38 nos.) from the opening after comparing the dimensions of PSH coils with the burner throat opening and straight spool piece of Spacer Tube S4 was cut out to facilitate removal of PSH coils as these were stacked between two spacer tubes S3 & S4. See Fig. 11
- In the meantime, we had cleared all the PSH opening area & straight spool piece of Spacer Tube S2 was cut out to facilitate removal of SSH coils from the opening of PSH Coil box as these were stacked between two spacer tubes S1 & S2. See Fig. 11
- Removed all SSH coils (36 nos.) from the PSH opening.
- After removal of all PSH & SSH coils, condition of Refractory lying at the bottom of SH coils was checked & found in loose condition along with a burnt piece of beam.
- Removed all the loose refractory & cleaned the area for pouring fresh refractory.
- Accmon Car Refractory was used. Whole area was divided in sections which were made through shuttering for refractory expansion on curing. Anchor was provided for giving strength to the refractory. After pouring, it was allowed for curing (moisture removal) up to 8 hrs.

- Insert SSH coils in the furnace by chain block. SHH3 & SHH4 headers were placed & positioned by taking reference from the marking done on plate & vertical column and then fit-up of coils were done by clamp.
- After Fit-up, tacking was done & then started welding of SSH coils with header. See Table2
- Fit-up & welding of PSH coils to be done in parallel with the SSH, but as we placed the PSH coil at its position in the furnace we found that the length of the PSH coil is more than the space provided for it. So, after taking permission from IBR authorities we had reduced the length of the entire 36 nos. coil (except 2 nos. steam cooled spacer front Assy.) by 160 mm on site. 4 Nos. weld joints increased in each repaired coil during repairing (Total = 144 joints). See Fig. 15 to Fig. 20 & Table3
- To avoid the delay due to unforeseen repair work in PSH coils, we started stacking & welding of SSH coils. In the meantime some repaired PSH coils were inserted in the furnace through PSH opening and then it was decided to place & position the SSH1, SSH2 & DSH headers.
- After positioning of headers, fit-up of SSH2 with Elbow, Elbow with DSH, DSH with Bottom spool piece & Bottom Spool piece with SSH3 were done. For fit-up of headers we had to reduce the elbow by 10 mm & spool piece by 5 mm.
- After completing fit-up of headers, fit-up & tacking of PSH coils started.
- After fit-up of headers, no space was left to insert the remaining PSH coils in the furnace; therefore we cut down straight spool piece from 2 nos. Furnace Rear Wall Panel tubes.
- Fit-up, tacking & welding of all 38 nos. PSH coils & steam cooled spacer front Assy. were done one by one. See Table 2
- Edge preparation of 8” steam drum outlet line (connected with SHH1), 10” superheated steam outlet main steam line (connected with SHH4) & 3” BFW inlet line (connected to spray nozzle of DSH header) was done. After getting clearance from DP test of edges, welding of 6 nos. header joints and one joint of BFW inlet line connected to spray nozzle of DSH header were done. See Table1
- Heat treatment of all 7 header joints was done successively. See Fig. 23 & Fig. 24
- After completing header welding, welding of 4 joints of Furnace Rear Wall Panel Tubes was done. After getting DP & Radiography clearance, fins were welded with tubes. See Fig. 21
- Refractory work (Castable + ACCMON CAR Refractory) was done on furnace opening from where PSH & SSH coils were coming out for interconnection with respective headers & after that seal plate & cover plate were seal welded. See Fig. 22
- In parallel, Thermo-well welding on the top & bottom spool piece was done & after that welding of Thermocouple Pad & Clamp was done as per the recorded measurement on the PSH & SSH coils outlet.
- All the Superheater drain & vent joints were welded.
- Bottom reference plate was removed & all the header supports were removed.
- Refractory curing cycle was followed during heat-up of Boiler. See Fig.25 Curing Cycle Curve for ACCMON CAR Refractory

Table 1

Welding & Inspection Details of Headers Joints (7 Joints), Coils Joints (148 Joints) & PSH Coil Repaired Joints (144 Joints)

Joint No.	Location	MOC	Method	Filler Wire & Electrode	Size of Joint
1	Drum Outlet Saturated steam line & SHH1	SA 106 Gr. B & SA 106 Gr. C	GTAW + SMAW	ER-70S2 – Root & Hot pass E-7018-1- Fill-up & Final weld	219 mm OD X 28 mm Thick
2	SHH2 & Elbow	SA 335 Gr. P12 & SA 335 Gr. P12	GTAW + SMAW	ER-80S B2 - Root & Hot pass E-8018 B2- Fill-up & Final weld	273 mm OD X 36 mm Thick
3	Elbow & DSH	SA 335 Gr. P12 & SA 335 Gr. P22	GTAW + SMAW	ER-90S2 B3 - Root & Hot pass E-9018 B3- Fill-up & Final weld	273 mm OD X 36 mm Thick
4	DSH & Spacer	SA 335 Gr. P22 & SA 335 Gr. P22	GTAW + SMAW	ER-90S2 B3 - Root & Hot pass E-9018 B3- Fill-up & Final weld	273 mm OD X 36 mm Thick
5	Spacer & SHH3				
6	SHH4 & Superheated Steam Outlet Main line	SA 106 Gr. C & SA 106 Gr. B	GTAW + SMAW	ER-70S2 – Root & Hot pass (GTAW) E-7018-1- Fill-up & Final weld (GMAW)	273 mm OD X 28 mm Thick
7	BFW inlet to De-Super heater	SA 182 F12 CL2 to SA 106 Gr. B	GTAW + SMAW	ER-80S B2 - Root & Hot pass E-8018 B2- Fill-up & Final weld	88.9 mm O.D. X 63.5 mm I.D.

Preheat Temp. : 150 ^{0}C, Interpass Temp. : 250 ^{0}C, Post Weld Heat Treatment (Stress Relieving) required.

Bevel Edge - DP Test

Root & Hot Pass - DP Test & 100 % Radiography

Final Weld - DP Test & 100 % Radiography + Hardness Testing

Table 2

Location	No. of Joints	MOC	Method	Filler Wire & Electrode	Size of Joint
PSH coils inlet to SHH1 header & PSH coils outlet to SHH2 header	38 + 38 = 76	SA 213 Gr. T22	GTAW	ER-90S2 B3 – Root, Hot pass, Fill-up & Final	51.0 mm OD X 7.1 mm Thick
SSH coils inlet to SHH3 header & SSH coils outlet to SHH4 header	36 + 36 = 72	SA 213 Gr. T22	GTAW	ER-90S2 B3 – Root, Hot pass, Fill-up & Final	51.0 mm OD X 5.6 mm Thick

Table 3

Location	No. of Joints	MOC	Method	Filler Wire & Electrode	Size of Joint
Repairing work on PSH coils (36 nos.)	144 (4 joints per coil)	SA 213 Gr. T22	GTAW	ER-90S2 B3 – Root, Hot pass, Fill-up & Final	51.0 mm OD X 7.1 mm Thick

Preheat Temp. : 150 ^{0}C, Interpass Temp. : 250 ^{0}C

Bevel Edge - DP Test

Root & Hot Pass - DP Test

Final Weld - DP Test & 100 % Radiography

BHEL BOILER INSPECTION

- Boiler was inspected by Boiler Inspector in open condition on 27.03.2009 & Hydrotest was carried out at 89.0 kg/cm2 pressure on 03.04.2009 and witnessed by Boiler Inspector.
- RV's were overhauled by M/s Flotec Engineering Services against WO No. 20080872 dated 29/11/2008. The nozzle seats of all three safety relief valves were in-situ machined by hand lapping & then assembled. The RVs were floated on 06.04.2009 & 09/04/2009 and their readings were as follows.

Description	Popping Pressure Kg/cm2g	Reset Pressure Kg/cm2g
Drum Rear R.V.	71.9	68.7
Drum Front R.V.	68.9	67.0
Super Heater R.V.	64.3	61.3

- 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 20080860 dtd – 24/11/2008).
- All 4 nos. inspection window glasses were checked, found 1 no. Peep glass located at Top burner side broken. Replaced the broken one. Cleaned glasses & 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.
- P.M. of LRB-1 & LRB-2 was done. The feed pipe of LRB-2 was replaced. Gland Packing of both LRB was replaced.
- RB-3, RB-4, RB-5 & RB-6 were taken for complete Overhauling.

All Rotary Blowers removed from its position & inspected it one by one.

- Feed Pipe of RB-3 was found damaged. Replaced it after making new pipe of SS 310 (Store Code: 146012141000 & 991030409H20). Replaced copper gasket & Gear box oil flushed & new oil charged.
- Dismantled RB-4. Found Feed Pipe & Feed Pipe gland plate broken. Replaced both parts. Also replaced steam block valve stem & seat as it was found damaged. Provided new Gland Packing.
- Dismantled RB-5. Found Feed Pipe cracked at various places on front side & Feed Pipe gland plate broken. Feed pipe was repaired by cutting 2' piece from front side & new piece of SS 310 (Store Code: 146012141000 & 991030409H20) provided. Feed Pipe gland plate replaced. Provided new Gland Packing. Steam block valve spindle was also replaced
- Dismantled RB-6. Found Feed Pipe OK & Feed Pipe gland plate broken. Feed Pipe gland plate replaced. Provided new Gland Packing.
- De-aerator top & sump side manhole opened for internal inspection. Found Bottom tray damaged. Repaired it & then boxed up. Manhole Gasket size: 20" X 150# - 2 nos. Prepared drawings of all trays.
- Water leakage from Top of NRV on BFW inlet line to Steam drum before Shut-off valve was reported. Therefore, NRV overhauled & High Pressure sealing ring replaced.

RE-GENERATIVE AIR PRE-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 6 nos. radial seal replaced.
- 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. The condition of Cold End bearing was found OK. So it was boxed-up and fresh oil (Servo Prime C 100, 8 liters approx.) charged.
- Crack was found on Hot End Bearing Outer Race. See Fig. 26. So, the bearing was replaced with the new one and the procedure adopted for the replacement of the bearing was as follows:

- Jack hole covers 4 nos. were removed one by one to place the screw jack so that rotor can be lifted for easy removal of bearing.
- Four numbers of jacks were made from the full threaded studs (2¼" and 17" long) with hexagonal nuts.
- Now these jack screws were kept under the jacking ring and the jacks were blocked up until the jacking ring meets the rotor. See Fig. 27
- Put Dial gauge on both ends to see how much the shaft lifted from both ends.
- As the jacking ring of all jack screws came in contact with rotor we applied equal torque on all jack screws to lift the shaft equally from both ends.
- After lifting the shaft, replaced cracked bearing with sleeve by spare one.
- Release the jack screws equally. Removed all jack screws from position & box-up all the Jack hole covers.
- Bearing Housing cover was then boxed-up 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 (MM)
1	Hot end bearing	0.23 mm
2	Cold end bearing	0.25 mm

- Steam nozzle for swivel type soot blower of RAH unit was cleaned.

COOLING TOWER AREA JOBS

- The cooling tower distribution valves were attended for smooth operation and isolation. One valve of Ammonia tower -1 (Lab side) was replaced.
- Brick wall open channel was extended and partition walls were made to facilitate the complete revamping of ammonia cooling tower cells (A4 to A6)
- Discharge valve's actuator of following CW Pumps were overhauled:
  - P-4401/A (Condensing turbine driven)
  - P-4401/B (Back pressure turbine)
  - P-4403 both 900 & 700 mm valves (Back pressure turbine driven)
  - P-4402 1100 mm valve (Motor driven)
- Refurbishing of Sluice Gate valve was done by M/s EFCO, Hyderabad
  - 900 mm of P-4402 Pump Discharge Line
  - 900 mm & 700mm of P-4403 Pump Discharge Line
  - 900 mm of P-4401 C & D Pump Discharge Line

DM PLANT JOB

The Degasser tower sump was opened for cleaning & inspection and after inspection boxed up.

RELIEF VALVE OVERHAULING & TESTING

The following Relief valves were removed, overhauled & tested with nitrogen medium on valve test bench. The services of M/s Tyco Valves & Controls Pvt. Ltd., Vadodara 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	3.5
2	RV-Soot Blower	Soot Blower R.V.	1½"	40.0	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"	44.5	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	5.0

STEAM LEAK & FABRICATION JOBS:

- Installed 2 Nos. of 6" x 1500# Gate valve in BFW Supply & Return line.
- Patch Ring welded on C.W. Pump Discharge lines
- SS 304 Pad welding on CW supply lines at ground level
- Modified Steam Trap Pot blind flange located at 40 ata Steam line inlet to Q-4411
- Replaced Damaged Flue Gas sample point of SH Zone (Near LRB-2) which was temporarily attended by M-seal
- Replaced all steam traps which were not working.

PAINTING JOBS

Painting Jobs carried out by M/s. B.Chauhan

- BHEL Boiler House Pipelines
- BHEL Boiler Chimney
- 42" Dia. Urea Cooling Water Supply & Return Header Line in front of Mech. Maint. Offsite Office up to Urea Battery limit.

Fig. 1 Welder Test for Pipes

Fig. 2 Welder test for Tubes

Fig. 3 Air & Sponge cleaning of Tubes

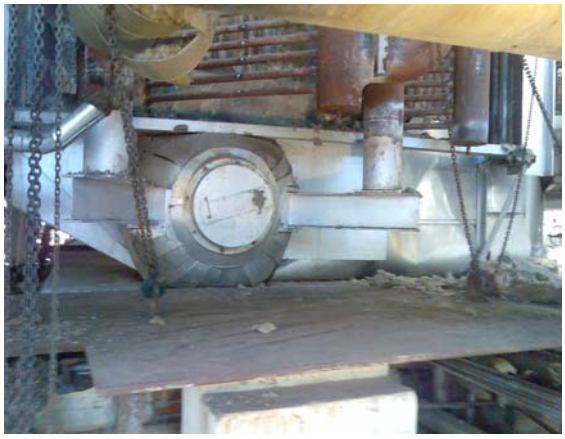


Fig. 4 Plate for marking of position of header

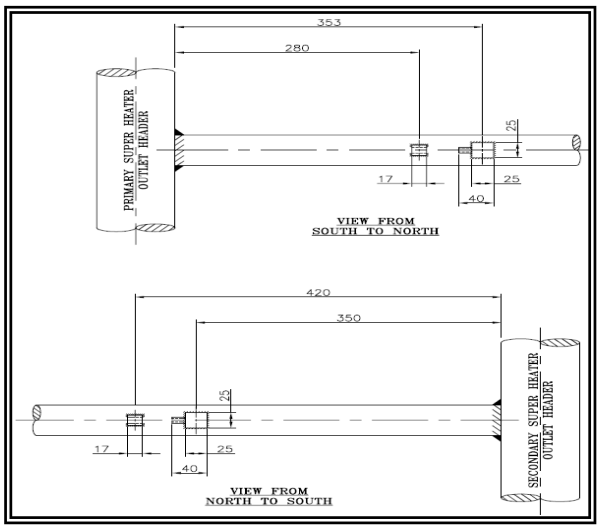


Fig. 5 Measurement of Peening Point

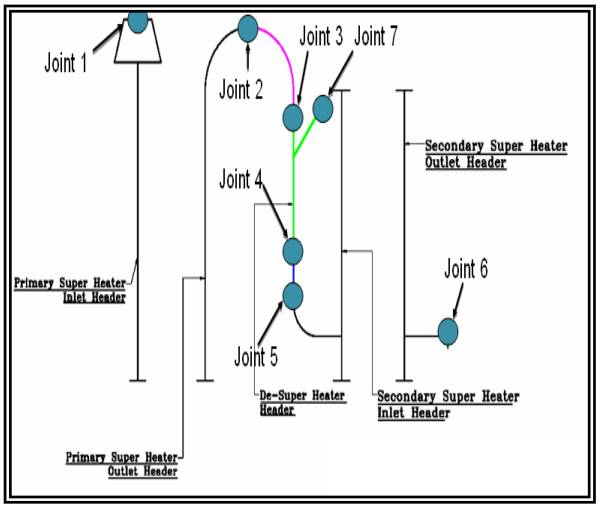


Fig. 6 Field Weld Joints of Headers

Fig. 7 Marking of Header Location by Plumb Method on Plate

Fig. 8 Transfer of Vertical Dimension by Water Level PVC Tube

Fig. 9 Level marking on Column

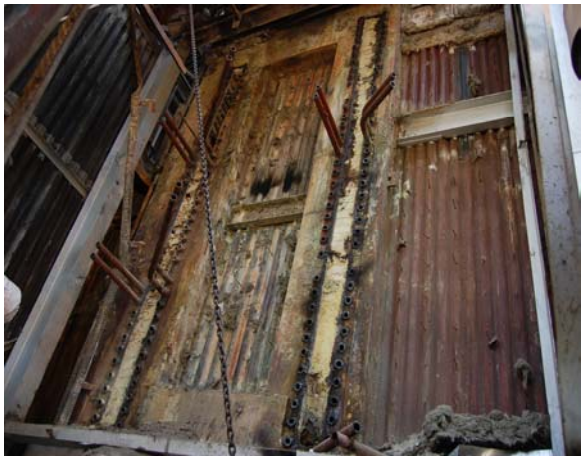


Fig. 10 View of Rear Wall after removal of Insulation

Fig. 11 Cut Spacer tubes S2 & S4 No any bank tube on PSH opening

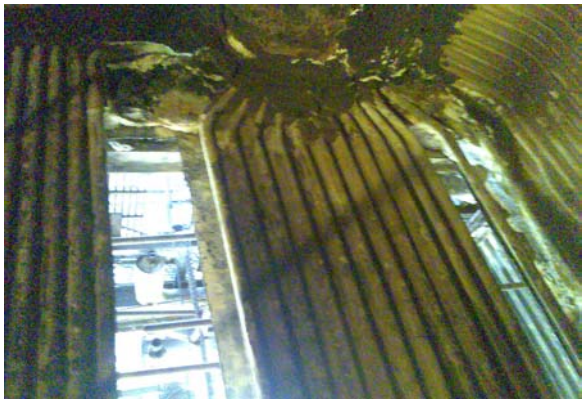


Fig.12 View after removal of Refractory.

Fig.13 PSH Coils After Work

Fig.14 PSH Coils Before Work

Fig.15 160 mm to be cut from PSH Coils

Fig. 16 Template made for Coil Repairing

Fig.17 Cut Pieces from PSH Coils

Fig. 18 Edge preparation by Machine tool

Fig. 19 Fit-up for Tacking

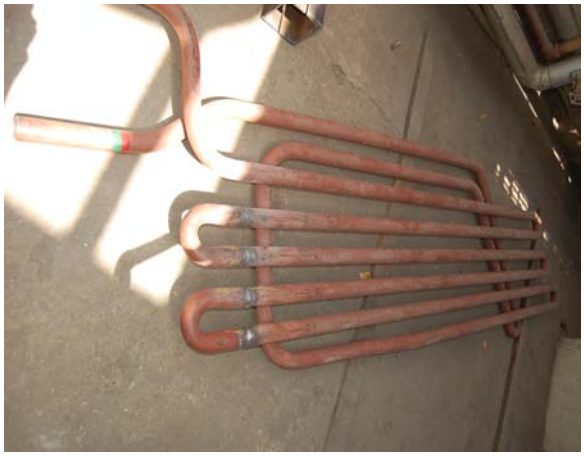


Fig. 20 PSH Coils after Repairing

Fig. 21 Location of Furnace Rear Panel Tubes Cut for Insertion of PSH Coils in Furnace

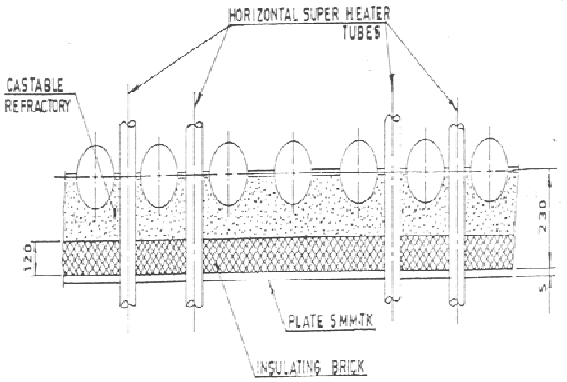


Fig. 22 Refractory Arrangement at PSH & SSH Coil opening

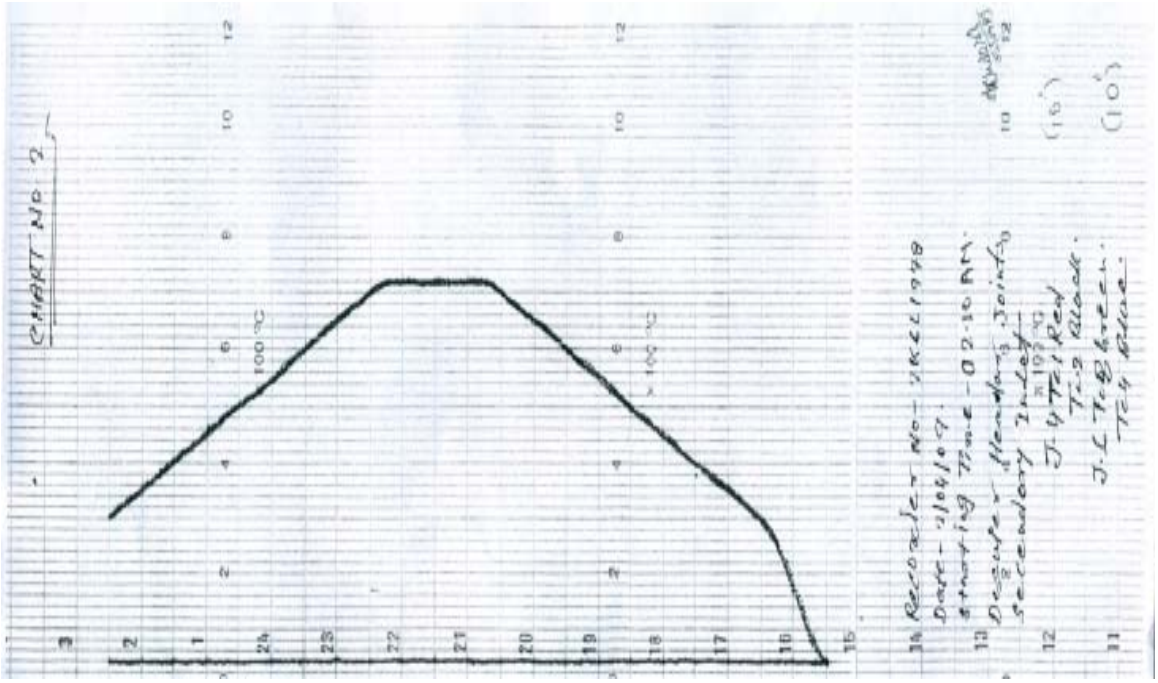


Fig. 23 PWHT Curve for P22 & P12 Header Joints (J2, J3, J4, J5 & J7)

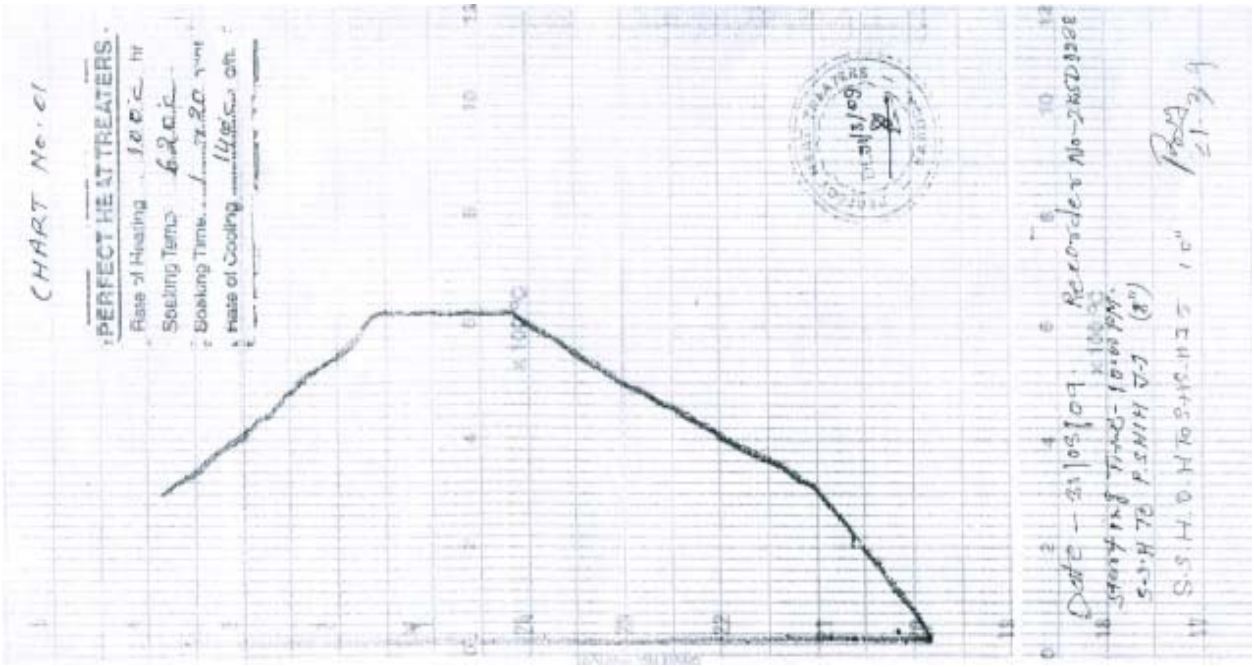


Fig. 24 PWHT Curve for CS Header Joints (J1 & J6)

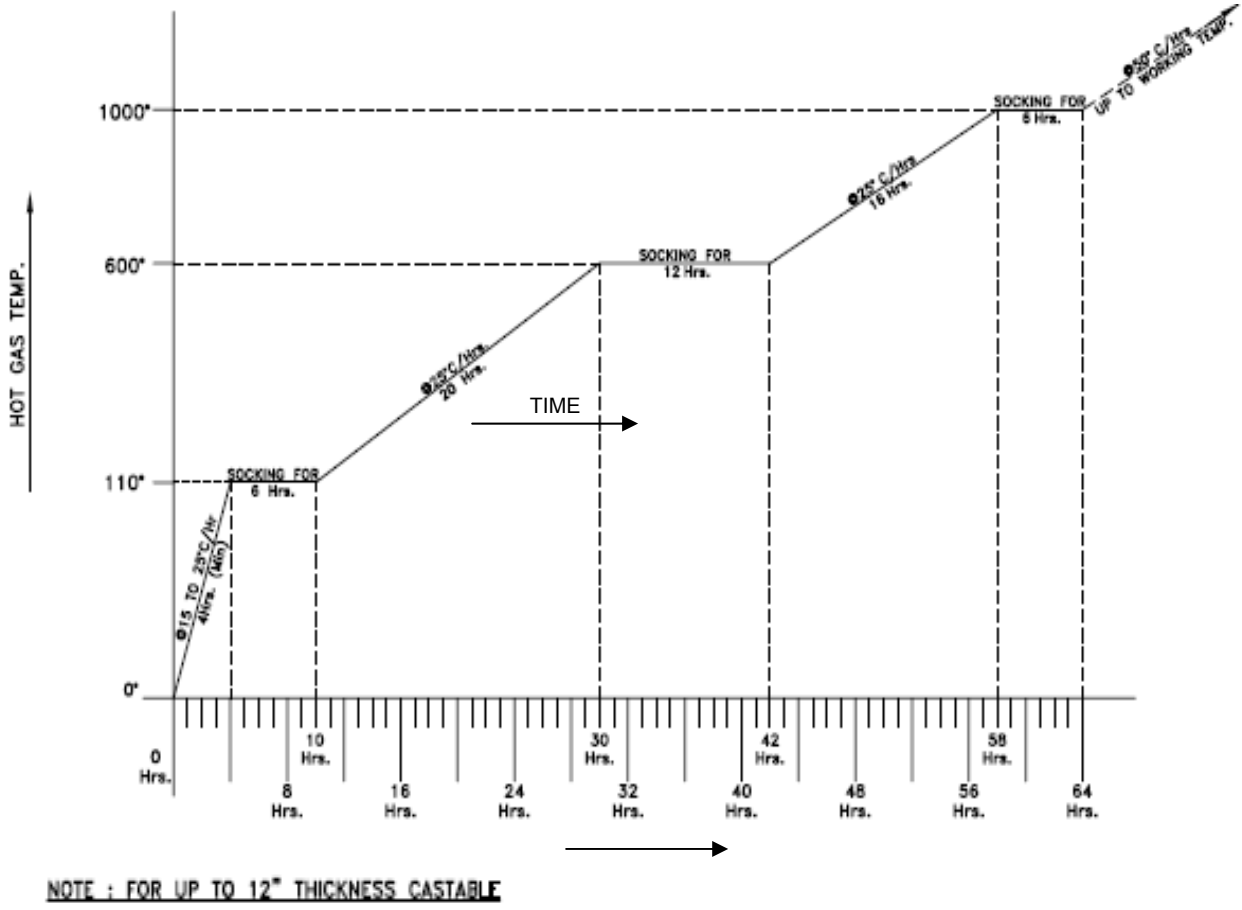


Fig. 25 Curing Cycle Curve For ACCMON CAR Refractory

Fig. 26(a)

Fig. 26(b)

Fig. 26(c)

Fig. 26 (a), (b) & (c) Damaged RAH Hot End Bearing

Fig. 27 Arrangement made for Bearing Removal

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. 20080878 dt.03/12/2008.

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.
- Checking of the scrapper chain, pin, washer and circlips done and replaced damaged spares.
- Scrapper chain Tail End bearing block replaced with new one.
- 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 Idler Gear teeth broken (half Teeth in each gear), Idler Pin found bent.
- Replaced both the Idler pins with hub by cutting the old assembly & welded new one.
- Provided stiffener plate on mother plate by welding.
- Replaced Idler Gears (repaired) with new bearings.
- New cover plate (12 mm thick with guide bushes) fabricated and installed.

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 coupling shim and coupling bolts as it was found damaged.
- Replaced Input and output shaft oil seals
- FC -20 coupling between Gearbox and duplex chain drive shaft found loose during inspection. It is attended.

- UT of duplex chain drive shaft carried out.
- 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:

- Removed the complete Bucket assembly from the position.
- 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.
- Replaced 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.
- 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.
- Assembled with Repaired hub & pinion with new shear pins.

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.

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 and found Head Pulley bearings and Rubber lagging of pulley damaged. New rubber lagging done on the Head pulley, reconditioned the bearing area and fixed the same pulley with new bearings.
- Preventive maintenance of Gear box done, replaced the oil seals, oil & 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

- Replaced hoisting rope (102 mtr) of hoisting mechanism with sheave pulley(4Nos.) which was found damaged. Cardium compound provided on wire rope.
- 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	Tail end pulley	01
2	Tail end pulley block	01
3	Disc washer	04
4	Scraper shaft Bearing (Needle-NA4824)	08
5	Oil seal (130x160x16) for scraper shaft	02
6	Oil seal (130x160x13) for O/P shaft of GB KCN 250	01
7	Oil seal (45x60x10) for I/P shaft of GB KCN 250	01
8	Tensioning device.	01
	Slewing Mechanism	
1	Slewing Pinion (12 Teeth)	01
2	Slewing Hub	01
3	Shear Pin	04
4	Rubber Bush for coupling	06

	Elevator Mechanism	
1	Top shaft	01
2	Bearing with front fit taper sleeve	02
3	Oil seal (130x105x16mm) for top shaft	02
4	Pin for take up unit	02
5	Bucket Pin	03
6	Circlips	03
	Hoist Mechanism	
1	Wire rope	102 Mtr
2	Sheave Pulley	04
3	Rubber Bush for coupling	06
	Travel Mechanism	
1	Input oil seal (35x47x7) for Travelling GB	02
2	Rubber Bush for coupling	06
	Link Conveyor	
1	Carrying roller	18
2	Return Roller	02
3	Head pulley Bearing (UCPX12)	02
4	Input Oil seal for GB (50x62x7)	02
5	Output Oil seal for GB (130x105x16)	02
6	Pivot block with pin	01

CONVEYOY BELT JOBS

CONVEYOR M-2110

Following jobs were carried out.

- Replaced the Complete length of conveyor belt with new Conveyor belt (141 meter length & 800 mm width) NN 630 / 4 M/s Nirlon make procured against P.O.No.9921429 Dated 02/01/2008
- Replaced Head pulley with the repaired pulley as running pulley was found damaged.
- Preventive maintenance of Gear Box carried out & coupling done after proper alignment.
- Replaced coupling bushes.
- Head pulley brush roller serviced.
- All damaged and noisy carrying rollers, Return rollers, and guide rollers were replaced.
- All pedestal bearings of snub pulley, head pulley, tail pulley and gravity pulley checked and greasing done.
- 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.
- Rubber lagging done on Tail pulley as it was found damaged
- Replaced carrying rollers with new rollers
- All noisy and damaged , guide and return rollers replaced with new rollers.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Preventive maintenance of Tripper system carried out.
- Realigned the gearbox with motor.
- Replaced coupling bushes.
- Complete cleaning 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.
- Diverter flapper valve of M-2121 conveyor attended for free and easy operation.
- 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.
- Complete greasing of all pedestal bearings done.
- Complete cleaning and painting of structure done.
- Head pulley shaft modified for provision of new Shanthi make gearbox in addition to existing gear box.

CONVEYOR M - 2122

Following jobs were carried out

- Preventive maintenance of Gear Box done and Coupling done after proper alignment.
- Replaced damaged oil seals of gearbox, coupling bushes and bolts
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers.
- Skirt rubbers were replaced.
- Complete greasing in all pedestal bearings done.
- Make new SS guard for head pulley as existing guard found damaged.
- Complete cleaning and painting of conveyor structure done.

CONVEYOR M- 2122 / A1

Following jobs were carried out

- Replaced the Complete length of conveyor belt with new Conveyor belt (37.5 meter length & 800 mm width) NN 630 / 4 M/s Nirlon make.
- 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

- 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.
- Replaced bearing, oil-seals, oil, coupling bolts and bushes.
- All damaged return rollers replaced alongwith J- brackets.
- All carrying rollers attended for free operation.
- New skirt rubber provided.
- 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.
- Cleaning of structure for all the screens was carried out.

PREVENTIVE MAINTENANCE OF PACKER SCALES :

Following preventive maintenance jobs were carried out in all packers Scales i.e. packer scale No. 1, 2, 3,4,7,8, 9A and 10A & 10B.

- Overhauling of Gate assembly.
- Overhauling of bucket assembly.
- Overhauling of sack grip assembly.
- Servicing of all cylinders.
- Replacement and Alignment of stabilizer plate.
- Calibration of packer scales.

Replaced all the bearings of Gate assembly, Bucket assembly, sack grip assembly and rubber gasket.

SLAT CONVEYOR M-2124

Following jobs were carried out on the slat conveyors

- Replaced Gearbox with base frame Slat No. 8 & 9 with 4” NU gear box.
- Preventive maintenance of Gear box done.
- Conveyor adjusting mechanism servicing.
- Cleaning of all slat conveyors.
- Replacement of damaged Coupling bushes and bolts.
- All SS rollers of Filled bag discharge chute at bagging platform checked, cleaned and replaced damaged rollers.

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, Also 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 end belt with new one
- Preventive maintenance of Gear Box and Coupling done after proper alignment.
- 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

INSPECTION JOBS

The following major inspection activities were performed in Ammonia Plant.

- Visual inspection of radiant and convection zone of Primary Reformer. Details are given at **Annexure-1 .**
- Automatic Ultrasonic Scanning of Primary Reformer tubes and risers was carried out by M/s. PDIL. Details are given at **Annexure -2**.
- Inspection of primary reformer catalyst tubes and risers with various NDT Techniques. Details are given at Annexure **- 3 to 6.**
- Visual inspection of equipments.
- RLA Study of steam drum (GT-1632) and its related pipelines and equipment. Details are given at **Annexure-7**
- 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-8**
- Thickness measurement of various equipment was carried out .Details are given at **Annexure-9**
- Thickness measurement of various pipelines was carried out .Details are given at **Annexure-10**
- Measurement of residual magnetism at various parts of rotating equipments and demagnetization of the same wherever required. Details are given at **Annexure-11**
- Insitu metallography of selected equipment and pipelines were carried out.. Detailed summary of observations and microstructure analysis is given at **Annexure-12**
- Inspection of newly fabricated pipelines and fabrication jobs carried out departmentally by Maintenance and Technical department.
- 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 321 nos. of tubes and between 0.17 to 0.70 % in 15 nos. of tubes. Creep measurement of the riser tubes at tunnel slab level was also carried out. Creep was found in the range of 0 - 0.33 % for all 8 nos. of Riser 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

- All the tubes of mixed feed coil were found to have hard scaling on the entire surface, and on some places the scale was loose also.
- All the Tunnel thermo wells were found in satisfactory condition.
- Bottom floor was found sagged at many locations.
- Cracks were observed on refractory linings of walls, roof and pillars.

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.
- Insulation protection sheet inside the duct was badly distorted and burnt off in extreme west passage top.
- Few bolts of west wall sheet(central location) were found missing/damaged.

L.T.CONVECTION SECTION

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

AUXILIARY BOILER

Hot Well Area

- North and West side Cladding sheet has got distorted and also burnt off at various locations.
- Inconel plate and its stiffners were observed bulged/thinned/distorted.
- East plate was found satisfactory.
- Roof plate was found satisfactory.
- East wall of furnace refractory observed having severe cracks.
- Fins of some the finned tubes were found distorted/ damaged.

RLA STUDY OF (GT-1632)

RLA Study of GT-1632 was carried out by M/s. Thermax. Following equipments were covered in this study: Details are given at Annexure-7

- Steam Drum
- Risers / Downcomers
- 101CA & CB ,Primary Waste Heat Exchanger
- 102-C ,Secondary Waste Heat Boiler
- 103-C ,Primary Shift Effluent Waste Heat Boiler
- Main Steam Pipings
- HT & LT Coils
- Auxiliary Boiler Coils
- Superheater Headers

VESSELS & OTHER EQUIPMENTS

107-C, M.P BOILER:(FROM OUTSIDE)

- Grayish black colouration was observed inside the boiler.
- All internals were found intact in position.
- Overall condition of the vessel was found satisfactory.

112-C, L.T. SHIFT CONVERTER INLET BOILER

From North Manhole

- Blackish coloration was observed inside the shell.
- 04 nos. tubes were found plugged.
- Shell and dish end welds were found in satisfactory condition.
- Bottom drain was found chocked with foreign matter, need to be cleaned.
- Overall condition of the vessel was found satisfactory.

From West Manhole

- Tubes in East direction were found sagged.
- Perforated nozzles were found intact.
- Condition of the shell was found satisfactory.

SECONDARY REFORMER (103-D)

Top Air And Gas Entry

- Zig-Zag scattered cracks were observed on the refractory lining all over dome and shell but these cracks were more prominent in upper portion of shell and dome area.
- At few scattered locations cracks having width approx 3mm or more was observed.
- First & Third Thermo well pipe from top was found bent/inclined upwards approx. 45 deg. from horizontal axis where as second Thermowell pipe was found bent upwards 90° from horizontal axis.
- Shift liner observed slightly buckled particularly more on 3rd segment from top.
- Gap of was observed between shift liner of top shell to transfer line liner. Liner patch to transfer line welding observed to have cracked (2" long approx.)
- Target hexagonal bricks and alumina balls were found in satisfactory condition.

107- D ,TRANSFER LINE (FROM INSIDE)

- Minor buckling/distortion of the liner was observed throughout the length of the transfer line.
- Minor damage of the refractory was observed at flange (entry) of the transfer line.
- Thermowell was found intact in position.
- Loose refractory wa observed near rise.
- Superficial cracks were observed on refractory.
- Buckling of liner was observed.

102-EB, CO2 STRIPPER

Visual inspection of vessel from top man hole was carried out and observations are as under

- Demister pads were found damaged in middle portion.
- Demister pads support ring and support angle was found buckled in middle portion.
- All liquid inlet nozzle flange bolts were found in sheared condition.
- East side stiffener pipe of distributor header support was found in broken condition.
- U-Clamp & its holding nuts were found in intact condition.
- South-west side distributor header was found sliding with the shell plate causing dent in the shell plate and same was also mentioned in previous year's inspection report.

LP FLASH VESSEL (103-E2 LP)

TOP MANHOLE COMPARTMENT

- Demister pad was found intact in its position in satisfactory condition.
- Condition of weld joints found satisfactory however these weld joints observed as if etching has occurred resulting in slightly differing colour in comparision to adjacent shell surface. Same was also observed in previous S/D.
- Condition of bubble cap s 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 nos. of rectangular clamps for holding bubble cap support tray were missing . These were marked and shown to mechanical maint. Staff.

BOTTOM MANHOLE COMPARTMENT

- Rectangular riser box and other fittings found intact in position.
- Holding bolts of top bubble cap tray found missing at scattered locations.
- Condition of weld joints was found satisfactory however these weld joints observed as if etching has occurred resulting in slightly differing colour in comparison to adjacent shell surface. Same as previous S/D observation.
- One no. bolt of central channel support East side was found loose. Marked with yellow chalk.

LTS GAURD VESSEL

Visual inspection of LTS Guard was carried out and following observations were made.

- Blackish coloration was observed inside the vessel.
- Condition of Thermo-wells were found satisfactory.
- Catalyst were found laying on the bottom wire mesh screen.
- Condition of the bottom wire mesh screen was found satisfactory.
- Alumina balls were found laying below the bottom wire mesh screen.
- Condition of catalyst dump out nozzle was found satisfactory.
- Condition of inlet distributor nozzle was found satisfactory.
- Some black stone like pieces were found clogged in the holes of the inlet distributor nozzle.

101-F, STEAM DRUM

- Grayish black colouration was observed inside the drum.
- All cyclone separators were found intact in position.
- Demister pad were found intact in position.
- Minor pitting of approx. 0.5 to 0.75mm depth was observed at scattered locations .
- Deep cavities approx. 3mm. to 4mm. deep and 5mm. in dia. were observed on east side shell near circumferential weld joint of shell to South side dish end. The same was also observed during previous S/D.

102-F, RAW GAS SEPARATOR

- Epoxy paint condition was found satisfactory.
- Condition of 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.
- Overall condition of the vessel was found satisfactory.

103-F, REFLUX DRUM

- Demister pads were found intact in its position.
- Epoxy paint was found scatched from few small scattered locations in the vessel. However epoxy primer was found intact at such location.
- Dust was found lying on the bottom of the vessel, need to be cleaned.
- Overall 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 satisfactory.
- Scattered hard scales were observed at bottom dish end.
- Weld joint condition was satisfactory.
- Grayish black coloration was observed on bottom area, whereas 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 pittings 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 pitting 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 pitting / 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.

111-F, SECOND STAGE REFRIGERANT FLASH DRUM

- The shell inside surface had assumed blackish gray coloration.
- The demister pads were found intact in position.
- Entire internal surface of the vessel was found oily.
- Scattered scales were observed on both the dished ends.
- Condition of all weld joints was found satisfactory.
- 10” nozzle on top of shell in the mid of the vessel has appx. 2” seal weld missing marked with yellow chalk.

112-F, THIRD STAGE REFRIGERANT FLASH DRUM

- 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.
- Condition of all weld joints was found satisfactory.

R-111, SULPHER ABSORBER

The following observations were made during visual examination.

BOTTOM COMPARTMENT

- Catalyst was found adhered in the top half of the vessel.
- Brownish gray loose scale was found deposited on the top grating supports.
- Top grating support structure was found in good condition.
- Thermowell was found intact in position.
- Sample point nozzle was found in good condition but its holes was found clogged with catalyst.
- Condition of bottom wire mesh could not be accessed as catalyst and alumina balls were not completely removed from the vessel.

- Top half of the vessel has assumed grayish black coloration whereas bottom half has assumed shiny silver coloration.

TOP COMPARTMENT

- Silver shining scales were found at scattered locations, which are loosely adhered to the shell.
- Brownish coloration was observed behind the scales.
- Condition of bottom wire mesh could not be accessed as catalyst and alumina balls were not completely removed from the vessel.

MISCELLANEOUS JOBS

WELDER QUALIFICATION TESTS

- Performance qualification test of 24 Nos. welders offered by M/s General Engineering was carried out. 06 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 17 Nos. welders offered by M/s Ganesh Engg. was carried out. 12 nos. of welders were qualified during the test. These welders were allowed to perform welding on Primary and Secondary Super Heater Coiles and Burner replacement job in BHEL Boiler and Autocalve liner repairing job.
- Welder qualification test of 05 Nos. welders of M/S. Rambahadur & Co. was carried out. 03 welders were qualified. These welders were qualified for performing general purpose welding 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.

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 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,101-JT, 105-JT, 107JT, 103JLJT were 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.
1	4,5,8,10,11,12
2	2,3,4,5,7,9,10,14
3	4,5,9,10,11,14
4	1,3,4,5,6,8-12,14
5	1,2,3,9,10,12,14
6	1,4-8,11,12
7	3,4,5,10,11,12,14
8	1,3,4,7,8,9,11,12,13
9	4,9,10,11,12

BOTTOM HEADER INSULATION

Header insulation was found damaged near following tube nos.:

Header No.	Tube nos where insulation found damaged
1	21,24,30,31,32,39
2	1 – 7,9,10,14,16,21,26,28
3	1,8,9,10,31,35
4	4-7,22,23,24,41
5	5 – 9, 12,13, Riser,23,36,37
6	2,13,14,16,21,40,41
7	3,5,6,8,14,15,17,18,Riser,25,26,34,36,37,38,40,41
8	1,4,6,9,23,24,25,30,31,34,35

ROOF INSULATION

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

- Riser of row no. 8
- Near tube no. 732,733,716 to 720
- Near tube no. 516,518,519
- Near tube no. 415, 419,420,424,431-434
- Near tube no. 319,330,331
- Near tube no. 202,203,237,241,242
- Near tube no. 109,111,120,126,133,134
- Near burner no. 6 of burner row no. 7
- Near burner no. 1,2,3,10,13 of burner row no. 6
- Near burner no. 1,13,14 of burner row no. 2

REFRACTORY WALLS

North Wall & West Wall

- Found satisfactory.
- Erosion of top layer of refractory was observed at top south end.

TUNNEL SLAB

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

CONVECTION ZONE

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

H.T. CONVECTION SECTION:

From Bottom Manhole

- All the tubes of mixed feed coil were found to have hard scaling on the entire surface, and on some places the scale was loose also.
- All the Tunnel thermo wells were found in satisfactory condition.
- Bottom floor was found sagged at many locations.
- Cracks were observed on refractory linings of walls, roof and pillars.

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 fasteners were found loose.
- Insulation protection sheet inside the duct was badly distorted and burnt off in extreme west passage top.
- Few bolts of west wall sheet (central location) were found missing.

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.

Annexure - 2 (1/5)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

ROW NO.1				ROW NO.2			
Tube	Aus	Tube	Aus	Tube	Aus Grade	Tube	Aus

No.	Grade	No.	Grade	No.		No.	Grade
1	B	22	B	1	B	22	B
2	B	23	B	2	B	23	B
3	B	24	B	3	B	24	B
4	B	25	B	4	B	25	B
5	B	26	B	5	B	26	B
6	B	27	B	6	B	27	B
7	B	28	B	7	B	28	B
8	B	29	B	8	B	29	B
9	B	30	B	9	B	30	B
10	B	31	B	10	B	31	B
11	B	32	B	11	B	32	B
12	B	33	B	12	B	33	B
13	B	34	B	13	B	34	B
14	B	35	B	14	B	35	B
15	B	36	B	15	B	36	B
16	B	37	B	16	B	37	B
17	B	38	B	17	B	38	B
18	B	39	B	18	B	39	B
19	B	40	B	19	B	40	B
20	B	41	B	20	B	41	B
21	B	42	B	21	B	42	B

Annexure – 2 (2/5)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

ROW NO. 3				ROW NO. 4			
Tube	Aus	Tube	Aus	Tube	Aus	Tube	Aus

No.	Grade	No.	Grade	No.	Grade	No.	Grade
1	B	22	B	1	B	22	B
2	B	23	B	2	B	23	B
3	B	24	B	3	B	24	B
4	B	25	B	4	B	25	B
5	B	26	B	5	B	26	B
6	B	27	B	6	B	27	B
7	B	28	B	7	B	28	B
8	B	29	C	8	B	29	B
9	B	30	B	9	B	30	B
10	B	31	B	10	B	31	B
11	B	32	B	11	B	32	C
12	B	33	C	12	B	33	B
13	B	34	B	13	B	34	B
14	B	35	B	14	B	35	B
15	B	36	B	15	B	36	B
16	B	37	B	16	B	37	B
17	B	38	B	17	B	38	B
18	B	39	B	18	B	39	B
19	B	40	B	19	B	40	B
20	B	41	B	20	B	41	B
21	B	42	B	21	B	42	C

Annexure – 2 (3/5)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

ROW NO. 5				ROW NO. 6			
Tube	Aus	Tube	Aus	Tube	Aus	Tube	Aus

No.	Grade	No.	Grade	No.	Grade	No.	Grade
1	B	22	B	1	B	22	B
2	B	23	B	2	B	23	B
3	B	24	B	3	B	24	B
4	C	25	B	4	B	25	B
5	B	26	B	5	B	26	B
6	B	27	B	6	B	27	B
7	B	28	B	7	C	28	B
8	B	29	B	8	B	29	B
9	B	30	B	9	B	30	B
10	B	31	B	10	B	31	B
11	B	32	B	11	B	32	B
12	C	33	B	12	B	33	B
13	B	34	B	13	B	34	B
14	B	35	B	14	B	35	B
15	B	36	B	15	B	36	B
16	B	37	B	16	B	37	B
17	B	38	B	17	B	38	B
18	B	39	B	18	B	39	B
19	B	40	B	19	B	40	B
20	B	41	B	20	B	41	B
21	B	42	B	21	B	42	B

Annexure – 2 (4/5)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

ROW NO. 7				ROW NO. 8			
Tube No.	Aus Grade	Tube No.	Aus Grade	Tube No.	Aus Grade	Tube No.	Aus Grade

1	B	22	B	1	B	22	B
2	B	23	B	2	B	23	B
3	B	24	B	3	B	24	B
4	B	25	B	4	B	25	B
5	C	26	B	5	B	26	B
6	B	27	B	6	B	27	B
7	B	28	B	7	B	28	B
8	B	29	B	8	B	29	B
9	B	30	B	9	B	30	B
10	B	31	B	10	B	31	B
11	B	32	B	11	B	32	C
12	B	33	B	12	B	33	B
13	B	34	B	13	B	34	B
14	C	35	B	14	B	35	B
15	C	36	B	15	C	36	B
16	B	37	B	16	B	37	B
17	B	38	B	17	B	38	B
18	B	39	B	18	C	39	B
19	B	40	B	19	B	40	B
20	B	41	B	20	B	41	B
21	B	42	B	21	B	42	B

Annexure – 2 (5/5)

GRADATION OF RISER TUBES BY AUS CARRIED OUT BY PDIL

ROW NO.	RISER NO.	AUS GRADE
1	1	B
2	2	B
3	3	B
4	4	B
5	5	B
6	6	B
7	7	B
8	8	B

Annexure – 3 (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 – 3 (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	38	04	

Annexure – 3 (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 – 3 (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	36	06	

Annexure – 3 (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 – 4

TUBE SPRING HANGER LOAD READINGS OF PRIMARY REFORMER HARP ASSEMBLY:

COLD LOAD READINGS IN MM:

ROW	TUBE NOS. (SOUTH TO NORTH)																					
	1	2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17	18 19	20 21	22 23	24 25	26 27	28 29	30 31	32 33	34 35	36 37	38 39	40 41	42
1	2	-2	-3	-4	-7	-7	-12	-16	-11	-5	-3	-2	-8	-7	-8	-4	-3	0	0	2	2	6
2	-7	-2	-3	-4	-4	-4	-6	-8	-4	-4	-2	-2	0	0	-4	-5	-7	5	-2	-2	-2	3
3	2	0	0	-5	-4	-6	-6	-4	-2	0	0	0	0	-2	-4	-3	-5	-3	-2	-2	2	0
4	1	4	0	0	0	0	0	0	0	0	4	0	0	0	2	2	0	0	0	0	2	2
5	0	-2	-5	-2	0	0	0	-2	0	0	0	0	0	0	0	3	2	2	3	5	10	2
6	0	-4	-3	-3	0	0	0	0	0	0	0	0	0	-10	-2	0	-2	0	3	5	8	8
7	0	4	0	0	0	0	0	0	0	0	0	-2	0	-5	-5	-5	-5	-3	0	2	3	5
8	0	0	0	0	-3	0	-4	-3	0	0	0	0	0	0	-4	-3	2	0	0	4	4	8

TRANSFER LINE SPRING HANGER LOAD READINGS

ROW	1	2	3	4	5	6	7
READINGS	-38	-30	-27	-33	-40	-20	16

BOTTOM DRAIN READINGS

ROW	1	2	3	4	5	6	7	8
READINGS	95	95	95	95	95	95	95	95

AUXILIARY BOILER SPRING READINGS

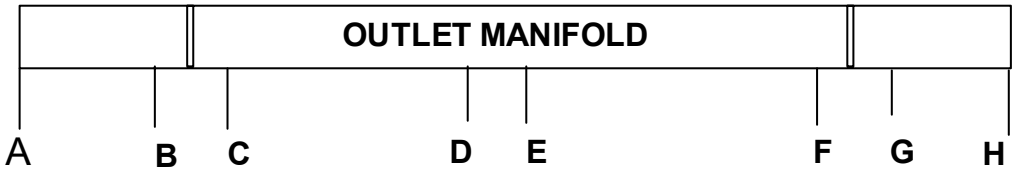
SPRING	S-E	N-E	S-W	N-W
READINGS	62	62	62	62

ANNEXURE- 5

CLEARANCE OF OUTLET MANIFOLD FROM GROUND FLOOR IN COLD CONDITION

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

7	290	290	290	290	290	290
8	280	290	290	290	290	280



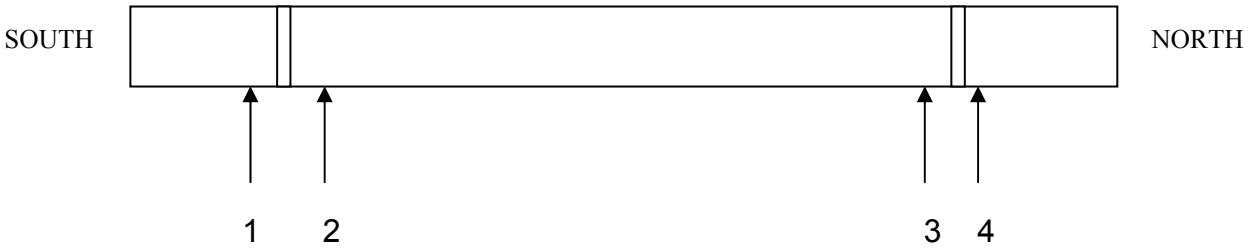
NOTE : (1) All readings are in MM

(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	142.20	142.37	141.17	141.50	141.50	141.45	141.52	141.84
2	142.09	142.44	141.01	141.48	141.48	141.36	141.89	141.52
3	141.90	141.95	141.13	141.27	141.27	141.73	141.43	141.79
4	141.14	141.10	141.29	141.14	141.14	141.28	141.38	141.83
5	141.62	141.60	141.39	141.39	141.39	141.30	141.57	141.69
6	141.45	141.65	141.20	141.12	141.12	141.29	141.60	141.75
7	141.40	141.64	141.15	141.16	141.16	141.25	141.29	141.45
8	141.17	141.32	141.25	141.20	141.20	140.96	141.20	141.19



ANNEXURE – 7

Condition Assessment and Remaining Life Analysis Waste Heat Boiler GT 1632.

Sr. No.	Location / Scope	Testing carried out	Extent of Testing	Observations / Recommendations
1	**Steam Drum**			
	a) Internally & Externally	Visual Inspection	All	Internal and external surface of the drum found to be Ok. No abnormality noticed.
	b) Drum ID and thickness measurement	Dimensional Measurement, Ultrasonic Thickness Gauging	All	No abnormality noticed.
	c) 'L' / 'C' seam	In-situ	7 Nos. replicas	Replicas will be evaluated at

	& base metal and HAZ (Heat Affected Zone)	Metallography	taken.	higher magnification at HO.
	d) On replica locations and dish ends.	Hardness testing	Replica locations and on both dish ends.	Hardness found within limits, no abnormality noticed.
	e) 12" X 12" spots on 'L' & 'C' seams & base metal.	Ultrasonic Flaw Detection (UFD)	100% L and C seam.	No relevant indication present. No major abnormality observed.
	f) Safety valve stubs & integral piping on dish ends, stub welds.	Dye Penetrant Testing & Magnetic Particle Testing.	All accessible piping attached to the drum	No Indication present.
	g) Drum internal deposits if any.	Deposit Analysis	Sample collected for further analysis	Deposits present inside steam drum collected for further analysis at HO.
2	**Riser / Down comers**			
	a) External surface	Visual Inspection.	All	Corrosion under insulation observed. It is recommended to replace the insulation.
	b) Through steam drum.	Fiberoptic internal inspection.	6 mtrs below steam drum.	Minor whitish brown scaling observed in risers & down comers internal surface, however this is generally found in boilers run for longer duration.
	c) All the welds joints to steam drum, accessible weld joints & all the bend locations.	Magnetic Particle Testing (MPT), Dye Penetrate Testing (DPT),.	All the accessible weld joints and bend locations.	Longitudinal crack (2mtrs length X 2.5-3.5 mm depth) found in Down comer X2 from HAZ of Nozzle to pipe joint. However it was grinded – inspected and confirmed to be removed. It is recommended to inspect and replace the entire down comer at the earliest.
Sr. No.	**Location / Scope**	**Testing carried out**	**Extent of Testing**	**Observations / Recommendations**
	d) Weld metal, base metal and HAZ (Heat Affected Zone)	Ultrasonic Flaw Detection (UT) Dimensional measurement.	All the accessible weld joints and bend locations 12" x 12" size at 2 locations	No abnormality observed. No reduction in thickness or diameter observed.
		In-situ Metallography and Hardness testing.	Replica 2 locations tested. 2 replicas were taken on X2 down comer at crack location.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
3	**Heat Exchanger 101 CA & 101 CB**			
	a) External	Visual Inspection	All	No surface abnormality

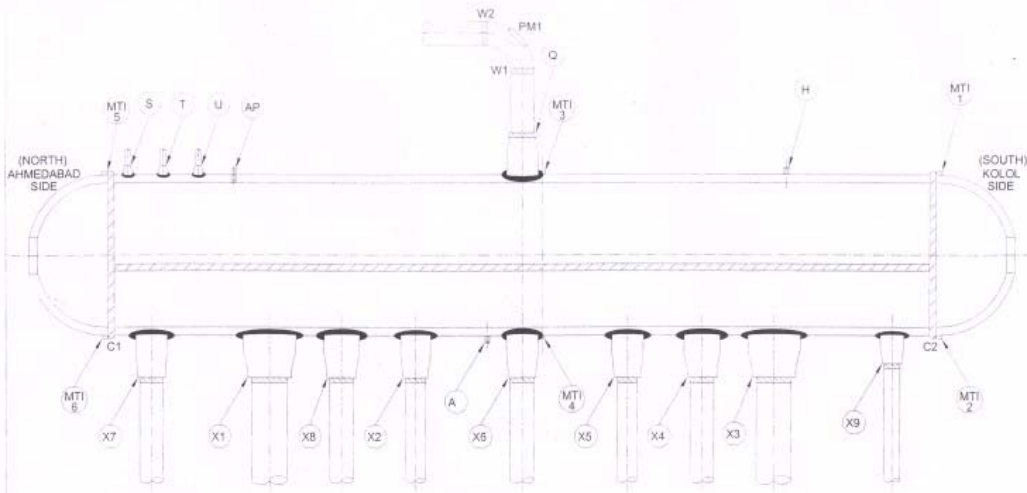
	surfaces of inlet & outlet piping			noticed.
	b) On inlet and outlet piping.	Dimensional measurements, Magnetic Particle testing (MPT), Ultrasonic Flaw Detection (UFD).	All the accessible weld joints & bend locations.	No reduction in thickness or diameter observed. No abnormality observed.
	c) On inlet and outlet piping.	In-situ Metallography and Hardness testing.	Replica 6 locations tested.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
4	**Heat Exchanger 102 C**			
	a) External surfaces of inlet & outlet piping	Visual Inspection	All	No surface abnormality noticed.
	b) On inlet and outlet piping.	Dimensional measurements, Magnetic Particle testing (MPT), Ultrasonic Flaw Detection (UFD).	All the accessible weld joints & bend locations.	No reduction in thickness or diameter observed. No abnormality observed.
	c) On inlet and outlet piping.	In-situ Metallography and Hardness testing.	Replica 2 locations tested.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
5	**Heat Exchanger 103 C**			
	a) External surface of Shell, inlet & outlet header, connecting piping to headers.	Visual Inspection. Dimensional measurements.	All All	External surface of shell found in good condition. Corrosion under insulation observed in headers and connecting piping. It is recommended to replace the insulation. No reduction in diameter observed.
Sr. No.	**Location / Scope**	**Testing carried out**	**Extent of Testing**	**Observations / Recommendations**
	b) Bottom inlet header.	Fiberoptic internal inspection.	Through flange opening.	No abnormality noticed in header. Minor white deposit present, however this is generally found in boilers run for longer duration.
	c) Inlet & outlet header, connecting piping, Shell.	Magnetic Particle testing (MPT) Ultrasonic Flaw Detection (UFD).	All the accessible weld joints. 12" x 12" size at 2 locations on each header and bend locations.	No abnormality observed.
	d) Inlet & outlet header, connecting	In-situ Metallography and Hardness testing.	Replica 2 locations tested on each header.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.

	piping, shell.		One parent location of shell.	
6	**Main Steam Line piping**			
	a) Pipe header external surface till turbine throttle valve & till let down station.	Visual Inspection.	All	External surface found in good condition.
		Dimensional measurements.	All	No reduction in diameter observed.
	b) Through super heater safety valve.	Fiberoptic internal inspection.	Internal surface	Whitish scaling observed on internal surface, however this is generally found in boilers run for longer duration.
	c) Weld joints of all the bend locations and parent metal locations till turbine throttle valve.	NDT on stub joints and header weld joints (MPT / DPT).	All the weld joints in the entire line till turbine throttle valve & also till let down station.	No abnormality observed.
	d) Weld metal, base metal and HAZ (Heat Affected Zone)	Ultrasonic Flaw Detection (UT).	All the weld joints in the line & bend locations 12" x 12" size at 14 locations	No abnormality observed.
		In-situ Metallography and Hardness testing.	**Replica 40 locations tested.**	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
Sr. No.	**Location / Scope**	**Testing carried out**	**Extent of Testing**	**Observations / Recommendations**
7	**HT & LT Coils**			
	a) External surface.	Visual Inspection.	All	External surface found in good condition.
		Dimensional measurements.	All accessible tubes.	No reduction in diameter observed.
	b) All the accessible tubes.	Non Destructive Oxide Thickness Inspection Survey (NOTIS).	At 3 accessible locations	No major abnormalities observed, however life calculation to be interpreted at HO based on oxide scale thickness.
	c) Accessible weld joints.	Dye Penetrate Testing (DPT).	All the accessible tubes.	No abnormality observed.
	d) Weld metal, base metal and HAZ (Heat Affected Zone)	In-situ Metallography and Hardness testing of HT & LT coils.	On 4 replica locations on HT & LT coils.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.

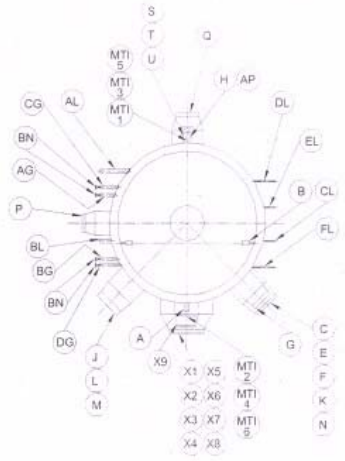
8	**Auxiliary Boiler Coils (A, B, & C Coils)**			
	a) Overall	Visual Inspection	All	No abnormality present.
	b) On all tubes at 3 elevations (so as to cover 100% tubes)	Ultrasonic thickness gauging	At 3 elevations on all 3 coils (A, B, & C).	Thickness gauging did not revealed any abnormality however will be further analyzed at HO.
	c) On all the tubes of (B coils burner elevation)	FHyNES™ (1000 mm length).	All the tubes of B coils at burner elevation.	No abnormality present.
	d) Auxiliary Boiler Coils (A, B & C coils).	In-Situ Metallography. Hardness testing.	3 replicas – one on each coil.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
9	**Superheater Headers.**			
	a) External surfaces.	Visual Inspection	All	No surface abnormality noticed.
	b) All the weld joints and tube to header joints of HT & LT Superheater header (inlet & outlet headers).	Magnetic Particle Testing (MPT), Dye Penetrate Testing (DPT) Ultrasonic Flaw Detection, Dimensional Measurement.	All the weld joints, tube to header joints, 12”X12” parent metal spot.	No reduction in thickness or diameter observed. No abnormality observed.
	c) HT & LT Superheater header inlet and outlet headers.	In-Situ Metallography. Hardness testing.	5 replicas – one on each header and one on connecting header.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
Sr. No.	**Location / Scope**	**Testing carried out**	**Extent of Testing**	**Observations / Recommendations**
10	**Auxiliary Boiler Coil Headers**			
	a) External surfaces	Visual Inspection	All	External surface found to be ok.
	b) A, B, C Coil Bottom Headers.	Dye Penetrate Testing (DPT) Magnetic Particle Testing (MPT), Ultrasonic Flaw Detecting (UFD), Dimensional measurement.	Accessible 20% of tube to header stub joints, Accessible weld joints and 12”X12” parent metal location on each header	No reduction in thickness or diameter observed.
	c) A, B, C Coil Bottom Headers.	In-Situ Metallography. Hardness testing.	3 replicas – one on each header. Hardness on replica location.	Replicas will be evaluated at higher magnification at HO. Hardness found within range.
11	**Supports & Structure**			
	a) External surfaces	Visual Inspection	All	Corrosion on external surface observed on steam drum supports. No major abnormality observed.

	b) Weld joints – supports to pressure part joints.	NDT of all joints (MPT / DPT).	Accessible support to pressure part joints.	No major abnormality observed.

STEAM DRUM



FRONT VIEW



SIDE VIEW

X 1 & 3	18"	SCH	100	DOWN COMER	CONN.	"C" DIM	15.920"
A 4,6,7 & 8	12"	SCH	100	DOWN COMER	CONN.	"C" DIM	11.210"
X 2 & 5	10"	SCH	100	DOWN COMER	CONN.	"C" DIM	9.43"
X 9	8"	SCH	100	DOWN COMER	CONN.	"C" DIM	7.53"
Q	12"	SCH	100	STM OUTLET	CONN.	"C" DIM	11.21"
C 1,2,3 & 4	12"	SCH	100	RISER	CONN.	"C" DIM	11.21"
F 1,2,3 & 4	12"	SCH	100	RISER	CONN.	"C" DIM	11.21"
E,N,K,J,L & M	12"	SCH	100	RISER	CONN.	"C" DIM	11.21"
G	10"	SCH	100	RISER	CONN.	"C" DIM	9.43"
P	6"	SCH	120	FEED INLET	CONN.	"C" DIM	5.58"
S,T &U	2 1/2"		120	SAFETY VALVE	CONN.	"C" DIM	2.75"
A P	3/4"		120	STM GAGE	CONN.	"C" DIM	
B	1 1/2"		120	CONT. B. O.	CONN.	MALE	
W	1"		120	CHEM. FEED	CONN.	MALE	
AG & CG	1 1/2"		120	WATER GAGE	CONN.	FEMALE	
BG & DG	1 1/2"		120	WATER GAGE	CONN.	FEMALE	
AL & BL	2"		120	WATER LEV CONT	CONN.	FEMALE	
CL & DL	3/4"		120	WATER LEV ALARM	CONN.	FEMALE	
BN	1 1/2"		120	INTER. B. O.	CONN.	FEMALE	
H	2"		120	VENT	CONN.	FEMALE	
EL & FL	3/4"		120	WATER LEV ALARM	CONN.	FEMALE	

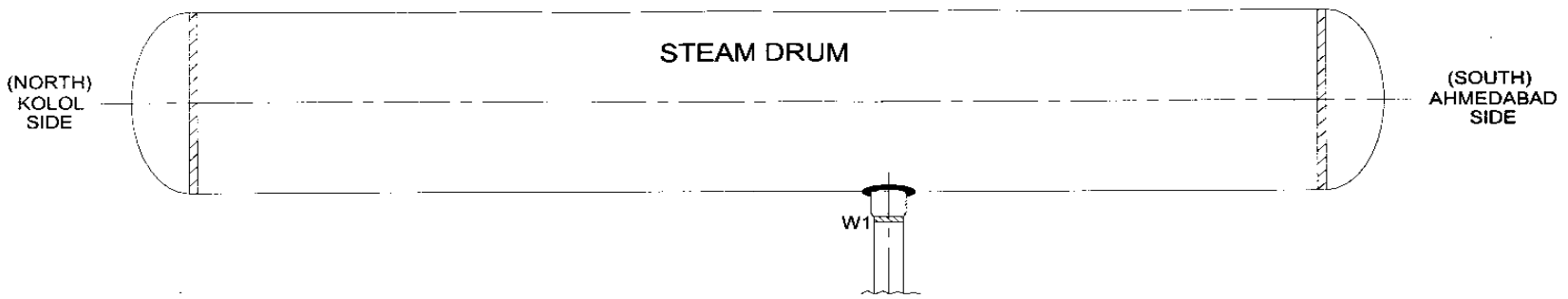
INDICATES MPT & UFD TEST LOCATION.
INDICATES DP" TEST LOCATION.

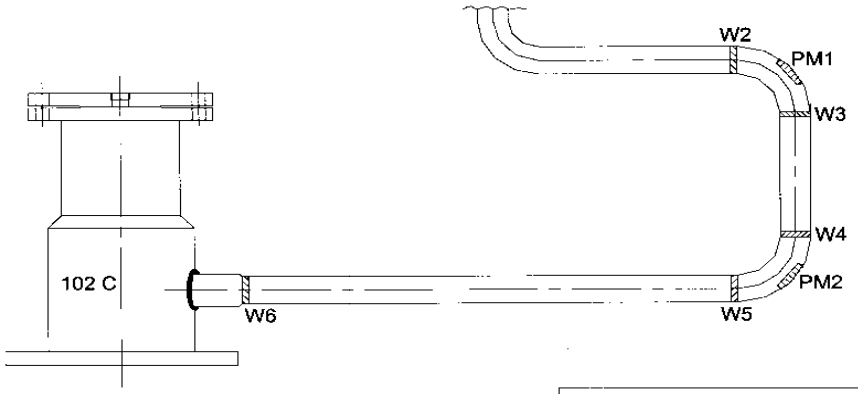
THERMAX BABCOCK & WILCOX

INDIAN FARMERS FERTILISER COOPERATIVE LTD.
KALOL, GUJARAT

BOILER NO. GT - 1632	COMPONENT STEAM DRUM
SKETCH NO.	SCALE NOT TO SCALE
TESTING NON DESTRUCTIVE TESTING	

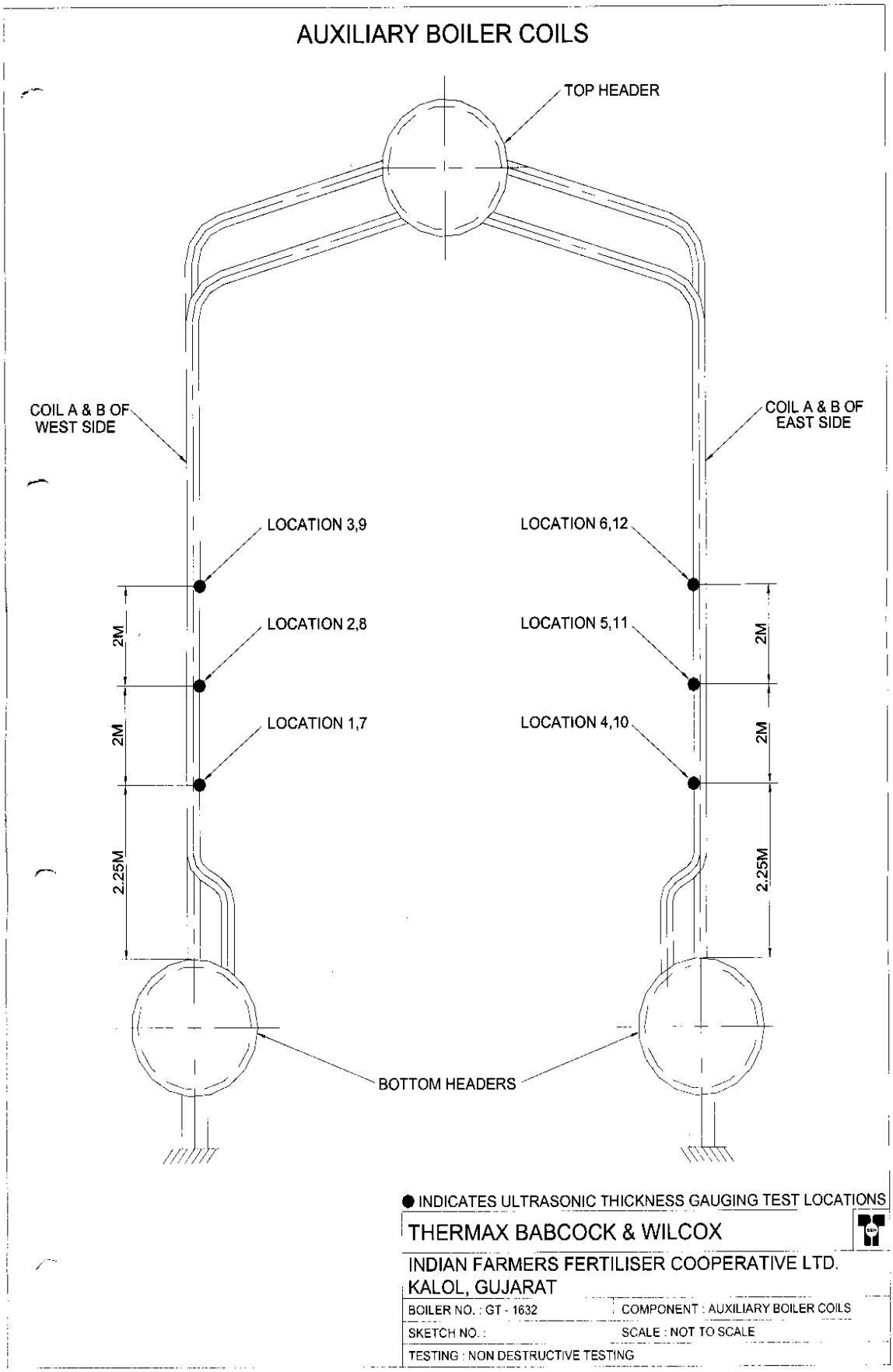
DOWN COMER NO. - X2





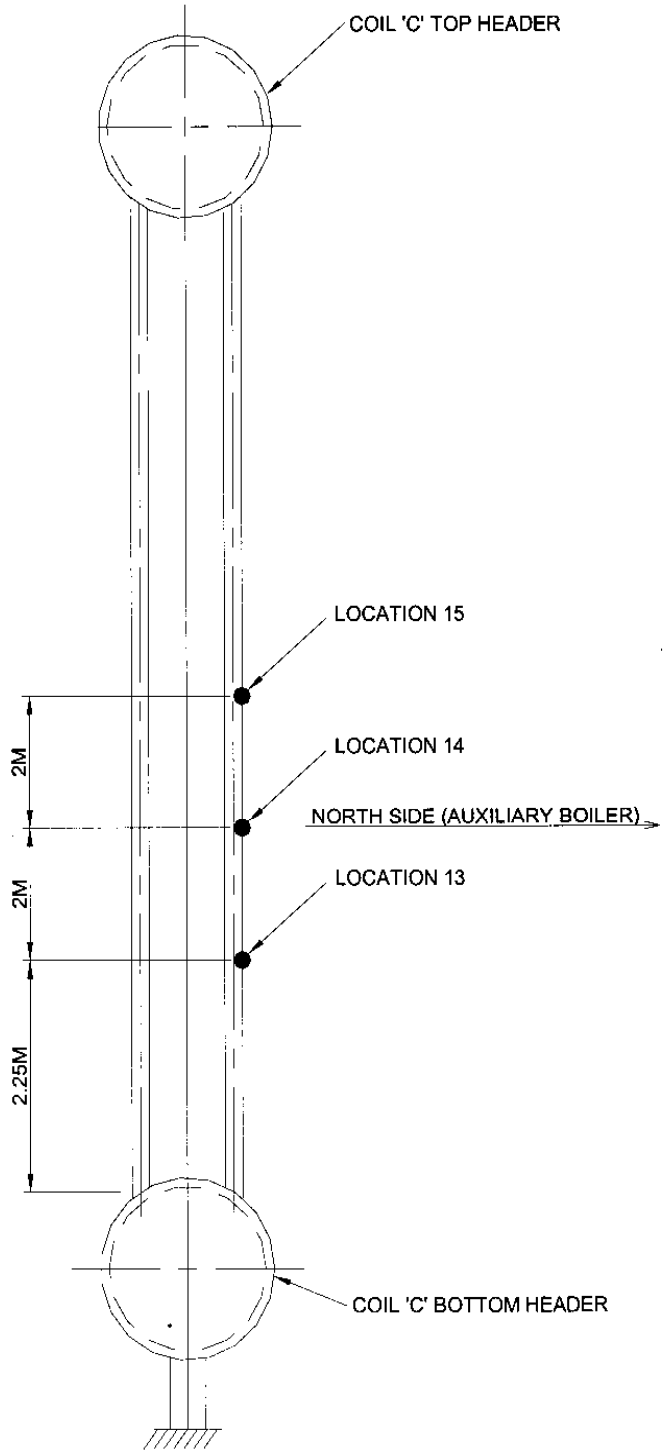
▨ INDICATES MPT & UFD TEST LOCATION.
■ INDICATES DPT TEST LOCATION.

THERMAX BABCOCK & WILCOX	
INDIAN FARMERS FERTILISER COOPERATIVE LTD. KALOL, GUJARAT	
BOILER NO. : GT - 1632	COMPONENT : DOWN COMER NO. - X2
SKETCH NO. :	SCALE : NOT TO SCALE
TESTING : NON DESTRUCTIVE TESTING	



AUXILLARY BOILER COILS NO. : A & B

AUXILIARY BOILER COIL 'C'



● INDICATES ULTRASONIC THICKNESS GAUGING TEST LOCATIONS

THERMAX BABCOCK & WILCOX	
INDIAN FARMERS FERTILISER COOPERATIVE LTD. KALOL, GUJARAT	
BOILER NO. : GT - 1632	COMPONENT : AUXILIARY BOILER COIL 'C'
SKETCH NO. :	SCALE : NOT TO SCALE
TESTING : NON DESTRUCTIVE TESTING	

AUXILLARY BOILER COILS NO. : C

Annexure – 8

UFD OF WELD JOINTS OF FOLLOWING PIPELINES WAS CARRIED OUT:

SR. NO.	LINE NO	SIZE	SCH	FROM	TO	NO. OF WELD JOINTS	REMARKS
1	SG-1303-08-14”	14	120	SG-33-14” (105-D)	108-D Inlet (Bottom)	15	No significant defects were observed.
2	SG-1303-09-10”	10	120	SG-1303-08-14” (105-D)	108-D Inlet (Bottom)	12	
3	SG-1303-08-10”	10	120	SG-1303.08-14”	108-D Inlet (Top North)	07	
4	SG-1303-12-10”	10	120	SG-1303.08-14”	108-D Inlet (Top South)	07	
5	SG-1303-10-14”	14	120	108-D	107-C	12	
6	SG-1303-11-14”	14	140	107-C	123-C	12	
7	SG-1303-02-14”	14	100	121-C	137-C	11	
8	SG-1303-03-8”	8	100	121-C	137-C	07	
9	SG-1303-06-14”	14	100	121-C	137-C	09	
10	SG-1303-04-8”	8	100	137-C	SG-51-8	08	
11	SG-1303-05-12”	12	100	SG-03-12	SG-14-10	06	
12	SG-1303-06-14”	14	100	121-C	124-C	16	
13	SG-1303-01-14	14	100	120-C	SG-35-12	08	
14	A-21-10”	10	120	101-B	103-D	01	
15	NG-09-12”	12	100	101-B	103-D	01	
16	SG-62A-4”	4	XXS	102-B	105D,SG-32-6”	03	
17	SG-62B-4”	4	XXS	102-B	105D,SG-32-6”	03	

Annexure - 9

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	105–CA	Co2 Stripper Gas Exchanger	28.58	29.60	-	26.99	29.20	-	-	-	-
2	105–CB	Co2 Stripper Gas Exchanger	28.58	29.30	-	26.99	28.50	-	-		-
3	108-C1A	aMDEA Solution Cooler	-	11.80	-		15.70	-	-	12.00	-
4	108-C2A	aMDEA Solution Cooler	-	13.00	-		15.40	-	-	12.60	-
5	112-C	Low Temp. Shift Inlet Boiler	12.70		-	26.9	28.80	-	-	32.50	-
6	123-C	NH3 Feed Water Exchanger			-		48.00	-	-		-
7	101-JCA	Surface Condenser			-			-	-	8.70	-
8	101-JCB	Surface Condenser		12.0	-			-	-	10.50	-

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.
9	101-JLC1	Lub Oil & Seal Oil Cooler for 101J/105J		7.80	-			-	-	7.80	-
10	101-JLC1	Lub Oil & Seal Oil Cooler for 101J/105J		7.90	-			-	-	7.20	-
11	101-D	Desulphuriser No.1	60.30	61.70	-	60.30	66.50	-	-	-	-
12	102-D	Desulphuriser No.2	60.30	62.90	-	60.30	67.70	-	-	-	-
13	104-D	Shift Converter	60.32	63.60	-	60.32		-	-	-	-
14	103-E2LP	L.P. Flash Vessel (Top Manhole)		14.58	-		14.40	-	-	-	-
15	102-F	Raw Gas Separator	34.93	36.70	-	33.33		-	-	-	-
16	103-F	Co2 Stripper Reflux Drum	11.11	10.00	-	11.1	13.30	-	-	-	-
17	109-F	Refrigerant Receiver	21.40	21.00	-	18.00	19.60	-	-		-
18	117-FA	aMDEA Carbon Filter	10.00	9.80	-	10.00	9.10	-		-	
19	141-F	New Instrument Air Receiver	NA	9.50	-	NA	10.00	-		-	-
20	2002-F	Demineralised Water Storage Tank	4.80	4.40	-	4.80	5.0	-		-	-
21	2001-LF	Hydrazine Mixed Tank	NA	2.90	-	NA	2.70	-		-	-
22	2002-LF	Phosphate Mixed Tank	NA	2.80	-	NA	3.90	-			-
23	2004-LF	Mixed Tank	NA	2.70		NA	2.30				
24	101-JLT	Lube Oil Tank for 101J	NA	6.40		NA	6.0				
25	103-JLT	Lube Oil Tank for 103J	NA	6.00		NA	6.00				
26	101-U	Deareator	9.53	9.90							-
27	2005-U	Condensate Polisher	NA	14.50		NA	23.80	-	-	-	-
28	2006-UF1	Salt Storage Tank	NA	4.90		NA	7.90	-	-	-	-
29	2006-UF2	Salt Storage Tank	NA	9.70		NA	8.0	-	-	-	-

Sr.	Equipt .	Equipment	Shell	Dish End	Channel

No	No.	Description	Nom./ Design	Min. Measured	% Red.	Nom./ Design	Min. Measured	% Red	Nom./ Design	Min. Measured	% Red.
30	2007-U	Resin Trap	NA	7.80		NA	9.0	-	-	-	-
31	1303-JLC1 (Top)	Lub & Seal Oil Cooler for 103-J	NA	7.40		NA	7.10	-	-	6.70	-
32	1303-JLC1 (Bottom)	Lub & Seal Oil Cooler for 103-J	NA	7.63		NA	6.80	-	-	8.0	-
33	2003-L (AD-A)	Instrument Air Drier		7.10			7.60	-	-	-	-
34	2003-L (AD-B)	Instrument Air Drier		6.60			7.70	-	-	-	-
35	H-110	Naphtha Pre heater (Conv. Coil)	5.50	5.0				-	-	-	-
36	H-110	Naphtha Pre heater (Radiant Coil)	8.56	7.20					-	-	-
37	H-111	Naphtha Superheater Coil (Conv. Coil)	7.11	7.60					-	-	-
38	H-111	Naphtha Superheater Coil (Radiant Coil)	10.97	8.0					-	-	-
39	173-C	Stripped Condensate Cooler	9.50	8.30				-	-	9.10	-

THICKNESS MEASUREMENT REPORT OF COILS				
SR. NO.	DESCRIPTION	DESIGN THICKNESS	MEASURED THICKNESS	% REDUCTION
1	BFW COIL OFFSITES (LT Convection, bottom most)	5.54	4.6	16.97
2	BFW COIL OFFSITES (LT Convection, 2nd from bottom)	5.54	4.5	18.77
3	NG FUEL FEED COIL	3.9	3.2	17.95
4	MIXED FEED COIL	8.0	11.40	-
6	BFW COIL AMMONIA	5.5	4.8	12.73
7	HT STEAM SUPER HEATER COIL	8.0	7.50	6.25
8	BFW COIL, BHEL BOILER	5.54	5.1	7.94
9	LT STEAM SUPER HEATER COIL	7.01	6.60	5.85
10	AUXILLIARY BOILER, COIL-A	7.0	6.4	8.57
11	AUXILLIARY BOILER, COIL-B	7.0	6.5	7.14
12	AUXILLIARY BOILER, COIL-C	7.0	6.5	7.14

ANNEXURE- 10

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.	A-32	6	40	7.11	CS	3RD ST. I/L 101J	V-18/ATM VENT	7.2	-
2.	CW-07	36		7.93	CS	CW-5	127-CB	6.2	21.81
3.	CW-09	10	30	7.8	CS	CW-23	115-C	6.9	11.54
4.	CW-48	6	40	7.11	CS	CW-5	173-C	5.5	22.64
5.	HS-07	10	100	18.3	P-11	HS-4	103-J	17.2	6.01
6.	HS-09	8	100	23.01	P-11	HS-5	HS-12	17.8	22.64
7.	HS-11	6	120	14.27	P-11	HS-9	PIC-13B	14.1	-
8.	HS-20	2	160	8.71		TRCV-142 STEM D/S LINE		7.2	17.36
9.	HW-04	2.5	40	5.16	CS	103-J GLAND CON.	HW-7	3.6	30.23
10.	HW-11	8	20	6.35	CS	116-C	HW-5	6	5.51
11.	HW-25	6	40	7.11	CS	124C	HW5	5.2	26.86
12.	aMDEA-19	8	30	7.04	CS	107-JD	aMDEA -21	6.8	14.77
13.	MS-06	6	40	7.11	CS	MS-1	107-JT	5.8	18.42
14.	NG-07	8	20	6.4	CS	101-B, NG FEED PRE-HEAT COIL	NG-8	6.0	6.25
15.	NG-22	6	40	7.11	CS	NG-16	NG-30	7.2	
16.	PG-08	20	STD	9.525	CS	104-C	112-C	8.8	7.61
17.	PG-12A	14	30	9.525	SS-304	105-CA	PG-26	7.5	21.26
18.	PG-12B	14	30	9.525	SS-304	105-CB	PG-26	8.5	10.76
19.	PG-14	16	40	12.7	CS	106-C	112-F	8.6	32.28
20.	PG-17	14	20	7.9	CS	136-C	104-C	8	
21.	PG-26	18	30	11.13	SS-304	HEADER		8.7	21.83
SR.	LINE	N.B.	SCH.	NOM.	MAT.	LINE DESCRIPTION		Minimum	%

NO.	NO.	(in.)		THK. (mm)		FROM	TO	Thickness Observed (mm)	RED.
22.	PG-33B	4	40	6.02	SS-304	105--CA	PG-34	6	
23.	PG	2	80	5.54	CS	BYPASS LINE	SP4(PG-8-18")	5.5	0.72
24.	PG	1	80	4.55	CS	BYPASS LINE	SP5(PG-20-8")	4	12.09
25.	PG-1101-01-F34	6	40	7.1	P-11	H-110	R-110	5.7	19.53
26.	PG-1102-01-G36	14	80	19.05	P-11	R-111	R-112	24.9	
27.	PG-1103-01-G36	6	80	10.97	P-11	PICV-1027 U/S GAS LINE		10.4	5.19
28.	PG-1103-01-G36	14	80	19.05	P-11	R-111	101-B	19.1	
29.	RG-04 (A21) PGR	4	40	6.02	CS	B-4	R1 & R2	5.5	8.63
30.	RG-03 (A21)PGR	4	40	6.02	CS	E-4	R1 & R2	6.6	
31.	PW-02	2	40S	3.91	SS	PW-03	LC-3B	2.6	33.50
32.	PW-03	2	40S	3.91	SS	PW-01	PW-12	3.0	23.27
33.	PW-05	2	10S	2.77	SS	106-J	PG-10	3.6	
34.	PW-13	6	80	10.97	CS	PW-12	SEWER	7.1	35.27
35.	PW-20A	6	80	10.97	CS	PW-20	170-JA	7.7	29.80
36.	PW-31	12	40	10.31	CS	PW-30	104-E	7.4	4.8
37.	SC-07	2.5	80	7.01	CS	SC-42	101-JCA	4.6	34.37
38.	SC-47A	10	40	9.27	CS	101JC	112J	6.0	35.27
39.	SC-47B	10	40	9.27	CS	101-JC	112-JA	6.0	35.27
40.	WA-01	36		7.93	CS	127-CA	WA-3	6.9	12.98
41.	WA-01	30		6.35	CS	101-JCA	WB-3	4.7	25.98
42.	WA-02	36		7.93	CS	127-CB	WA-03	6	24.33
43.	WA-03	36		7.93	CS	HEADER	WA-15 & WA-8	6.0	24.33
44.	WA-12	16	20	7.92	CS	WA-8	108-C2A	7.3	7.83
45.	WA-15	30		6.35	CS	WA-3	101-JCA	4.9	22.83
SR.	**LINE**	**N.B.**	**SCH.**	**NOM.**	**MAT.**	**LINE DESCRIPTION**		**Minimum**	**%**

NO.	NO.	(in.)		THK. (mm)		FROM	TO	Thickness Observed (mm)	RED.
46.	WA-17	8	30	7.04	CS	WA-15	116-C	8.8	-
47.	WA-34	6	40	7.11	CS	WA-23	WA-37/38	5.3	25.45
48.	FICV-14	6	40	7.11	CS	aMDEA-98	102-EB	5.9	17.01
49.	CW-30	6	40	7.11	CS	CW-9	131-JC	6.2	12.70
50.	WA-21	4	40	6.02	CS	UNDER GROUND	103-JA/JB	4.6	23.58
51.	HW-14	4	40	6.02	CS	103-JA/JB	UNDER GROUND	5.2	13.62
52.	NG-23	8	40	8.18	CS	NG-30-20”	NG-26-6”	8.0	2.20
53.	NG-26	6	40	7.11	CS	NG-23-8”	5-AUX. BURNERS	6.9	2.95
54.	HW-48	6	40	7.11	CS	173-C	HW-5	7.4	-
55.	NH-17	6	80	10.97	CS	109-F	NH-88-8”	9.6	12.48
56.	NH-88	8	80	12.70	CS	NH-17-6”	121-J	10.8	14.96
57.	NH-88-A	8	80	12.70	CS	NH-88-8”	121-JA	9.8	22.83
58.	SG.1303.01	14	100	23.83	CS	120-C	SG-35-12”	23.0	3.64
59.	SG.1303.02	14	100	23.83	CS	121-C	SG.1303.03 (121-C)	21.7	8.93
60.	SG.1303.03	8	100	15.09	CS	SG.1303.02.14” (121-C)	137-C	14.6	3.24
61.	SG.1303.04	8	100	15.09	CS	137-C	SG-51-8”	14.2	5.89
62.	SG.1303.06	14	100	23.83	CS	121-C	124-C	21.0	11.87

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
101-BJT			
Journal Bearing Liner	East Side	2.1	2.1
	West Side	1.9	1.9
Shaft Journal	East Side	2.5	2.5
	West Side	3.0	3.0
101-JR (High Speed Drive Pinion)			
Journal Bearing	East Side	1.6	1.6
	West Side	1.8	1.8
Shaft Journal	East Side	2.7	2.7
	West Side	1.2	1.2
101-JR(Low Speed Driven Gear)			
Journal Bearing Liner	East Side	2.7	2.7
	West Side	2.5	2.5
Shaft Journal	East Side	2.7	2.7
	West Side	3.2	3.2
101-BJ			
Journal Bearing Liner	East Side	2.5	2.5
	West Side	2.0	2.0
Shaft Journal	East Side	3.4	3.4
	West Side	1.9	1.9
Thrust Collar	West Side	1.5	1.5
Thrust Bearing	West Side	2.0	2.0
115-JAT			
Journal	Non drive end	1.1	
	Drive end	2.7	
Journal Bearing	Non drive end	0.9	
	Drive end	0.7	
Thrust Collar		2.7	
Thrust Bearing	Active	0.8	
	Inactive	1.3	
115-HT(hydraulic turbine)			
Journal	Non drive end	1.2	
	Drive end	1.6	
Journal Bearing	Non drive end	0.6	
	Drive end	1.3	
Thrust Collar		1.0	
Thrust Bearing	Active	0.8	
	Inactive	0.9	
Gear Box	High Speed Shaft		
DESCRIPTION	**POSITION**	**BEFORE (Gauss)**	**AFTER (Gauss)**
115-JA (Gear Box)			

High Speed Shaft,Journal Bearing	West End	3.3	
High Speed Shaft,Journal	West End	2.6	
	East End	0.8	
Low Speed Shaft,Journal Bearing	East End	2.9	
Low Speed Shaft,Journal	West End	0.8	
	East End	1.3	
115-JA (Pump)			
Pump journal bearing	Inboard	1.4	
	Outboard	1.9	
Thrust Pads Outboard	Inactive	2.4	
	Active	2.2	
Shaft Journal	Inboard	2.6	
	Outboard	2.0	
Thrust Collar		2.1	
115-JBT			
Journal	Non drive end	1.2	
	Drive end	2.1	
Journal Bearing	Non drive end	2.7	
	Drive end	4.9	0.5
Thrust Collar		.09	
Thrust Bearing	Active	0.8	
	Inactive	1.6	
Gear Box	High Speed Shaft		
115-JA (Gear Box)			
High Speed Shaft,Journal Bearing	West End	2.0	
High Speed Shaft,Journal	West End	0.7	
	East End	1.3	
Low Speed Shaft,Journal Bearing	East End	1.1	
Low Speed Shaft,Journal	West End	0.9	
	East End	0.8	
115-JA (Pump)			
Pump journal brg.	Inboard	2.7	
	Outboard	0.5	
Thrust Pads OB	Inactive	1.2	
	Active	2.7	
Shaft Journal	Inboard	1.9	
	Outboard	1.8	
Thrust Collar		2.0	

ANNEXURE-12

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	Location: 1 (Parent Metal) On face of 1st Bend of NG-9-12" (101B mixed feed coil outlet to NG11)	P 11	Microstructure shows ferrite and spheroidial carbide structure. Degradation of pearlite observed in terms of spherodization. Possibilities of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
2	Location: 2 (Weld / Haz) On weld between Pipe & Bend of NG-9-12" (101B-mixed feed coil outlet to NG-11)	P 11	Microstructure shows isolated creep cavities at the grain boundaries.	Creep cavities are present .II nd stage of creep ,monitor after 2 years of service.
3	Location: 3 (Weld / Haz) Between Pipe & bend of NG-9-12" (101B mixed feed coil outlet to NG11)	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 3rd stage of creep monitor after 1 year of service.
4	Location: 4 (Weld / HAZ of P-11) On dissimilar Weld between pipe & Nozzle of header	P 11 to 304H	Isolated + oriented creep cavities are observed at grain boundaries on P11 metal side	Creep cavities are present .II nd stage of creep ,monitor after 1 year of service.
5	Location: 5 (Weld / Haz) On dissimilar Weld Between pipe & Nozzle of Header	304H to 304H	Microstructure at parent metal (SS 304H) shows austenite grains with twins where as 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.
6	Location: 6 (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 and fine-grained ferrite/pearlite structure. Parent metal microstructure shows fine-grained non-uniformly distributed ferrite/pearlite structure with presences of widmanstatten ferrite. Initial stage of in-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**

7	Location: 7 (Weld / Haz) On weld between flange & Bend of gas inlet nozzle.PG-6 – 18" towards east side of 103-C	P-11	Microstructure shows isolated creep cavities at the grain boundaries with indication of getting oriented in the direction of stress.	IInd stage of creep degradations. Monitor after 1 year of service.
8	Location: 8 (Parent Metal) SG - 34 - 14" On face of gas outlet bend	P 11	Microstructure shows fine-grained ferrite and pearlite structure. In situ spheroidzation of pearlite observed.	IInd stage of creep degradations. Monitor after 1 year of service.
9	Location: 9 (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 and coarse-grained ferrite/ bainite structure. Parent metal shows fine-grained ferrite/pearlite structure. Initial stage of in-situ spheroidzation of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
10	Location: 10 (Weld / Haz) SG-34-14 On weld & Haz of pipe of gas outlet bend	P 11	Microstructure shows isolated creep cavities at the grain boundaries.	Creep cavities are present .II nd stage of creep ,monitor after 2 years of service.
11	Location: 11 (Weld / Haz) SG-1303, 09--10 (H-36) On 108D converter inlet nozzle	P-22	Microstructure shows isolated creep cavities at the grain boundaries.	Creep cavities are present .II nd stage of creep ,monitor after 2 years of service.
12	Location: 12 (Weld / Haz) SG-1303, 09-10 (H-36) On 108D converter inlet nozzle of bend at bottom .	P-22	Microstructure at HAZ shows fine-grained ferrite and bainite structure. Where as parent metal microstructure shows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	IInd stage of creep degradations. Monitor after 1 year of service.
13	Location: 13 (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 parent metal microstructure shows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	IInd stage of creep degradations. Monitor after 1 year of service.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**

14	Location: 14 (Weld / Haz) SG-1303, 10-14 (H-36) On 108D converter outlet nozzle of pipe	P-22	Microstructure at HAZ shows fine-grained ferrite and bainite structure. Whereas at parent metal microstructure shows ferrite and bainite structure. Bainite is observed degrading in to carbides and ferrite.	IInd stage of creep degradations. Monitor after 1 year of service.
15	Location: 15 (Weld / Haz) SG-1303 10-14 (H-36) On 107C Gas inlet nozzle of pipe	P-22	Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows in situ spherodization of pearlite/bainite structure. Indications of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
16	Location: 16 (Weld / Haz) SG - 1303 11-14 (H-34) On 107C Gas outlet nozzle & Haz of pipe	P-11	Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows in situ spherodization of pearlite/bainite structure. Indications of isolated creep cavities are observed	IInd stage of creep degradations. Monitor after 1 year of service.
17	Location:17 (Weld / Haz) SG-1303 11-14 (H-34) On 107C Gas outlet nozzle	P-11	Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows in situ spherodization of pearlite/bainite structure. Indications of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
18	Location: 18 (Weld/Haz) SG-1303 11-14 (H-34) On 123C Gas inlet nozzle	P-11	Microstructure at HAZ shows fine-grained bainite and ferrite structure. Parent metal microstructure shows fine-grained bainite and ferrite structure.	IInd stage of creep degradations. Monitor after 1 year of service.
19	Location: 19 (Weld/Haz) SG-1303 11-14 (H-34) On 123C Gas intlet nozzle Haz of bend	P-11	Microstructure at weld shows dendritic structure ferrite/carbides and bainite structure. Whereas at parent metal microstructure shows ferrite and spherodized pearlite structure. Indications of isolated creep cavities are observed at grain boundaries.	IInd stage of creep degradations. Monitor after 1 year of service.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**
20	Location: 20 (Parent Metal) SG-1-12" On face of 3rd bend of gas intlet line	P-11	Microstructure shows fine-grained ferrite and spherodized pearlite structure.	IInd stage of creep degradations. Monitor after 1 year of service.

21	Location: 21 (Parent Metal) SG-1-12" On face of 1st bend of gas intlet line	P-11	Microstructure shows fine-grained ferrite and pearlite structure. In situ spherodization of pearlite observed.	IInd stage of creep degradations. Monitor after 1 year of service.
22	Location: 10 (Parent Metal) PIC 13B inlet spool piece	Carbon Steel	Microstructure shows fine grained ferrite and pearlite structure. In situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
23	Location: 23 (Parent Metal) MIC-22 Up stream piece	Carbon Steel	Microstructure shows fine gained ferrite and pearlite structure. In situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
24	Location: 24 (Weld / Haz) 102B SG-62 A-4 line	A-335, Grade-5	Isolated creep cavities are observed at the grain boundaries.	IInd stage of creep degradations. Monitor after 2 year of service.
25	Location: 25 (Weld / Haz) 102B SG-62 B-4 line	A-335, Grade-5	Isolated creep cavities are observed at inter-dendritic regions with indication of orientation	Creep avities are present. II nd stage of creep monitor after 1 year of service.
26	Location: 28 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-1	P-22	Presences of isolated creep cavities are observed.	Monitor after two years of service.
27	Location: 29 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-2	P-22	Microstructure shows fine-grained essentially ferrite structure. Indications of creep cavities are observed at grain boundaries.	IInd stage of creep damage. Monitor after 1 year of service.
28	Location: 30 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-3	P-22	Microstructure shows fine-grained essentially ferrite structure. Indications of creep cavities are observed at grain boundaries.	IInd stage of creep damage. Monitor after 1 year of service.
29	Location: 31 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-4	P-22	Microstructure shows in situ spherodization of ferrite/pearlite & bainite structure. Indications of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**
30	Location: 32 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-5	P-22	Microstructure shows in situ spherodization of ferrite/pearlite & bainite structure. Indications of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.

31	Location: 33 (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 spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
32	Location: 34 (Parent Metal) Pre reformer R-112 Outlet line pipe after 1st outlet elbow	P-22	Microstructure shows ferrite and spheroid carbide structure. Degradation of bainite is observed. Possibilities of isolated creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
33	Location: 35 (Weld / HAZ) Pre reformer R-112 Outlet line pipe to 2nd 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.	IInd stage of creep degradations. Monitor after 1 year of service..
34	Location: 36 (Weld / HAZ) SG-26-6" SG-23 to MICA-14	Carbon Steel	Microstructure at weld shows ferrite and carbides in dendritic form where as at HAZ microstructure shows fine-grained ferrite / pearlite structure. Microstructure at parent metal shows fine grained non-uniformaly distributed ferrite/ pearlite structure with presences of widmanstatten ferriteIn-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service..
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**

35	Location: 37 (Weld / HAZ) SG – 27 - 6" MICA - 15 to MICA - 15	Carbon Steel	Microstructure at weld shows ferrite and carbides in dendritic form where as at HAZ microstructure shows fine-grained ferrite / pearlite structure. Microstructure at parent metal shows fine grained non-uniformaly distributed ferrite/ pearlite structure with presences of widmanstatten ferriteIn-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service..
36	Location: 38 (Weld / HAZ) SG – 28 - 6" MICA-16 to MICA-16	Carbon Steel	Microstructure at weld shows ferrite and carbides in dendritic form where as at HAZ microstructure shows fine-grained ferrite / pearlite structure. Microstructure at parent metal shows fine grained non-uniformaly distributed ferrite/ pearlite structure with presences of few widmanstatten ferrite. In-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service..
37	Location: 39 (Weld / HAZ) SG – 32 - 6" SG - 62A/B to SG-25	P-5	Microstructure at weld shows ferrite and carbides in dendritic form where as at HAZ microstructure shows fine-grained ferrite / pearlite structure. Microstructure at parent metal shows fine grained non-uniformaly distributed ferrite/ pearlite structure with presences of few widmanstatten ferrite. In-situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service..
38	Location: 40 (Weld / HAZ) 101-F Steam drum (On circum weld joint of shell of south side DE)	SA 515 Gr. 70	Weld microstructure shows ferrite and carbides in dendrite form. HAZ microstructure shows fine ferrite pearlite structure. Parent metal microstructure shows fine-grained ferrite pearlite structure. In situ spherodization of pearlite is observed.	IInd stage of creep degradations. Monitor after 1 year of service.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**

39	Location: 41 (Weld / HAZ) 101-F Steam drum (On circum weld joint of shell)	SA 515 Gr. 70	Weld microstructure shows ferrite and carbides in dendrite form.HAZ microstructure shows fine ferrite pearlite structure. Parent metal microstructure shows fine-grained ferrite pearlite structure. In situ spherodization of pearlite is observed.	IInd 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.
40	Location: 42 (Weld / Haz) Main steam pipe HS-2H-12" 120mm below the bottom butt weld of valve.	Carbon Steel	Weld microstructure shows ferrite and carbides in dendrite form. HAZ microstructure shows fine ferrite pearlite structure. Parent metal microstructure shows fine grained ferrite/pearlite structure.	IInd stage of creep degradations. Monitor after 1 years of service..
41	Location:43 (weld / Haz) 104D HTS on "T" Joint	SA516 Gr. 70	Microstructure at weld shows fine dendritic structure of ferrite and carbides. Where as at HAZ microstructure shows fine-grained ferrite and pearlite structure. Parent metal microstructure shows fine-grained ferrite pearlite structure.	IInd stage of creep degradations. Monitor after 1 years of service..
42	Location: 44 (Parent Metal) At bottom dish end from south side. (104-D, HTS)	P1	Microstructure shows fine grained ferrite/ pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.
43	Location: 45 (weld / HAZ) At LS weld joint bottom side shell from south side(104-D, HTS)	P1	Microstructure at weld shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse grained ferrite / pearlite structure. Parent metal microstructure shows fine-grained ferrite / pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.
SR. NO.	**LOCATION**	**MOC**	**MICROSTRUCTURE OBSERVATION**	**REMARK**

44	Location: 46 (weld / HAZ) At TS weld joint bottom side shell from south side. (104-D, HTS)	P1	Microstructure at weld shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse grained ferrite / pearlite structure. Parent metal microstructure shows fine-grained ferrite / pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.
45	Location: 47 (Parent Metal) At bottom side shell from south side. (104-D, HTS)	P1	Presence of spheroidal carbides are observed.	Monitor after 1 year of service. Recommended to monitor from external surface.
46	Location: 48 (Parent Metal) At top side shell from south side. (104-D, HTS)	P1	Microstructure shows fine grained ferrite / pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.
47	Location: 49 (weld / HAZ) At TS weld joint top side shell from south side. (104-D, HTS)	P1	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 microstructure shows fine- grained ferrite / pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.
48	Location: 50 (Parent Metal) At top dish end from south side. (104-D, HTS)	P1	Microstructure shows fine grained ferrite / pearlite structure. In -situ spherodization of pearlite is observed.	Monitor after 1 year of service. Recommended to take microstructure from external surface.

UREA PLANT

INSPECTION JOBS:

During Shutdown 2009, the following major inspection activities were performed in the Urea plant.

- Internal inspection of High-pressure vessels viz Autoclave (V-1201), H.P Stripper (H-1201), H.P Condenser (H-1202), H.P Scrubber (H-1203).
- Inspection of Autoclave liner weld repair job in Compartment no.1 & 3.
- Air test of Complete Autoclave liner weld joints. Detailed report is attached at **Annexure-1**
- Eddy Current Testing of H.P. Stripper tubes, H.P. Condenser tubes & K-1801 Intercoolers H-1811, H-1812 & H-1813 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-2.**
- Ultrasonic thickness measurement of lines other than H.P lines in the plant. Detailed report is attached at **Annexure-3.**
- Ultrasonic thickness measurement of various equipment in the Plant. Detailed report is attached at **Annexure-4.**
- 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-5**.
- Insitu-Metallography at selected spots on some equipment was carried out. Summary of observations and microstructure analysis is given in **Annexure-6**.
- 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 equipments of the Urea Plant were inspected. Main observations are listed here:

AUTOCLAVE (V-1201):

VISUAL INSPECTION:

Thorough visual inspection of the liner, its welds, trays and internals 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 also grayish oxide layer was observed on dome and man way surface.
- Dark brown grayish patches observed on East side of shell liner.
- Some of the tray holding nuts were found loose.
- Bolts found stuck in the clearance between down comer & tray.
- Bulging on petal weld East side approx. in 3" length approx. 6" from C-seam.

Compartment No.2

- Minor roughening of tray holding clits and grayish brown oxide layer was observed on bottom side of trays.
- 10 Nos. of J-bolts were found loose.
- Bulging in shell liner in NE direction 300mm. below C-seam.
- 01 no. corrosion cavity on top edge of C-seam in NW direction.**(R-10)**
- Some of tray holding nuts were found loose.

Compartment No.3

- Very minor roughening was observed on insert liner.
- 01 no. pinhole 6mm deep on south side cleat weld. **(R-9)**
- Bulging of approx. 8mm depth and 2.5" width was observed behind tray skirt in SW to South direction.
- Some nut bolts found loose and lying on the tray.

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.
- Concave depression of approx 2-5 mm depth observed at approx. 200mm below the C-seam in approx. 80% of the periphery.
- Grayish and brownish oxide layer was observed on the bottom side of trays.
- 03 nos. corrosion cavity on liner parent metal. **(R- 6, 7 & 8)**
- 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.

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.

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.
- (b) Concave depression of approx. 5 mm depth was observed at approx. One meter below C-seam from East to west side L-seam though north side of the shell. The same was observed during last inspection also.
- 01 No. of 'J' bolts and some tray holding nuts and bolts were also found loose which were marked.
- Liquid box left side cleat weld has a cavity and cleat was also observed corroded. **Need to be replaced. (R-5)**
- Liquid box right side cleat was found discolored / blackish and its weld corroded. **Need to be replaced. (R-4)**
- NW long seam above C seam found corroded.

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.
- 01 no. south side bolt was found dislocated from its groove.
- Concave bulging 1200mm below C seam and max. 5 mm. depth in approx. 60% periphery
- 2 Nos. of 'J' bolts was found loose which was marked.

Compartment No.8

- Concave bulging at the elevation of 1ft above tray and 3 to 6mm. deep from East to South & from NE to NW.
- 02 no. crevice/corrosion cavities on upper C seam of Insert liner. **(R-2&3)**
- 01 no. corrosion cavity on L seam above the C seam in East direction.
- Some of the tray holding nuts and bolts were found loose.

Compartment No.9

- Found in satisfactory codition.

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.
- 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.
- 100mm. dia & 4 mm. concave bulging was observed in NE direction approx. 25mm. above tray.

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 in last S/D 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.
- Some of the tray holding nuts were found loose.
- Grayish Chrome oxide layer on trays.

Compartment No.12 (Bottom Compartment.)

- South side tray skirt is touching the shell liner.
- Down comer nozzle with dish end liner weld joint edges were observed exposed. 01 no. pinhole on HAZ to be repaired. **(R-1)**
- 01 no. shallow pinhole on bottom most dish mid weld joint.
- Dark brown coloration on dish end.
- 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.
- Underside corrosion of tray bottom face has been observed at the location of Tray Segment joint. Approx. depth 1-2mm.

NOTE

- Total 10 no. repairs R1 to R10 counting from bottom to top compartment were marked.
- R4 and R5 cleat replacement in compartment no. 6.
- Repair / welding of 02 long seams and C-seam in compartment no. 3 from top.
- Repair / welding of 02 long seams in compartment no. 1 from top.
- Severe etching observed on down comer 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, L-Long seam, C-Circumferential seam.

REPAIR / WELDING JOB IN COMPARTMENT NO. 1& 3

After Visual Inspection it was decided to carry out repair and re-welding of 02 nos. Longitudinal and only circumferential weld seam in Compartment no. 3 & 02 nos. longitudinal weld seams of old liner in Compartment no. 1.

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 passivate the weld by washing with 10% HNO3 and rinse with plenty of DM water.
- Air testing.

THICKNESS MEASUREMENT:

Main Liner Thickness				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks (Mini. thk. observed on)**	**Design / Installed Thk. (mm)**
Compartment 1	6.81(new) 4.06 (old)	7.05(new) 4.80(old)	East side.	6.50 (new) 5.00 (old)
Compartment 2	3.60	4.78	East side.	5.00
Compartment 3	3.80	4.68	East side.	5.00
Compartment 4	3.73	4.73	West side	5.00
Compartment 5	4.36	5.00	North side	5.00
Compartment 6	4.09	4.92	North side	5.00
Compartment 7	4.20	4.91	North side	5.00
Compartment 8	4.27	5.01	West side	5.00
Compartment 9	4.31	4.95	East side	5.00
Compartment 10	4.52	5.28	South side	5.00
Compartment 11	4.38	4.85	North side	5.00
Compartment 12	4.47	4.74	North side	5.00

Down comer Thickness				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks**	**Design/ Installed Thk.(mm)**
Compartment 2	7.45	7.57	The downcomer was replaced in 1997.	9.50
Compartment 3	7.45	8.12		9.50
Compartment 4	7.71	7.89		9.50
Compartment 5 (Shiny Portion)	9.51	9.81		9.50
Compartment 5	7.48	7.72		9.50
Compartment 6	7.73	7.90		9.50
Compartment 7	7.76	8.07		9.50
Compartment 8	7.97	8.34		9.50
Compartment 9	8.45	8.56		9.50
Compartment 10	8.62	8.84		9.50
Compartment 11	8.92	9.17		9.50
Compartment 12 Downcomer Reducer (10”) Reducer (8”) Distance Piece	 9.67 9.67 8.69 4.65	-	Shutdown 2006 Readings	 10.0 10.0 10.0 6.0

Tray Thickness measurement				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks**	**Design / Installed Thk.(mm)**
Compartment 1	5.21	6.22	-	8.00
Compartment 2	5.16	5.55	-	8.00
Compartment 3	5.18	5.68	-	8.00
Compartment 4	5.57	5.83	-	8.00
Compartment 5	5.53	5.73	-	8.00
Compartment 6	5.82	6.66	-	8.00
Compartment 7	6.10	6.33	-	8.00
Compartment 8	6.13	7.23	-	8.00
Compartment 9	7.11	7.64	-	8.00
Compartment 10	7.37	7.98	-	8.00
Compartment 11	7.79	8.22	-	8.00

INSERT LINER

Compartment Nos.	Thickness observed(MM)	Installed Thickness (MM)	Year of Replacement
3	6.75-6.89	6.0	1997
4	5.97-6.11	6.0	1999
8	6.37-6.84	6.0	2000
9	6.64-6.99	6.0	2001
10	6.51-6.73	6.0	2002
11	6.64-6.84	6.0	2002

Other Areas

LOCATION	MIN.	MAX.	REMARK	DESIGN.
Man way	6.90	7.02	Replaced in 2002	6.5
Top dome	6.70	6.90	Replaced in 2002	6.5
Liner below dome	6.81	7.05	750 mm section BC.05 – replaced in 2002	6.5
Bottom Dome	6.29	6.65	Replaced in1993	7.00

HP STRIPPER (H-1201)

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) completely, 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 had been observed.
- The overlay welding on the tube sheet was grey and slightly etched.
- Condition of tube to tube sheet welds could not be completely accessed as brownish scales were deposited on it.
- The tubes were found smooth from inside.

.**BOTTOM CHANNEL**

- The condition of sealing face was 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 grey and slightly etched.
- The tube sheet was covered with a thin blue grey oxide layer.
- The tubes inside were smooth. 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 REPORT OF OVERLAY WELD AND LINER

The weld overlay thickness is measured with a Fischer DualScope MP4, Probe EK-50 (accuracy 0.5 mm) and liner thickness was measured with Ultrasonic thk. Meter Panametrics MG2-XT (accuracy 0.01mm)

BOTTOM DOME

LOCATION	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Overlay)	10.4	15.5	8.0
Dome area (Overlay)	12.3	14.3	8.0
Cylindrical area (Liner)	8.14	8.75	8.0
Tube sheet-Overlay weld	12.9 (Machined)	15.2 (Machined)	8.0
Bottom Cover (Overlay)	16.6	20.3	8.0

TOP DOME

LOCATION	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Overlay)	13.2	22.1	8.00
Dome area (Overlay)-minimum 7.5 mm betn.the strip beads	10.1	14.5	8.00
Cylindrical area (Liner)-Gas phase	8.18	9.15	8.00
Cylindrical area (Liner)-Liquid phase	8.06	8.90	8.00
Tube sheet-Overlay weld	12.5 (Machined)	15.4 (Machined)	8.00

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. The Results are as under :

- Wall loss: 0 to 0.33mm observed in 27 tubes
- Wall loss: 0.36 to 0.495mm observed in 1776 tubes
- Wall loss: 0.528 to 0.66mm observed in 796 tubes

The 02 no. tubes showing maximum 0.627mm wall loss are 34/51 and 43/39 (Tube sheet layout attached at **Annexure-7**)

H.P. CONDENSER H-1202

VISUAL INSPECTION

TOP CHANNEL

- The internals (liquid inlet box and liquid/gas divider plate) were grey and slightly etched.
- The gasket sealing face was satisfactory.
- The liner and welds in the man way were grey and smooth.
- The liner and welds in the channel were grey and slightly rough.
- The tray support clits were grey and slightly corroded.
- The tube-to-tube sheet welds were found satisfactory.

BOTTON CHANNEL

- The sealing face was satisfactory.
- The manway liner was grey and smooth.
- In the hemi-head and cylindrical area the liner was grey and etched.
- All liner welds and repairs were bright and smooth .
- The tubesheet welds were bright shiny and smooth.

BOTOM COVER

- The sealing face was satisfactory.
- The liner was grey metallic and hardly etched.
- The vortex breaker and welds were smooth.

THICKNESS MEASUREMENT

WELD OVERLAY AND LINER

The wall thickness of the liner was measured using Ultrasonic thk. Meter Panametrics MG2-XT (accuracy 0.01mm.).

The weld overlay thickness has been measured using a DualScope MP4, Probe EK-50 (accuracy 0.5 mm).

BOTTOM DOME

	Minimum Thickness (mm)	Maximum Thickness (mm)	Design Thickness (mm)
Man way (Liner)	**3.95***	7.58	6.0
Dome area (Liner)	6.50	7.15	6.0
Cylindrical area (Liner)	6.40	7.25	6.0
Tube sheet-Overlay weld	10.3	13.25	8.0 (Min)
Bottom Cover (Liner)	18.90	19.80	18.0

***Near vertical seam.**

TOP DOME

	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Liner)	5.73	7.40	6.0
Dome area (Liner)	6.35	6.85	6.0
Cylindrical area (Liner)	6.29	6.92	6.0
Tube sheet-Overlay weld	10.1	14.5	8.0 (min)

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 1737 tubes tested for 3000mm. length. 10 tubes could not be tested due to tray support pads obstructing the probe. 03 tubes were plugged before inspection. The observations are as under:

- 05 no. tubes were observed having defect in OD / dent under tubesheet region. All these tubes were plugged. Tubes are 22/24, 24/32, 26/27, 28/7 & 28/11.
- No reduction in wall thickness was detected in rest of the tubes. (Tube sheet layout attached at **Annexure-8**)

H-1203, HP SCRUBBER

VISUAL INSPECTION

TOP SHELL

- Shell internal surface was found Reddish-brown in coloration
- Scratch marks were found on the inside surface of shell liner.
- CO_2 inlet nozzle flange (3/4”NB) located at west side was found in satisfactory condition.
- CO_2 inlet line in South was found intact with its supports.
- Shell liner weld joint below the diaphragm plate has 05 nos. corrosion cavities.
- Condition of liquid inlet and gas outlet pipe found satisfactory.
- Pin holes were observed in the diaphragm plate bottom side weld.

BOTTOM SHELL

- Visual condition of the tube bundle was found satisfactory.
- Some Nuts of the Diaphragm ring was found lying on the first baffle plate.
- CO_2 inlet nozzle flange (3/4”NB) located at west side found in satisfactory condition.

THICKNESS MEASUREMENT

TOP SHELL

Thickness measurement of top half of shell liner was carried out and found in range of 4.72 to 5.14mm. **(Design thk. 5.0mm.)**

BOTTOM SHELL

Thickness measurement of bottom half of shell liner was carried out and found in range of 5.21 to 5.48 mm. **(Design thk. 5.0mm.)**

U-TUBES

Thickness measurement of U-TUBES in approach was carried out and found in range of 3.40 to 3.50mm.**(Design thk. 3.6mm.)**

EDDY CURRENT TESTING OF INTERCOOLER TUBES OF K-1801

All the three interstage coolers were Eddy Current Tested. Eddy current inspection was carried out by M/s TesTex NDT India Pvt. Ltd.

H-1811, 1st Stage Intercooler

Total 1024 no. tubes were inspected. 01 no. tube was observed with I.D. pit and same was confirmed by boroscope. The tube was plugged.

Tube Identification : Row no. 1 / Tube no. 17

(Tube sheet layout attached at **Annexure-9**)

No reduction in wall thickness or any abnormality was observed in rest of the tubes.

H-1812, 2nd Stage Intercooler

Total 431 no. tubes were inspected. 26 no. tubes were observed showing defect type indication. (Tube sheet layout attached at **Annexure-10**)

No reduction in wall thickness or any abnormality was observed in rest 405 tubes.

H-1813, 3rd Stage Intercooler

Total 182 no. tubes were inspected. 15 no. tubes were observed showing defect type indication. All these 15 tubes were replaced by new tubes.

(Tube sheet layout attached at **Annexure-11**)

No reduction in wall thickness or any abnormality was observed in rest 157 tubes.

INSPECTION OF OTHER VESSELS

H-1101 ($C0_2$ KNOCKOUT DRUM)

- Epoxy paint was found peeled off from few locations, however primer at these locations was found intact and no sign of corrosion was observed.
- 03 nos. demister pads in west half were found lifted upwards, which need to be fixed.

H-1104 ($C0_2$ SPRAY COOLER)

Inspection was carried out from top manhole & observations are as under :

- Demister pad condition was found satisfactory.
- Fasteners of the Grating were found intact in position.
- Weld joint condition was found satisfactory.

H-1204 (RECIRCULATION HEATER)

- Minor scaling was observed inside the tubes.
- Orifice plugs in the bottom were found intact in position.
- Brownish scaling was observed inside the plugs.
- Grayish scales was found deposited on the bottom tube sheet and orifice plugs

H-1207 (CIRCULATION SYSTEM –II COOLER):

- Heavy corrosion/ pitting and scaling were observed on the tube sheet area needs proper cleaning.
- Condition of channel covers was found satisfactory.
- Hard Scaling was observed on the inside surface of all tubes.

H-1209 (LP ABSORBER COOLER):

- Tube bundle was pulled outside.
- Brownish & whitish thick scales was deposited on the inside surface of the shell which needs proper cleaning.
- Condition of the channel covers was found satisfactory.
- Thick hard scales were observed on the outer surface of the tubes which needs proper cleaning for effective heat transfer.
- Condition of the tube sheet was found satisfactory.
- Condition of tube to tube sheet welding was found satisfactory.
- Brownish coloration was observed on $3/4^{th}$ of the surface of tube sheet whereas blackish coloration was observed on the remaining $1/4^{th}$ surface.

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 more prominent in East half of the tubes.

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.
- 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 found satisfactory.
- Minor whitish scaling was observed inside the tubes.
- Brownish coloration was observed on the tube sheet.
- Overall condition of heat exchanger found satisfactory**.**

H-1420 (FINAL CONDENSER)

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

H-1422 (1ST STAGE EVAPORATOR)

- The shell and Dish ends have assumed grayish black in coloration with scattered brownish and whitish patches.
- Coloration of tube sheet was shiny.
- Tube to tube sheet weld joints was found satisfactory.
- Solidified Urea particles were observed on the inside surface of the tubes.
- Condition of impingement cone was found satisfactory.
- Impingement cone to support welding was found satisfactory.
- Water was found accumulated at the bottom of the dish end.
- Urea lumps were observed in top distributor outlet vanes, need to be cleaned.
- Condensate flushing spargers (08 nos.) were found in satisfactory condition.

H-1424 (2ND STAGE EVAPORATOR)

- Shiny surface was observed inside the vessel.
- Tube to tube sheet weld joints were found slightly etched.
- Impingement cone was found bent in downward direction at two locations, one is in north-west direction and the other is in south-west direction.
- Thin whitish scaling was observed inside of all the tubes approx from 2” below the tube face.
- Water was found on the bottom of the dish end.

H-1425 (SECOND EVAPORATOR FIRST CONDENSER)

Inspection was carried out from top tube sheet & observations are as under :

- Tube to tube sheet welding was found satisfactory.
- Whitish scale was observed inside the tubes.
- 03 Nos, of tubes were found chocked with debris and the same was marked with yellow chalk for proper cleaning. These tubes was again checked today and found all these tubes clear from any debris/scales.

H-1426 (SECOND EVAPORATOR SECOND CONDENSER)

- Tube to tube sheet welding was found satisfactory.
- Tube sheet was found brownish in coloration.
- All tubes were found filled with water.

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

- Internal condition of tubes and tube sheet were found satisfactory.
- Most of the epoxy coating was found peeled off in the dome covers of H-1814A & B.

H-1815 (SURFACE CONDENSER FOR HITACHI COMPRESSOR)

SOUTH SIDE HALF (EAST SIDE CHANNEL)

TOP HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside some of the tubes.

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed on inside of the tubes.
- Epoxy coating was found peeled off from the entire surface of channel head and also from the channel cover.

SOUTH SIDE HALF (WEST SIDE CHANNEL)

BOTTOM HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside the tubes.

TOP HALF

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside the tubes.
- Epoxy coating was found damaged at some localized spots.

NORTH SIDE HALF (EAST SIDE COVER)

- Tubes and tube sheet surface condition was found satisfactory.
- Epoxy coating was found peeled off at several locations.
- Minor scaling was observed inside the tubes.

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.

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 up side at different locations. Same was observed in past also.
- Weld joints and nozzle condition was found satisfactory.
- Internal surface of the shell was found oily.
- Condition of the Roof condition was found satisfactory.

T-1301-A (NEW 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 the shell.
- All weld joints and nozzle condition was found satisfactory.
- Overall condition was satisfactory.

T-1401 (UREA SOLUTION TANK)

- Bottom plate was having bulging upward as had been observed in the past 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 the Weld joints was found satisfactory.
- Reddish brown coloration was observed inside the tank.
- Dust and weld spatters were observed lying inside the tank near East dish end, need to be cleaned.
- Water was found at the bottom of the vessel.
- Overall condition of the vessel was found satisfactory.

V-1101 (CO_2 KNOCK OUT DRUM)

- Epoxy paint was found peeled off from few locations, however primer at these locations was found intact and no sign of corrosion was observed.
- 03 nos. demister pads in west half were found lifted upwards, which need to be fixed.

V-1102 (NH_3 SUCTION FILTER)

- Coloration 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 (NH_3 SUCTION VESSEL)

- Coloration of vessel from inside was found blackish.
- The condition of longitudinal and circumferential weld joints was satisfactory.
- Oily layer with sludge was found on the bottom dished end.
- Proper cleaning is recommended.

V-1202 (RECTIFYING COLUMN)

FROM TOP MANHOLE

- Coloration 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.
- 07 nos. tacked nuts on the tray support ring have bolts with sheared head.
- 06 nos. nuts were found missing from the grating support ring in the manway.
- Cleats for holding the trays have fastener holes, these holes were observed elongated downwards.

FROM BOTTOM MANHOLE:

- Coloration of top cone was silver with black patches where as brown coloration was found on bottom-dished end and shell portion
- Thick scaling was observed on shell just below dome to shell circumferential weld seam.

V-1203 (L. P. ABSORBER)

FROM TOP END

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

FROM BOTTOM END

- Coloration of shell was observed brownish black whereas in some areas it was grayish.
- Concave bulging on shell opposite to 8” inlet line was observed in apprx. 1 ft. diameter and 1.5” depth.
- Overall condition of the shell was found satisfactory.

V-1206 (ATMOSPHERIC VENT SCRUBBER)

- Demister pads were found intact in position and condition of the same was found satisfactory.
- Reddish brown coloration was observed inside the vessel.
- Overall condition was found satisfactory.

V-1301 (SECOND DESORBER)

BOTTOM COMPARTMENT

- Brownish coloration was observed inside the vessel.
- One clamp of the tray was found loose and the same was marked with yellow chalk.
- Nozzle condition was found satisfactory.

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 only top and bottom compartment was carried out.

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.
- Trays had brownish coloration.
- Fasteners were found intact in position.
- Condition of top tray was found satisfactory.
- 4” LT nozzle in the east side on shell was found having loose scale from inside. Need to be cleaned.

BOTTOM COMPARTMENT

- Grayish black coloration was observed from inside.
- Oily surface was observed from inside.
- 02 no. of bolt/nuts of steam inlet flange was found loose. Need to be tightened.
- Clamping bolt / washer of steam inlet pipe to shell was found missing. Need to be provided.

V-1352 (FIRST DESORBER)

FROM BOTTOM MANHOLE

- Brownish coloration was observed inside the vessel.
- Trays and its fasteners were 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 $1^1/_2$" reflux line towards south.

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 at demister pads at few locations.
- Support channels and outer ring of demister pads were found lifted in East direction, tied by metallic wires.
- 01 no. nut of J-bolt was found missing & 01 no. J-bolt was found loose, marked with yellow chalk.

V-1501 (4 ATA STEAM DRUM)

- Coloration of shell and Dish ends was found brownish black.
- Distribution sparger was found intact in position.
- Demister pads were found intact in position and condition of the same was found satisfactory.
- Water was found accumulated in the bottom of the vessel.
- Condition of all weld joints was found satisfactory.
- Minor pittings were observed on bottom of the shell.
- Hard scaling was observed at both dished ends.

V-1502 (23 ATA STEAM DRUM)

- Brownish black coloration was observed inside the vessel.
- Hard 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.

V-1503 (9 ATA STEAM DRUM)

- Grayish black coloration was observed inside the vessel.
- Scattered scales were observed on both the dished ends.
- Nut of the south side U-clamp of inlet steam header was found missing. Need to be provided.
- Overall condition of the vessel was found satisfactory.

V-1811 (IST STAGE SEPARATOR)

- Demister pads were found intact in position.
- Vortex breaker was found intact in position.
- Urea/Carbamate powder was found sticking on the bottom half of the vessel.
- Condition of the weld joints was found satisfactory.
- Overall condition of the vessel was found satisfactory

V-1812 (IInd STAGE SEPARATOR)

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

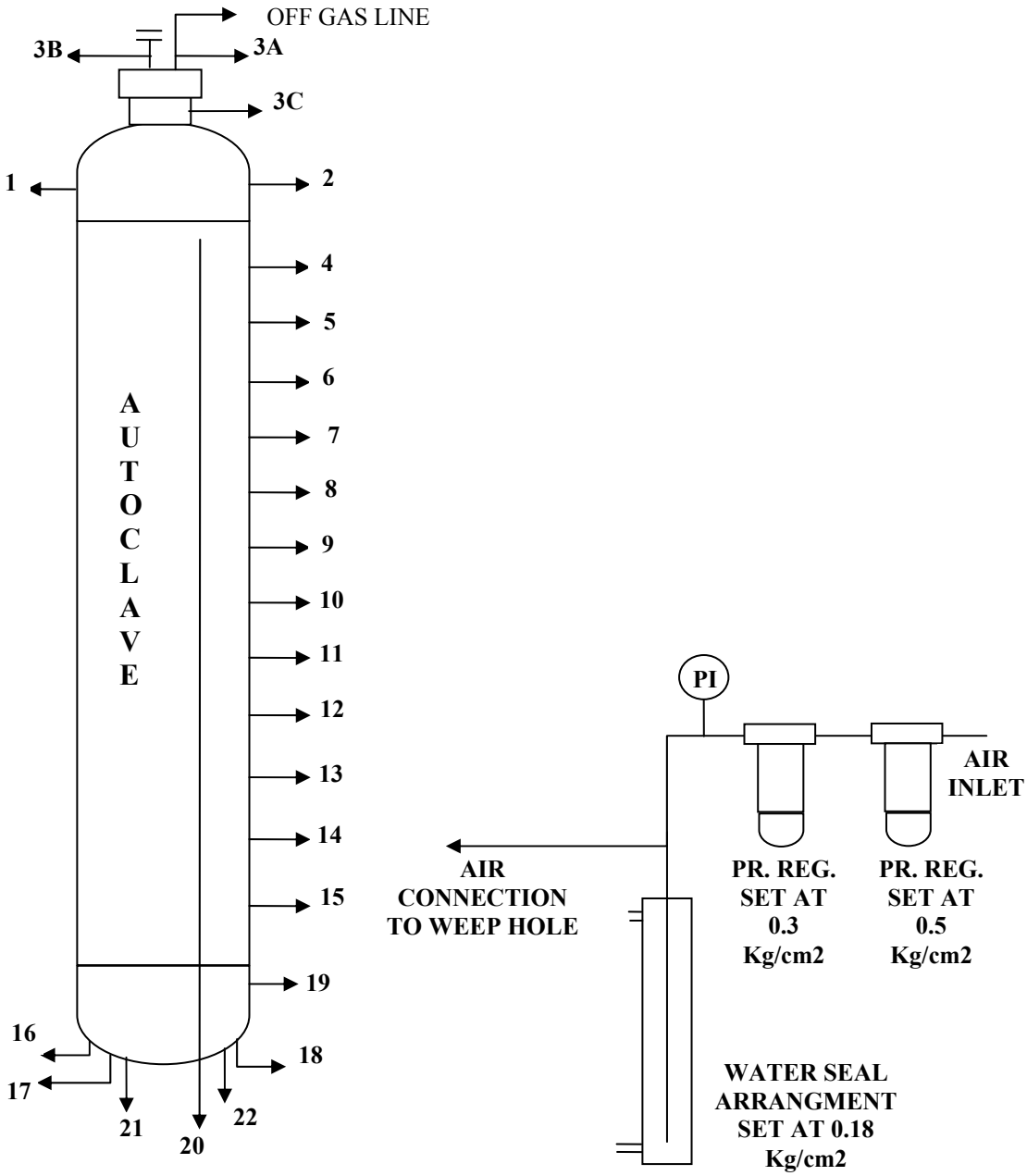
V-1813 (IIIrd STAGE SEPARATOR);

- No abnormality observed.
- Overall condition of the vessel was found satisfactory

ANNEXURE-1 (1/2)

DETAILS OF AIR TEST CARRIED OUT ON AUTOCLAVE LINER WELD JOINTS

Air test of all the liner weld joints of Autoclave was carried out before final box-up of the equipment. There are 24 nos. of weep holes provided on the vessel for leak detection. The location of all these weep holes and Air test arrangement made are shown below.



ANNEXURE-1 (2/2)

Weep hole locations and their nos. are given below:

Weep hole No.	Location
1	Top hemi-head (near radioactive source)
2	Top hemi-head (North side)
3A	Off gas line
3B	Blind Nozzle on Man-hole cover
3C	Man way
4 to 15	On Shell at various elevations
16	Ammonia Inlet nozzle
17	Carbamate nozzle from H-1203
18	Carbamate nozzle from H-1202
19	Gases from H-1202
20	Autoclave over-flow to Stripper
21-22	Bottom hemi head

Air test of Complete liner weld joints and nozzles was carried out in following steps:

- Air given from weep hole no. 15 and PI mounted on weep hole no.4. Rest all the weep holes of shell were plugged. When PI was showing 0.18 Kg/Cm2 soap solution test was carried out from inside to check integrity of shell liner weld joint. No leakage was observed.
- Air given from weep hole no. 21 and PI mounted on weep hole no.22. When PI was showing 0.18 Kg/Cm2 soap solution test carried out from inside to check integrity of bottom dish end liner weld joints. No leakage was observed.
- Air given from weep hole no. 2 and PI mounted on weep hole no.1. When PI was showing 0.18 Kg/Cm2 soap solution test carried out from inside to check integrity of top dish end liner weld joints. No leakage was observed.
- Air given from weep hole 3C to check integrity of man way liner weld joints. No leakage was observed.
- Air was given from individual nozzle weep holes 3A-3B-16-17-18-19 &20. Weld joints were soap solution tested from inside and no leakage was observed.

ANNEXURE-2 (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-E10-2122	6	80	10.97	H-1813	V-1813	9.5	13.40
2	CO-F10-2124	8	160	23.01	K-1801,IV discharge	GA-1602-8"-F2	21.50	6.5
3	CO-F10-2140-PP25	4	160	13.49	CO-F10-2119-PP25	CO-E10-2139-PP25	12.20	9.56
3A	DRAIN	'3/4"	160	5.54	CO- F10- 2140	DRAIN	**2.17***	60.8
4	CO-F10-2119	8	160	23.01	K-1801,HP case 3rd discharge	H-1813	21.90	4.82
5	GA-1112	6	F2	14.27	K-1101-2	GA-1201	12.50	13.39
5A	BY PASS LINE	1.5	F2	7.14	GA-1112	BY PASS LINE	**3.6***	49.5
6	GA-1201	6	X4	13.33	GA-1112	H-1201	13.5	--
6A	VENT	1.5	X4	5.08	GA-1201	VENT	5.40	--
7	GA-1202	1	F2	6.35	GA-1112	GA-1203	5.10	19.21
8	GA-1203	1	X1	4.55	GA-1202	SCRUBBER	4.10	9.89
8A	DRAIN	0.5		3.73	GA- 1203	DRAIN	3.8	--
9	GA-1204	1	F2	6.35	GA-1202-1"-F2	PR-1231	3.8	59.8
9A	DRAIN	0.5		5.54	GA-1204-1"	DRAIN	2.7	51.2
10	GA-1602	8	F2	23.01	K-1801,CO-2124-8"-F10	H-1201,GA-1112-6"-F2	21.90	4.82
11	GA-1603	4	F2	11.13	GA-1602-8"-F2	PIC-1810	11.40	--
12	MA-1106/A-4"	4	E2	8.56	P-1102-A DISCH	MA-1123-4"	7.80	8.87
12A	DRAIN LINE	1		4.55	MA-1106/ A- 4"	DRAIN LINE	5.0	--
13	MA-1106/B-4"	4	E2	8.56	P-1102-A, MA-1605-6"	MA-1123-4", MA-1203-4"	6.8	20.44
13A	BY PASS	1	E2	4.55		BY PASS	4.0	12.0
14	MA-1123	4	E2	8.56	P-1102/B	MA-1605-6"	8.0	6.5
15	MA-1201	3	E2	7.62	MA-1605-6"	MA-1202-3"	6.90	9.44
16	MA-1201	2	E2	5.54	MA-1605-6"	MA-1202-3"	4.20	24.18
17	MA-1202	3	X4	7.62	MA-1201/MA-1605-6"-E2	V-1201	7.30	4.19
18	MA-1203	4	X4	9.14	MA-1106-B-4"	PR-1230-6"	10.20	--
18A	VENT	0.75	X4	3.91	MA-1203	VENT	7.20	--
19	MA-1603	6	C2	7.11	MA-1122-6"	MA-1603-4"	6.10	14.2
19A		4	C2	6.02	MA-1603-4"	P-1102/C SUC.	4.7	21.9

ANNEXURE-2 (2/2)

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERVED	%AGE RED.
					FROM	TO		
20	MA-1604	3	E2	7.62	P-1102/ C DISCH.	MA1604- 4”	6.2	18.63
21	MA-1604	4	E2	8.56	MA-1604-3”	MA-1605-6”	7.90	7.71
22	MA-1605	6	E2	14.27	MA-1123-4”-E2	MA-1106/B-4”-E2	12.4	
22A	MA-1605	4	E2	11.13	MA-1123-4”-E2	MA-1106/B-4”-E2	12.0	--
23	MA-1607	4	C2	6.02	MA-1604-4”	MA-1116	5.60	7.0
23A	DRAIN	0.75		3.91	MA-1607	DRAIN	4.0	--
24	MA-1609	4	C2	6.02	P-1102/C RV	MA-1503-6” -C2	4.7	21.9
25	PR-1201	8	X1	19.58	V-1201	H-1201	17.30	11.82
26	PR-1202	10	X1	24.33	H-1201	HP-CONDENSER	22.0	9.57
27	PR-1203	8	X1	19.58	H-1202	V-1201(VAPOR LINE)	17.90	8.58
28	PR-1204	8	X1	19.58	HP-CONDENSER	V-1201(LIQUID LINE)	18.10	7.55
29	PR-1205	6	X1	15.24	PR-1205-8”	V-1202	15.0	1.57
30	PR-1205	8	X1	19.58	STRIPPER BOTTOM	V-1202	20.80	--
31	PR-1208	4	X1	10.41	AUTOCLAVE TOP	PR-1206-4”-X1	9.70	6.82
32	PR-1211	0.5	X1	3.73	PR-1208	PR-1212	4.0	--
33	PR-1212	4	X1	10.40	SCRUBBER	AUTOCLAVE BOTTOM	7.6	26.9
34	PR-1213	2	X4	5.54	PR-1201	PR-1205-6”	4.50	18.77
35	PR-1224	3	X4/80S	7.62	P-1201B (Disch)	PR-1638-4”-X4A	7.40	2.88
36	PR-1225	3	X4	7.62	P-1201A/B, PR-1638-4”	H-1203	5.3	30.4
37	PR-1230	6	X1	15.24	MA-1203-4”	H-1202 (HPCC)	13.70	10.10
38	PR-1231	3	X1	8.12	H-1203	PRCV-1201	6.50	19.70
39	PR-1234	3	X4/80S	7.62	P-1201A (DISCH)	PR-1638-4”-X4A	7.60	--
40	PR-1637	3	X4A	9.14	P-1201C	PR-1638-4”	10.90	--
41	PR-1638	4	X4/80S	9.14	P-1201 A/B/C	PR-1230-6”	12.20	--

*** Points recommended for replacement.**

ANNEXURE-3 (1/2)

UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY (OTHER LINES)

Sr. No	LINE NO.	NB (inch)	SCH	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	% AGE RED.
					FROM	TO		
1	CO-E10-2139-PP25	4	80	8.56	CO-F10-2140-PP25	CO-E10-2112	6.3	26.4
2	MA-1103-6"-C5	6	C5	7.11	MA-1102-6"	MA-1101-6"	5.5	22.6
2A		4	C5	6.02	MA-1102-6"	MA-1101-6"	5.2	13.6
3	MA-1104	4	C2	6.02	V-1102	V-1103	5.1	15.28
3A		3	C2	5.49	V-1102	V-1103	6.1	--
4	MA-1108	3	B2	4.85	PR-1309-20"	MA-1113-1"	3.6	25.77
5	MA-1113	1	B2	4.55	RV-1110, MA1101-6"	MA-1108	2.4	47.0
6	MA-1114	1	B2	4.55	RV-1106	MA-1113	2.7	40.6
7	MA-1122	6	C2	7.11	MA-1105	P-1102/B	5.6	21.2
8	PR-1214	8	X6	4.57	V-1202	H-1204	3.6	21.22
9	PR-1223	4	X3	3.05	L.P. SEP., V-1205	P-1201 A/B SUCTION	2.1	31.2
10	PR-1302	3	X3	3.05	P-1302A/B/C	H-1301	2.7	11.04
11	PR-1333	2	X3	2.77	P-1305A	PR-1334-2"	**1.6***	42.2
12	PR-1334	2	X3	2.77	P-1305	LICV-1281	3.2	--
13	PR-1351	4	X3	3.05	V-1203	H-1301-C	2.0	34.5
14	PR-1373	4	X3	3.05	P-1351B-DISCHARGE	PR-1361	2.3	24.6
15	PR-1403	6	X3	3.40	T-1401	P-1401/A	2.6	23.5
15A		8	X3	3.76	T-1401-A	P-1401-A	3.1	17.55
16	PR-1403	4	X3	3.05	T-1401	P1401-A	2.4	21.31
17	PR-1404	4	X3	3.05	P-1401	V-1409	2.0	34.42
18	PR-1608	2	X6	2.77	H-1421	V-1200	2.0	27.79
19	PR-1616	8	X3	3.76	T-1401-A	PR-1403	3.1	17.5
20	PW-1101	3	B3	3.05	V-1101	SEAL POT	3.4	--
21	PW-1301	4	X3	3.05	V-1301	H-1301	2.1	31.14
22	SC-1239	16	B4	9.53	H-1202	V-1501	10.0	---
23	SC-1504	4	B4	6.02	V-1503	V-1501	4.1	31.89
24	SC-1523	3	B4	5.49	HEADER	SCI409-4"	**2.2***	59.9
25	ST-1211	2	B4	3.91	ST-1409	H-1202	2.8	28.38

ANNEXURE-3 (2/2)

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	% AGE RED.
					FROM	TO		
26	ST-1413	1.5	B4	5.04	4 ATA STEAM HEADER	EJECTOR P-1425	4.1	18.65
27	ST-1502	3	B4	5.49	PICV-1502-A	ST-1503-12” -B4	5.5	--
27A		4	B4	6.02	ST-1502-8”	ST-1503-12”	5.6	6.9
27B		8	B4	8.18	ST-1116	ST-1503-12”	7.3	10.75
28	ST-1508	2	B4	3.91	ST-1508-3” BY PASS		4.5	--
28A		3	B4	5.49	ST-1506	PCV-1502	3.5	36.24
29	ST-1614	4	B4	6.02	ST-1409	H-1424	4.6	23.5

*** Points recommended for replacement.**

ANNEXURE-4 (1/2)

UREA PLANT VESSEL THICKNESS MEASUREMENT SUMMARY

Sr. No.	Equip. No.	Equip. Description	Shell			Dish End			Channel		
			Nom./ Design	Min./ Meas	% Red.	Nom./ Design	Min./ Meas.	Red	Nom./ Design	Min./ Meas	Red.
1	H-1104	CO2 SPRAY COOLER	10.0	7.8	22.0	9.0 / 13.0	11.8	-			
2	H-1205	LP CARBAMATE CONDENSER	8.0	7.4	7.5	10.0	12.4	-			
3	H-1205/A	ADDITIONAL LP CARBAMATE CONDENSER	12.0	12.1	-	10.0	9.5	5.0	8.0	8.0	-
4	H-1207-A	CCS-II EXCHANGER	10.0	7.8	22				8.0	12.4	-
5	H-1301/A	ADDITIONAL DESORBER HEAT EXCHANGER	9.5	10.2	-						
6	H-1301/B	ADDITIONAL DESORBER HEAT EXCHANGER	7.9	6.8	13.9	5.0	5.2	-	5.0	5.0	-
7	H-1301/C	ADDITIONAL DESORBER HEAT EXCHANGER	7.9	7.1	10.1	5.0	5.2	-	5.0	5.2	-
8	H-1305	FEED COOLER FOR V-1203	9.1	9.6	-						
9	H-1351/A	HYDROLYSER FEED PREHEATER	12.0	12.2	-	12.0	11.2	6.66			
10	H-1351/B	HYDROLYSER FEED PREHEATER	12.0	12.2	-	12.0	11.2	6.66			
11	H-1351/C	HYDROLYSER FEED PREHEATER	12.0	12.1	-	12.0	11.4	5.0			
12	H-1352	REFLUX CONDENSER	8.0	7.7	3.75				14.0	14.2	-
13	H-1418	PRE EVAPORATOR SEPARATOR	12.0	7.9	34.16						
14	H-1420	FINAL CONDENSER		7.5	-		8.4			9.6	
15	H-1422	FIRST STAGE EVAPORATOR SEPARATOR	12.0	12.5	-						
16	H-1422/A	UREA SOLUTION CCS-II HEAT EXCHANGER		8.1	-		7.8				
17	H-1427	CIRCULTION COOLER FOR V-1423	8.0	7.1	11.25						

ANNEXURE-3 (2/2)

Sr. No.	Equip. No.	Equip. Description	Shell			Dish End			Channel		
			Nom./ Design	Min./ Meas.	% Red.	Nom./ Design	Min./ Meas.	Red	Nom./ Design	Min./ Meas.	% Red.
18	T-1301	LEAN AMMONICAL WATER TANK	6.0	5.8	3.33	5.0 ROOF 7.0 BOT.	4.7 ROOF 7.3 BOT	6.0			
19	T-1301/A	STRONG AMMONICAL WATER TANK	6.0	5.3	11.6	5.0 ROOF.	5.3 ROOF	-			
20	T-1401	UREA SOLUTION TANK	6.0	5.6	6.6	6.0	5.9 BOT.	1.6			
21	T-1401/A	UREA SOLUTION TANK	6.0	5.8	3.33	6.0					
22	T-1501	STEAM COND. TANK	10.00	9.8	2.0	10.00	10.7	-			
23	T-1701/A	UREA DUST DISSOLVING TANK		5.9	-						
24	T-1701/B	UREA DUST DISSOLVING TANK		6.0	-						
25	V-1102	LIQUID NH3 FILTER	11.0	10.9	1.0						
26	V-1103	NH3 SUCTION VESSEL	21.0	20.9	0.4	21.0 / 23.0	22.2	-			
27	V-1200	LEAN CRBAMATE SEPARATOR	6.0	4.5	-	6.0	6.0	-			
28	V-1203	LOW PRESSURE ABSORBER	6.0	6.2	-						
29	V-1205	L.P. CARBAMATE SEPARATOR	7.0	7.6	-	7.0	9.3	-			
30	V-1206	ATM. VENT SCRUBBER	5.0	5.0	-	8.0	7.0(T) 7.6(B)	12.5			
31	V-1207	AMMONIA SCRUBBER	5.8	5.4	6.8						
32	V-1351	HYDROLYSER	28.0	28.4	-	28.0 / 32.0	30.10	-			
33	V-1421	FLASH TANK SCRUBBER	5.0	5.3	-	6.0	5.8(T) 5.9(B)	3.3			
34	V-1423	1^{SI} STAGE EVAPORATOR SCRUBBER	8.0	7.9	-	10.0	8.7(T) 10.0(B)	13.0			
35	V-1501	4 ATA STEAM DRUM	15.0	14.31	6.9	15.0 / 18.0	16.75	-			
36	V-1503	9 ATA STEAM SATURATOR	13.0	12.68	2.5	13.0 / 15.0	13.95	-			

ANNEXURE-5 (1/2)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT OF K-1801 (HITACHI COMPRESSOR)

DESCRIPTION	POSITION	BEFORE (Gauss-max.)	AFTER (Gauss max.)
Journal Bearing Liner	Governor side	0.4	
Shaft Journal	Governor side	0.4	
Thrust Collar	Governor side	0.9	
Thrust Bearing	Governor side	0.6	
Thrust Base Ring	Governor side	1.6	
Thrust Bearing Pads	Governor side	1.6	
TURBINE (NORTH END)			
Journal Bearing Pads	Top Half	1.3	
	Bottom half	2.5	
Journal Bearing Base Ring	Thrust End	1.5	
	Non Thrust End	1.2	
L.P. CASE (TURBINE END)			
Shaft Journal		2.2	
Journal Bearing Pads		0.9	
Journal Bearing Base Ring	Top	2.0	
	Bottom	1.2	
L.P. CASE (G.B. END)			
Shaft Journal		1.3	
Journal Bearing Pads		1.8	
Thrust Base Ring	L.P. Outboard	2.5	
	L.P.Inboard	2.5	
Thrust Bearing Pads	Inboard side	1.6	
	Outboard side	1.3	
Thrust Collar		1.8	
GEAR BOX			
L.S. Shaft Journal Bearing L.P. Side	Top half	2.6	
	Bottom half	2.4	
L.S. Shaft Journal Bearing H.P. Side	Top half	1.9	
	Bottom half	2.5	
H.S. Shaft Journal Bearing L.P. Side	Top half	1.4	
	Bottom half	1.2	
H.S. Shaft Journal Bearing H.P. Side	Top half	1.5	
	Bottom half	2.3	

ANNEXURE- 5 (2/2)

DESCRIPTION	POSITION	BEFORE (Gauss-max.)	AFTER (Gauss-max.)
L.S. Shaft	Teeth	2.0	
	Journal portion	1.2	
H.S. Shaft	Teeth	--	
	Journal portion	1.7	
Thrust pads	Inboard side	2.3	
	Outboard side	2.0	
Thrust Base Ring	Inboard side	2.8	
	Outboard side	2.7	
Thrust Collar L.S. Shaft		1.5	
H.P. CASE (FREE END SIDE)			
Shaft Journal		1.2	
Journal Bearing Pads		1.3	
Journal Bearing Base Ring	Top	1.3	
	Bottom	2.6	
Thrust Base Ring	Inboard side	1.4	
	Outboard side	1.4	
Thrust Pads	Inboard side	1.5	
	Outboard side	1.2	
Thrust Collar		0.9	
H.P. CASE (G.B. SIDE)			
Shaft Journal		0.8	
Journal Bearing Pads		0.8	
Journal Bearing Base Ring	Top	1.2	
	Bottom	1.7	

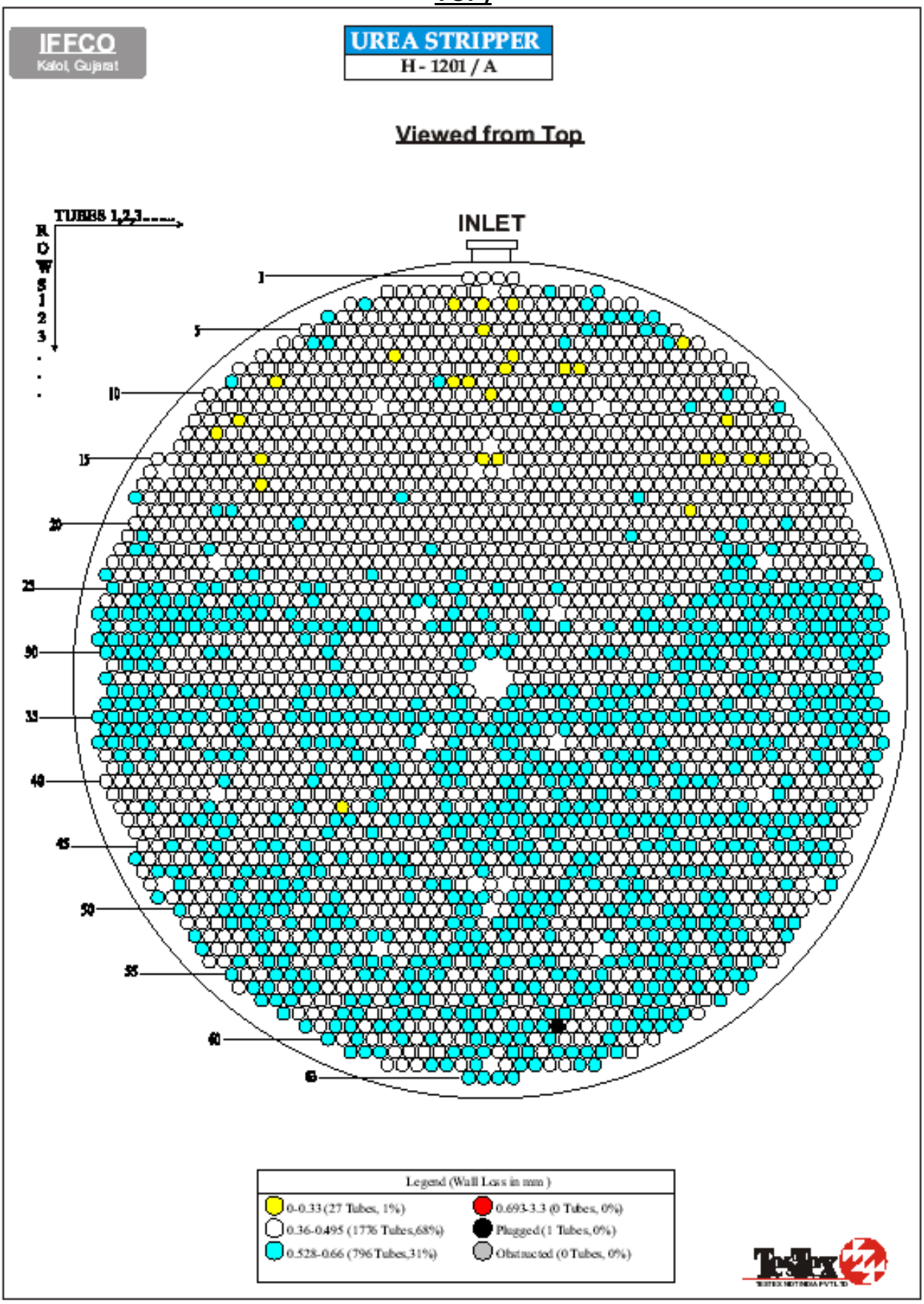
ANNEXURE-6

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	Location: 26 (Parent Metal) **HP STRIPPER H-1201** Stub end Liquid inlet top side	Carbon Steel	Microstructure at weld shows fine dendritic structure of Austenite solid solution at inter dendritic regions, where as at parent metal microstructure shows coarse austenite grain with twins.	Monitor after one year of service.
2	Location: 27 (Parent Metal) **HP CONDENSER H-1202** Stub end Gas outlet bottom side	Carbon Steel	Microstructure shows fine gained ferrite and pearlite structure. In situ spherodization of pearlite is observed.	Monitor after one year of service.
3	Location: 51 (Parent Metal) H-1812 at 1st stage tube	304L	Microstructure shows fine-grained austenite with twins.	Monitor after one year of service.
4	Location: 52 (Parent Metal) H-1812 at 2nd stage tube	304L	Microstructure shows fine-grained austenite with twins.	Monitor after one year of service.
5	Location: 53 (Parent Metal) H-1813 On failed tube away from crack	304H	Microstructure shows fine-grained austenite with twins.	Monitor after one year of service.
6	Location: 54 (Parent Metal) H-1813 On tube	304H	Microstructure shows fine-grained austenite with twins.	Monitor after one year of service.
7	Location: 55 (Parent Metal) H-1813 On failed tube at cracked location	304H	Microstructure shows fine-grained austenite with twins. Presence of heavy trans-granular mild branched nature of cracks observed in microstructure.	Replaced
8	Location:56 (Parent metal) H-1813 On failed tube near cracked location	304H	Microstructure shows fine-grained austenite with twins. Presence of heavy trans-granular mild branched nature of cracks observed in microstructure.	Replaced

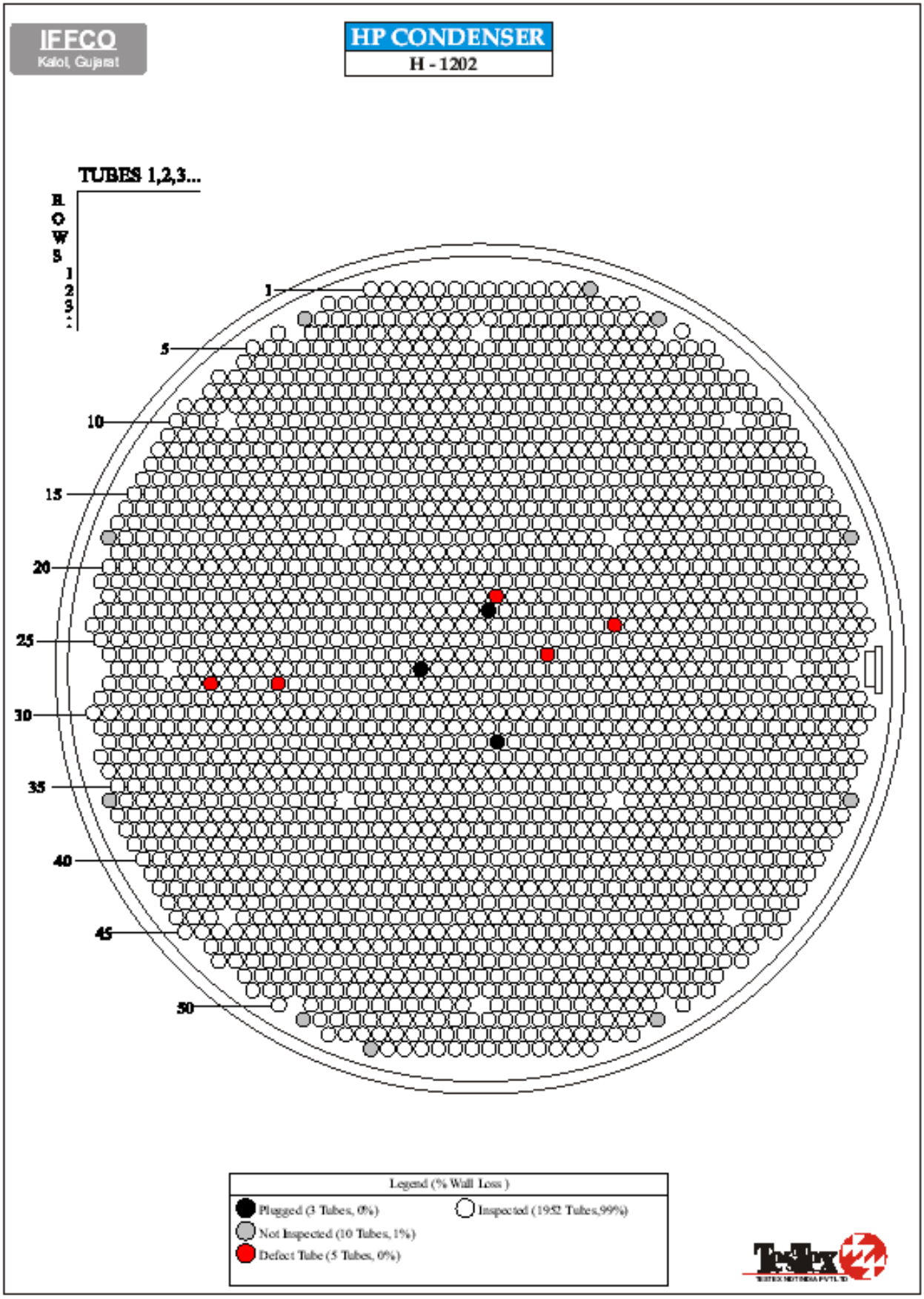
ANNEXURE-7

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



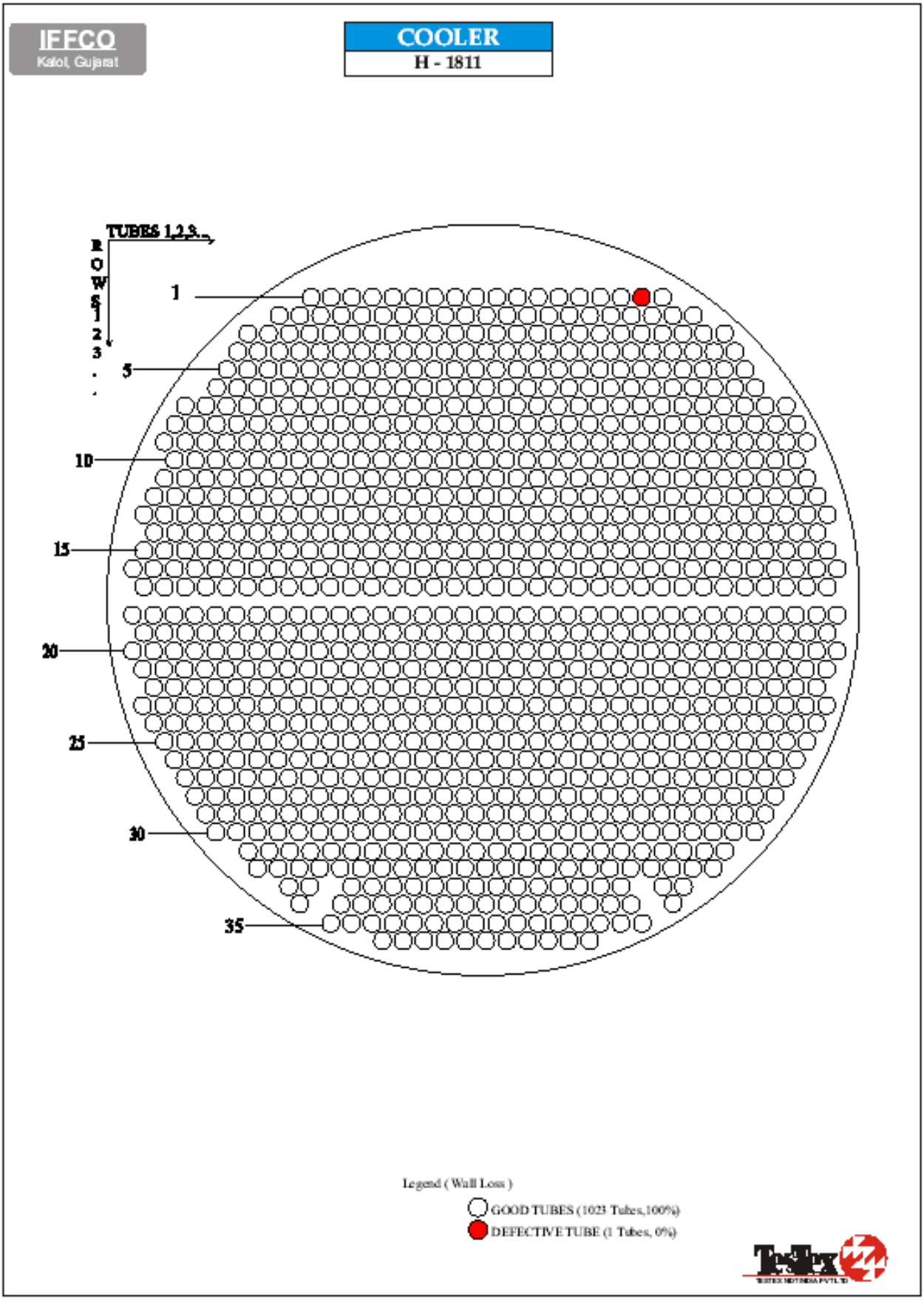
ANNEXURE-8

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



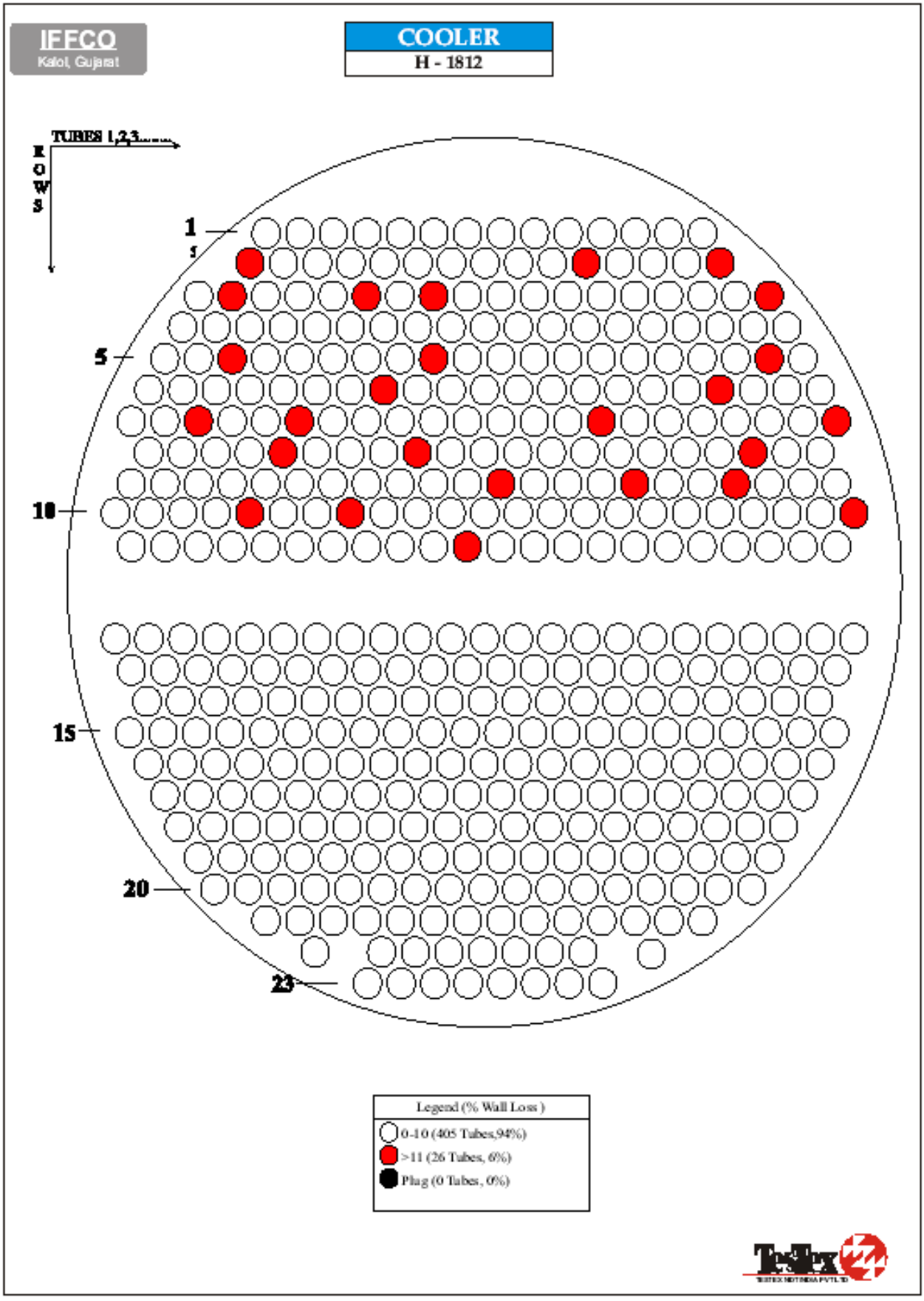
ANNEXURE-9

TUBE SHEET LAY OUT OF H-1811 (VIEWED FROM NORTH)



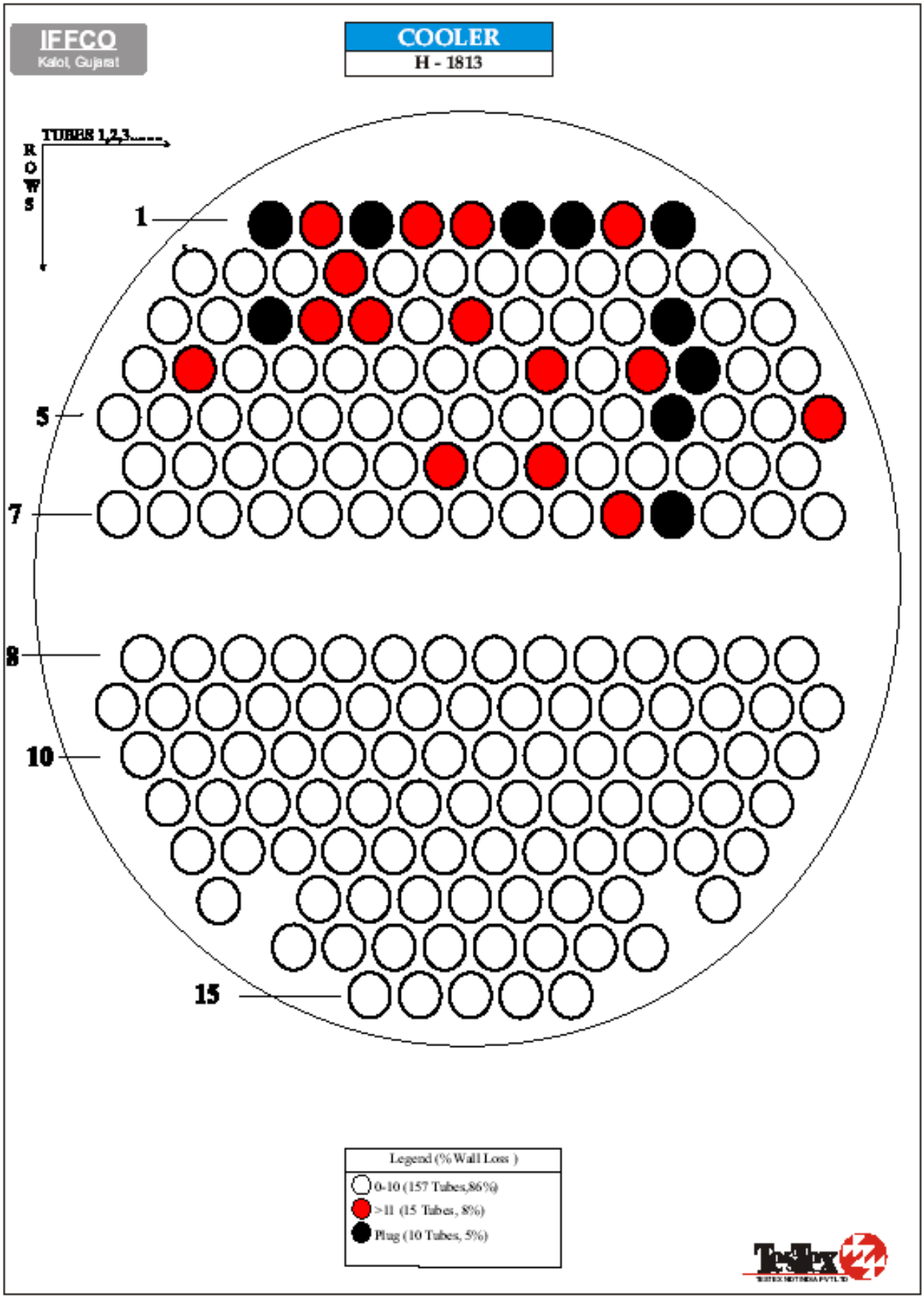
ANNEXURE-10

TUBE SHEET LAY OUT OF H-1812 (VIEWED FROM NORTH)



ANNEXURE-11

TUBE SHEET LAY OUT OF H-1813 (VIEWED FROM NORTH)



OFFSITE & UTILITY PLANT

During Shutdown 2009, the following major inspection activities were performed in Utility Plant.

Inspection of BHEL boiler drums and furnace tubes.

Inspection of Deaerator.

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)

Visual inspection of Steam Drum, Mud Drum, Furnace tubes and Super heater tubes was carried out during this shutdown. Also, Ultrasonic thickness measurement of all accessible tubes, steam drum, mud drum and super heater tubes was carried out. The following observations were made during visual examination.

STEAM DRUM

- The internal surface of the drum had assumed blackish brown coloration.
- All the weld joints were found in satisfactory condition.
- Overall condition of the steam drum was found to be satisfactory.

MUD DRUM

- The shell had assumed blackish brown coloration.
- The condition of the weld joints was found satisfactory.
- The tube stub ends were found satisfactory.
- In general, the overall condition of the mud drum was found satisfactory.

DEAERATOR

Inspection of the Deaerator Head and the Storage Shell was carried out observations are as under.

Deaerator Head

- Two nos. spring loaded distribution valve located on the top observed to have leakage from “O” ring.
- Angle supports provided below 4^{th} & 5^{th} tray from top were found broken and damaged which needs to be repaired.
- All the three segments of the 4^{th} & 5^{th} tray from top were found damaged and dislocated from its position and the same should be repaired.
- A pin hole and leakage was observed in top hood to dome inside welding and the same is marked for repair.

Deaerator Storage Shell

- Brownish coloration was observed inside the shell.
- Condition of the weld joint was found satisfactory.
- Water is found accumulated in the bottom portion of the shell.
- Broken pieces of tray supporting angles were also found inside the storage shell.

FURNACE TUBES

In general, the condition of the furnace tubes and super heater tubes exposed to flue gases was satisfactory. The thickness measurement of, Bank tubes, Sidewall tubes, Baffle wall tubes, D-Panel tubes, Cut corner tubes, Rear wall tubes and Front wall tubes was carried out. The Summary indicating the thickness of individual type of the tubes is given below:

Sr. No.	Description	Minimum Thickness (mm)	Design Thickness (mm)	Percentage Reduction	Refer Annexure
1	**South Manhole**				
(A)	Baffle Wall Tubes	3.7	4.5		**Annexure - 1, 3**
(B)	D- Panel Tubes	4.7	4.5		**Annexure - 1, 3**
(C)	Cut Corner Tubes	4.3	4.5		**Annexure - 1, 3**
(D)	Rear Wall Tubes	3.2	4.5		**Annexure - 1, 3**
(E)	Front Wall Tubes	4.8	4.5		**Annexure - 1, 3**
2	**North Manhole**				
(A)	Bank Tubes	3.3	3.6		**Annexure - 2, 3**
(B)	North Side Wall Tubes	4.5	4.5		**Annexure - 2, 3**

Inspection details of Super Heater Coils and its associated headers

Sr. No.	Description	MOC & Dimension Details	Quantity (nos.)	No. of Joints	NDT Services Carried Out
1	Primary Super Heater Coils	MOC: SA- 213 T-22 Size: 51.00 mm O.D. x 7.1 mm Thick	36	72	• DP Test of Bevel Edges, & Final weld. • 100% Radiography of all weld joints was done.
2	Spacer Coil Primary Super Heater Coils	MOC: SA- 213 T- 22 Size: 51.00 mm O.D. x 7.1 mm Thick	02	04	
3	Secondary Super Heater Coils	MOC: SA- 213 T- 22 Size: 51.00 mm O.D. x 5.6 mm Thick	34	68	
4	Spacer Coil Secondary Super Heater Coils	MOC: SA- 213 T- 22 Size: 51.00 mm O.D. x 5.6 mm Thick	02	04	
5	Modifications carried out in Primary Super Heater Coils	MOC: SA- 213 T-22 Size: 51.00 mm O.D. x 7.1 mm Thick	36	144	

6	Boiler Furnace Rear Panel	MOC: SA 192 Size: D 76.1 x 4.5 x 6500 mm long	02	04	
7	Spacer Tubes	MOC: SA- 192 Size: D 51 x 4.5 mm Thick	02	04	
8	Primary Super Heater Inlet Header (SSH1)	Main Pipe: MOC: SA- 106 Gr. C Size: D 273 x 28mm Thick Bent Nipple: MOC: SA- 213 T- 22 Size: D 51 x 7.1 mm Thick	01	01	• DP Test of Bevel Edges, Root, & Final weld. • 100% Radiography of all weld joints was done. • Hardness Measurement after stress relieving.
9	Primary Super Heater Outlet Header (SSH2)	Header Pipe: MOC: SA- 335 P- 22 Size: D 273 x 36 mm Thick Nipple: MOC: SA- 213 T- 22 Size: D 51 x 7.1 mm Thick	01	01	
10	Spool Piece between Primary Super Heater Outlet Header & De- super heater assembly	Main Pipe: MOC: SA- 335 P- 22 Size: D 273 x 36 mm Thick	01	01	
11	Extension Pipe between De-Super Heater & Secondary Super Heater Inlet Header	Main Pipe: MOC: SA- 335 P- 22 Size: D 273 x 36 mm Thick	01	01	
12	Secondary Super Heater Inlet Header (SHH3)	Header Pipe: MOC: SA- 106 Gr. C Size: D 273 x 28 mm Thick Nipple: MOC: SA- 213 T 22 Size: D 51 x 5.6 mm Thick	01	01	
13	Secondary Super Heater Outlet Header (SHH4)	Header Pipe: MOC: SA- 106 Gr. C Size: D 273 x 28 mm Thick Nipple: MOC: SA- 213 T- 22 Size: D 51 x 5.6 mm Thick	01	01	
14	De Super Heater assembly	Main Pipe: MOC: SA- 335 P- 22 Size: D 273 x 36 mm Thick	01	01	

Hardness Measurement reading after Stress Relieving

Sr. No.	Location	Hardness Readings (in BHN at different points)		
		Weld	Parent metal	Heat affected Zone
1	Primary Super Heater Inlet Header	145 - 164	112 - 115	124 - 126
2	Primary Super Heater Outlet Header	158 - 178	124 - 132	129 - 145
3	Spool Piece between Primary Super Heater Outlet Header & De- super heater assembly	162 - 188	116 - 124	120 – 128
4	Extension Pipe between De-Super Heater & Secondary Super Heater Inlet Header	129 - 135	112 - 120	115 - 119
5	Secondary Super Heater Inlet Header (SHH3)	157 - 178	120 - 127	112 - 126
6	Secondary Super Heater Outlet Header (SHH4)	162 - 181	127 - 129	140 - 167

MISCELLANEOUS JOBS

D.P. TEST

Dye reentrant 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.

ANNEXURE- 1

Thickness measurement report of Front Wall Tubes, D- Panel Tubes, Cut Corner Tubes, Rear Wall Tubes, and Baffle Wall Tubes,

Front Wall Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	1	**4.8**	5.0	5.0
2	4	5.0	5.2	5.2
3	7	5.2	5.1	5.0
4	10	5.1	5.0	5.1
5	13	5.4	5.3	5.2
6	16	5.2	5.4	5.1
7	19	5.0	5.1	5.2
8	22	5.2	5.0	5.1
9	25	5.1	5.2	5.0
10	28	5.2	5.2	5.1
11	30	4.9	5.4	5.1
12	34	5.1	5.2	5.3
13	37	5.1	5.0	5.2
14	39	5.4	5.2	5.3

D- Panel Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	1	5.2	5.1	4.9
2	7	5.1	5.1	5.2
3	13	5.1	5.1	4.9
4	18	5.3	5.2	5.3
5	23	4.8	4.8	**4.7**
6	29	5.2	5.1	5.1
7	35	5.1	5.2	4.9
8	41	4.8	4.9	4.9
9	47	5.1	5.2	5.2
10	53	4.9	4.9	4.8
11	59	4.8	4.9	4.8
12	65	4.9	4.9	4.8
13	71	5.2	5.3	5.2

Cut Corner Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1.	1	4.8	4.9	5.2
2.	7	**4.3**	4.4	5.1
3.	13	4.8	4.6	5.2
4.	19	5.0	5.0	5.2
5.	25	5.2	5.1	5.2
6.	30	4.8	5.1	4.9
7.	33	4.8	5.2	5.0

Rear Wall Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	1	4.8	4.9	4.9
2	2	4.8	4.8	4.7
3	3	4.9	4.9	4.9
4	4	4.7	4.8	4.8
5	5	4.8	4.9	4.7
6	6	4.8	4.7	4.7
7	7	4.8	4.8	4.9
8	8	4.8	4.9	4.8
9	9	4.8	4.8	4.9
10	10	4.9	4.8	4.9
11	11	4.8	4.8	4.9
12	12	4.7	4.7	4.7
13	13	4.7	4.7	4.6
14	14	4.7	4.6	4.6
15	15	4.8	4.8	4.8
16	16	4.6	4.7	4.8
17	17	4.6	4.7	4.7
18	18	3.7	3.6	**3.2**
19	19	3.5	3.6	3.4
20	20	3.6	3.6	3.6
21	21	3.7	3.9	3.7
22	22	3.6	3.5	3.5
23	23	3.4	3.4	3.4
24	24	3.7	3.7	3.8
25	25	3.5	3.5	3.7
26	26	3.5	3.6	3.6
27	27	3.4	3.6	3.6
28	29	3.6	3.8	3.8
29	30	3.4	3.6	3.8

Baffle Wall Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	1	5.1	5.0	5.2
2	3	4.6	4.7	4.9
3	5	4.7	4.9	4.8
4	7	5.4	5.2	5.1
5	9	4.7	4.8	5.0
6	11	5.4	5.2	5.3
7	13	5.2	5.2	5.1
8	15	4.7	5.0	5.1
9	17	4.9	5.2	4.8
10	21	5.0	5.1	4.9
11	25	4.9	5.2	5.1
12	29	5.1	5.3	5.0
13	33	5.1	4.9	5.1
14	37	5.2	5.1	5.0
15	41	4.9	4.9	5.1
16	45	4.8	5.1	4.9
17	49	5.0	5.1	5.0
18	53	5.1	4.9	4.8
19	57	5.2	4.7	4.8
20	61	5.1	5.0	4.9
21	62	4.7	4.8	4.7
22	63	5.0	4.9	4.9
23	64	4.9	4.7	4.8
24	65	4.8	4.6	4.5
25	66	5.1	5.0	5.0
26	67	5.1	5.2	4.7
27	68	5.2	5.1	4.7
28	69	5.0	5.4	4.9
29	70	5.1	5.0	5.2
30	71	5.2	5.1	4.9
31	72	4.9	4.7	4.8
32	73	4.9	5.0	5.1
33	74	4.7	4.9	5.0
34	75	4.7	4.9	4.8
35	76	4.8	5.0	5.1
36	77	5.0	5.0	4.8
37	78	5.1	4.7	4.9
38	79	5.0	4.7	4.5
39	80	**3.7**	3.8	3.8
40	81	4.5	4.8	5.0
41	82	5.2	4.5	4.5
42	83	5.4	4.6	4.9
43	84	5.2	4.9	4.8

Note : 1. Refer Annexure- 3 showing tube layout & numbers identifying the individual tubes.

ANNEXURE- 2

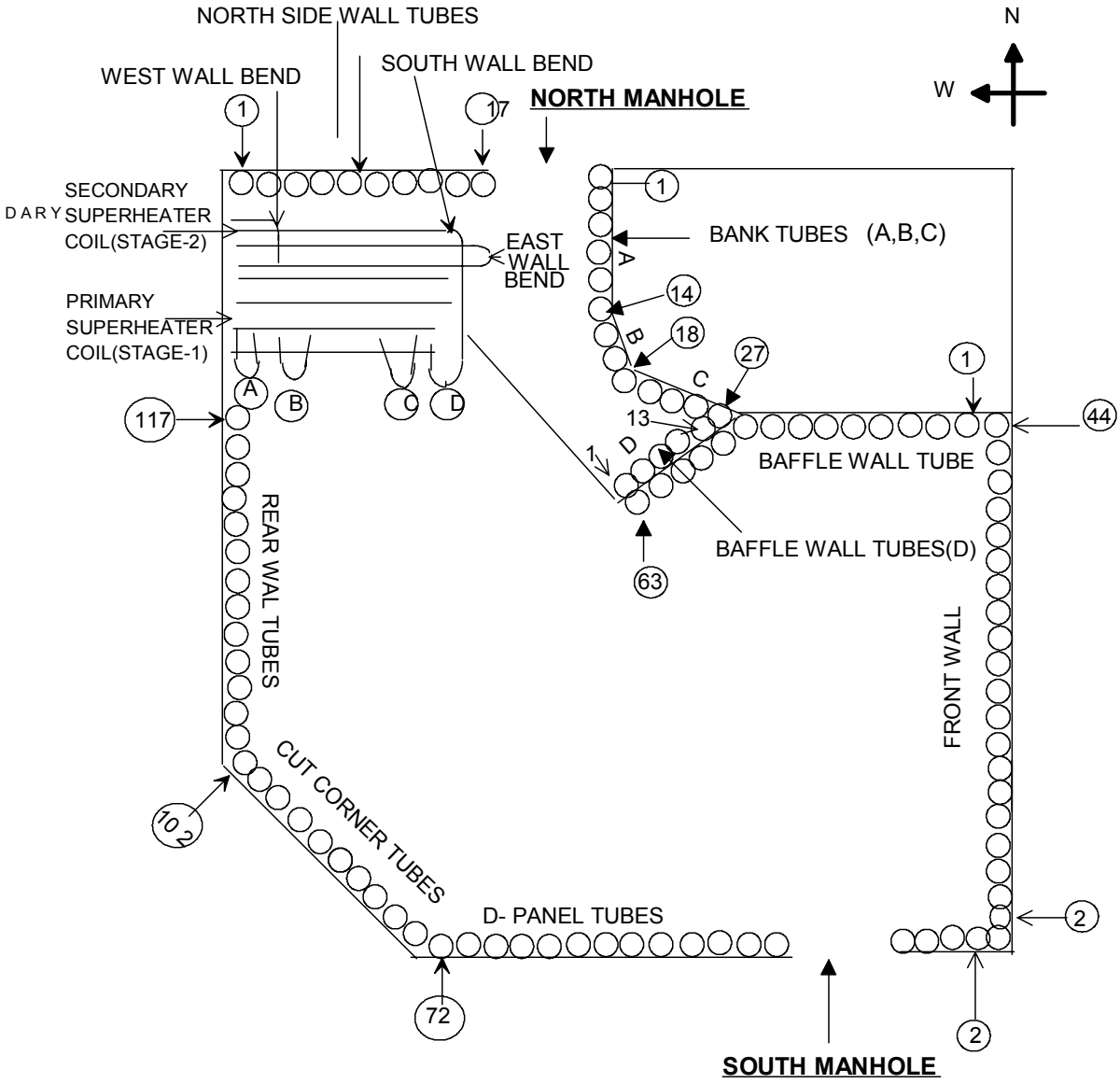
Thickness measurement report of Bank Wall tubes, North Side Wall tubes:

Bank Wall Tubes (Design Thickness: 3.6 mm)					
Sr. No.		**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	A	1	3.8	3.8	3.7
2		4	3.9	3.8	3.7
3		7	3.9	3.9	4.0
4		10	3.5	3.6	3.6
5		13	3.5	3.6	3.5
6	B	14	**3.3**	3.6	**3.3**
7		15	3.4	**3.3**	3.4
8		16	**3.3**	**3.3**	3.4
9		17	**3.3**	**3.3**	**3.3**
10	C	18	3.4	3.4	3.4
11		21	3.8	3.9	3.9
12		24	3.7	3.7	3.4
13		27	3.7	3.7	3.9

North Side Wall Tubes (Design Thickness: 4.5 mm)				
Sr. No.	**Tube No.**	**Bottom** (Thickness in mm)	**Middle** (Thickness in mm)	**Top** (Thickness in mm)
1	1	5.0	5.1	4.7
2	2	5.2	5.0	**4.5**
3	3	5.0	4.6	4.6
4	4	4.7	4.6	4.7
5	5	4.8	4.7	**4.5**
6	6	4.7	4.8	4.8
7	7	5.0	5.1	5.1
8	8	5.1	5.2	**4.5**
9	9	5.2	5.1	5.1
10	10	5.0	5.4	5.2
11	11	5.2	5.3	5.4
12	12	5.1	5.5	5.2
13	13	5.0	5.3	5.0
14	14	5.3	5.3	5.2

Note : 1. Refer Annexure- 3 showing tube layout & numbers identifying the individual ubes.

ANNEXURE- 3



BHEL BOILER FURNACE LAYOUT
(GT-2068)

INSTRUMENTATION

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. Finally control valve stroke was checked.

FRCV-2 : Actuator diaphragm was checked, found ok. General cleaning of positioner, Air filter regulator was carried out. Gland packing was replaced. Finally control valve stroke was checked.

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. Finally the stroke was checked.

PRCV-18 : C/V removed from bonnet , seat & plug were checked. All parts were cleaned and overhauled, found ok. General cleaning of valve positioner was carried out. Replaced gland packing. Finally the stroke was checked.

PICV-181 : C/V removed from bonnet & replaced the gasket to stop leakage from. General cleaning was carried out. Replaced gland packing. Finally stroke was checked.

PICV-14 : C/V was opened from body. Inspected plug and seat. All parts were cleaned, overhauled and assembled. 2 no of Gaskets were replaced & new gland packing was provided, finally C/V stroke was checked.

PICV-24 : Butterfly Valve was opened from body. Inspected trim parts. Provided cold welding material in baffle seating portion. All parts were cleaned, overhauled and assembled. Gaskets were replaced & new gland packing was provided, finally C/V stroke was checked.

FICV-485 : C/V was removed from line. Inspected Plug and seat. Fine cut on plug/seat was taken & lapping job was carried out. general cleaning were carried out. checked the valve for tight shut off & Finally reinstalled & stroke checked.

LCV-490 : C/V was removed from line. Inspected Plug and seat. Finally reinstalled, checked the stroke.

PICV-17 : C/V was removed from line. Replaced the valve body with spare one. Inspected Plug and seat. Fine cut on plug/seat was taken & lapping job was carried out. general cleaning were carried out. checked the valve for tight shut off & Finally reinstalled & stroke checked.

LCV-21 : C/V was removed from line. Replaced the valve body with spare one. Inspected Plug and seat. Fine cut on plug/seat was taken & lapping job was carried out. general cleaning were carried out. checked the valve for tight shut off & Finally reinstalled & stroke checked.

LCV-3B : C/V was removed from bonnet. Inspected Plug and seat. Fine cut on plug/seat was taken & lapping job was carried out. general cleaning were carried out. Finally reinstalled & stroke checked.

FRCV-5 : Control valve was dropped from line. Actuator diaphragm was opened and checked. Provided new gland packing. Stroke was checked.

TRCV-142 : General cleaning was carried out & provided new gland packing & checked stroke.

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

V-3 : Actuator diaphragm was opened and replaced by new one. General cleaning in was carried out. C/V operation was checked.

PRCV- 25 : C/V diaphragm was opened and replaced by new one. 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.

MICV-22 : Gland packing was replaced. General cleaning & greasing was carried out. Finally control valve operation was checked.

PICV-13B : C/V removed from bonnet. Machining of gasket seating surface done in mech. Workshop & replaced the bonnet gasket. Plug/seat were inspected. General cleaning was carried out. Reinstalled it with new flange gaskets. Provided new gland packing. Finally stroke was checked.

FICV-9, 10, 11 : Preventive maintenance was carried out of all three valves. Checked the stroke, found ok.

FICV-7, 8, 15 : Preventive maintenance was carried out for all three valves. Inspected the diaphragm of FICV-7 & 8. Finally checked the stroke of all these valve and found ok.

PRCV-6 : Replaced existing I/L make control valve with KOSO make new control valve with higher leakage class V.

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-61 : General cleaning/greasing was carried out , hand-jack was checked. Finally the stroke was checked.

PGR : Ball valve KV-120-1,2,7,8,9,10 : All the 6 valve were removed from line to facilitate mechanical work.. General cleaning was carried out. After completion of mechanical work reinstalled the valve with new gaskets & operation was checked. In KV-120-1 replaced the Teflon seal ring of ball valve.

PICV-003 : valve was removed from line to facilitate catalyst filing work. General cleaning was carried out. After completion of catalyst work, reinstalled the valve with new gaskets & operation was checked.

PRC-23 : Auxiliary Boiler damper control system general cleaning & checking was carried out. Finally checked the operation.

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	V-18	9	HICV-1004	17	FICV-002
2	V-7	10	PICV-1016A	18	PICV-002
3	LICV-416	11	PICV-1016B	19	PICV-006
4	PICV-470	12	MICV-13	20	MICV 1A to 9A
5	LCV-2	13	MICV-14	21	MICV 1 to 9
6	LCV-2A	14	MICV-15	22	MICV 24 to 32
7	PICV-484	15	MICV-16	23	LCV-16, 17, 19
8	PICV-20	16	LCV-3A	24	MICV-12

COMPRESSOR HOUSE JOBS

Air Compressor (101J)

- 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. After completion of 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. 4H, 7H, 8V & 8H.
  - Replaced broken flexible metal and plastic hose-conduit with new conduit.
- **HIC-101J :** General cleaning and overhauling of governor positioner 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.
- **TRIP-101J:** Mechanical trip feedback Limit switch was overhauled and checked its operation.
- **VS-101J:** The Trip Solenoid valve was overhauled and changed its coil with new one. 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.
- **ZSH-18:** Control valve OPEN/CLOSE Feedback Limit switch was overhauled and checked its operation.

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. After completion of Mech. 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. EA & EB.
  - Replaced broken flexible metal and plastic hose-conduit with new conduit.
- **PRC-9** – General cleaning and overhauling of governor positioner carried out, replaced 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.
- **TRIP-105J:** Mechanical trip feedback Limit switch was overhauled and its 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.

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. After completion of Mech. jobs the same were fixed back after cleaning/functional checking. Gap voltage adjustments for radial and axial probes were carried out.
  - Replaced speed sensor/magnetic pickup with new.
  - Replaced Vibration probe with new Probe for Pt. No. 1V, 9A &10B.
  - Replaced temperature sensor of TI-103J-10A and TI-103J-10B.
  - Replaced damaged flexible metal and plastic hose-conduit with new conduit.
- **PRCV-12(103JAT):** Replaced the Piston/Cylinder & Positioner assembly with spare one. Its air regulator, gauges were replaced. Faulty air lock relay was also replaced with new one. Checked calibration of I to P convertor. Checked air failure action and Stroke-checking was performed locally as well as from control room.
- **MIC-23(103JBT)**: General cleaning and overhauling of governor positioner 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.
- **PSL-104:** 103J L. O. pressure low switch was shifted at a new location as per the requirement of the Production Dept.
- **VS-103J & VS-103:** Trip solenoid valves VS-103J & VS-103 were overhauled. The coil of VS-103J was changed.
- **103J (Trip logic):** Checked the setting for alarm and trip logic.

FIELD INSTRUMENTS JOBS

- 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, changed one MPU with new one.
- Calibration was checked of Alarm, AOP & Trip pressure switches of 115JA, 115JB
- PAL- 432 PAL- 433
- PSL-115JA PSL-115JB
- PSLL-115JA PSLL- 115JB
- Replaced Thermowell with Thermocouple of TI-0118, TI-0119, TI-0120 of 103D (secondary reformer) as same were found bent & open.
- Removed the thermocouples connection of 103D metal temperature points MTI-105,106,107,108 to facilitate catalyst filling job and refixed the same after completion of catalyst loading job.
- In primary rerformer catalyst filling Job: Provided press. Gauges & PVC tubing as per requirement of Production Dept.
- Removed all tunnel T/Cs with Thermowell for inspection and refixed after checking. Replaced thermocouple of TI-0071 & TI-0075.
- TI-0085 & TI-0110: Replaced the thermo-couple by new one.
- Various instruments were removed at 107-JAT to facilitate Mech. Maint. jobs. After completion of Mech. jobs the instruments were reinstalled.
- 107 JAT Trip Solenoid valve was removed and total overhauling, recabling & rewiring for trip switch & solenoid valve were carried out.
- Replaced Air/Filter regulator with new ones of I/P converters of the following control valves: HICV-431, HICV-435, TRCV-484, LICV-416, FICV-470, HICV-487
- Provided low range Pressure Gauges at different locations 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.
- LT-103D: the transmitter was flushed & it's zero was checked.
- 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.
- FICV-7: provided new SS tubing on control valve & valve Positioner.
- Provided new ¼" SS needle valve in lab. Sample line.
- Steam Drum(101F): Following instruments of steam drum were checked.
- Level monitoring system- Level State.
- Level transmitters.
- Pressure Transmitters.
- Level switches.

- FRC-2 (DCS) : Replaced the transmitter with new calibrated Yokogawa make transmitter. Also its Orifice was inspected & it was found as per design data, no erosion or corrosion was found.
- 104-J : provided a manual loader for mechanical governor checking purpose & removed after completion the mech. Work. Calibration was checked of PSL-104J lube oil AOP switch
- 116JAT : Removed & refixed all the instruments (MPU, Sol.Valve, Governor signal tubing) to facilitate mech. maintenance jobs.
- MICV-12 : Replace the signal isolator & relocated wiring at 24V DC busbar.
- Instrument Air Drier: Overhauled all the NRVs and four way valve.
- USV-932 : removed the tubing & Sol. Valve accessories to facilitate mech. Work (SS Flange replacement) same were reconnected after completion of maint. work.
- 103-J Lube oil consol pressure gauge extra panel was removed. For that AOP PSL-103-J pressure switch was relocated & necessary cable rerouting job was carried out.
- 108-C & 109-C (Mdea cooler): Removed the thermocouple, pressure gauges & other instruments to facilitate mechanical jobs and same were reinstalled after completion of maint. work.
- Sample tubing of 3/8" SS tubing from HTS/LTS/HTS guard to Laboratory was done also necessary fittings & isolation needle valves were provided in laboratory. The same were removed after regeneration of catalyst job.
- Fabrication & Welding work was carried out to provide new SS air header from PGR to GAIL area. Provided isolation valve.
- TI-0098: Provided New thermowell & thermocouple at 122-C outlet.
- TI-102B: Replaced the RTD by new one.
- Removing and refixing of instruments at different locations to facilitate mech. Job.
- C.G.Circulator: Cooling water pressure & Suction pressure switches were calibrated.
- LT-13 (106f\F Level): Provided new DP transmitter for level measurement.
- LC-2(Level Tx. Surface condenser) Separate Tapping for DP Tx. for HP tapping was taken earlier it was from level gauge bottom isolation valve.
- Inlet & Outlet tapings from Inlet & Outlet line were provided form existing air dryer for new coming instrument air dryer.
- JBC-29 & JBC-30: 12 pair cables were inspected from JB to Control room. Also new lugs & ferrules were provided in DCS marshalling cabinet for JBC-30.
- TI-0123: Thermo-well removed from line inspected & fixed back.
- Provided 1/4” SS Valve in sample line of 105-D inlet & outlet as well as 108-D outlet.
- FR-33: Tx calibrated by applying actual DP, found ok.
- ZSL-104, ZSL-110: Replaced the micro switches in limit switches of valve and new cable provided from Limit switch to Junction box. Checked the on/off indication in PLC.
- General cleaning & Calibration were carried out of ISO & CDM related instruments.

- Following ISO related Quality/Safety affecting 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	11	
3	FR-6	6	PI-676	9	TI-0065	12	

ANNUAL MAINTENANCE OF DCS, PLC, UPSS & GAS ANALYSER

FUJI UPSS

- The battery No.27, 116, 124 were removed from battery bank and charged separately with external charger for 24 hours and refixed in the bank.
- 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).
- Load testing for the battery bank was carried out. Duration for that was 15 minutes. After 15 min. the battery bank voltage was found normal i.e 220V 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.

YIL DCS

DCS shutdown maintenance activities were carried out as per the AMC procedure. The following activities were carried out in Ammonia plant.

- 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 were 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 and found OK.
- Redundancy checks were performed on HF-BUS, Vnet, 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 of Centum-XL and system cabinet of FCS0101. Presently all fans are functioning ok.
- 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

HIMA PLC shutdown/ preventive maintenance activities were carried out as per the AMC procedure.

- Cleaning of filters, fans, cabinets etc. was carried out for all the four PLC stations.
- Checked the redundancy of all the four PLC at card, CPU and power supply level.
- The Faulty F-3237 card was replaced with spare card: Location: 1307 in PLC-3.
- Back up copy of all the programs (ELOP and Wizcon) were taken.

On line Gas Analyser : ABB make CH_4 and CO_2 (AR-1 & AR-2)

- Preventive maintenance of ABB make CO2 and CH_4 analyzer was carried out. CO_2 and CH_4 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 CO_2 and CH_4 analyser was performed & found ok.

On line Gas Analyser : O_2 and H_2 (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 O_2 and H_2 analyser was performed & found ok.

CONTROL ROOM JOBS

- Monitor of HIS-0161 was repaired.
- CS3K Analog inputs reshuffling job: 2 nos of new Analog Open Loop cards (Model No - AAV 141) were installed in System Cabinet, 1 nos of Analog Open Loop ELCO board was mounted inside Marshalling cabinet & the other was mounted inside System Cabinet, required wiring from Signal isolator to ELCO board was carried out. List of tags reshuffled is mentioned below.

		FROM	TO
	Tag.	Isolator Details	Isolator Details
1	FI-475	RB1-17-5/6	RB3-17-5/6
2	LI-101JLT	RB1-29-5/6	RB3-18-5/6
3	LI-103JLT	RB1-31-5/6	RB3-19-5/6
4	SI-101BJT	RB2-5-6/8	RB3-20-6/8
5	SI-431	RB2-7-6/8	RB3-21-6/8
6	SI-432	RB2-9-6/8	RB3-22-6/8
7	SI-433	RB2-11-6/8	RB3-23-6/8
8	FR-650	RB3-9-5/6	RB3-24-5/6
9	FI-503	RB3-11-5/6	RB3-25-5/6
10	LI-172F	RB3-13-5/6	RB3-26-5/6
11	LI-2801	RB3-15-5/6	RB3-27-5/6

- TDIX units were relocated & rerouting of cabling & wiring job was carried out.
- Faulty V-Net Cable replaced with a new one by YIL People.
- New Graphic page designed in CS3K (for Syn Gas Loop).
- Faulty CD-ROM drive replaced in HIS0162.
- MOV SP-152: Pulse to operate MOV increased from 30 sec to 180 sec as per the requirement of electrical & production people.

TECHNICAL DEPT. JOBS

- **Synthesis Gas to BHEL boiler** scheme following jobs were carried out.

  PIC-007: Installed the Transmitter & control valve and related cabling, wiring, air header for I to P converter ,Control valve & Tubing work was carried out & line up in DCS.

  LIC-007 : Installed the Transmitter & control valve and related cabling, wiring, air header for I to P converter ,Control valve & Tubing work was carried out & line up in DCS.

  Press. Gauge & Temp. gauge :Provision was done for them & provided the same.

- **Cold Ammonia from storage inlet to 107- F instead of 109- F. (Ammonia Suggestion: SS/Amm/020/07)**

  FI-107 : Prepared the orifice and **:** Installed the flow transmitter and related cabling, wiring & impulse Tubing work was carried out & line up in DCS.

- **Scheme of diversion of 104-E overhead vapors to 101-B stack.**

  LT- 22 : Installed the Level transmitter and related cabling, wiring & Tubing work was carried out & line up in DCS.

  TI-0061A, TI-0061B, TI-0061C : Provided 3 nos. of new thermowells & Thermocouples On ID Fan suction & Discharge. Thermocouple cabling, wiring work was carried out & line up in DCS.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND

- **PRCV-6 :** A new koso make class V control valve was procured & installed in CO2 absorber vent for that necessary tubing,Cabling & wiring job was carried out. Finally checked the loop from DCS.
- **FRCV-5 :** A new IL make control valve was installed in 107JT for that necessary tubing, Cabling & wiring job was carried out. it was found that control valve Cv in higher side and turbine operation was within 10% of total range. hence, new valve was removed from line & original old valve was installed. Necessary action will be taken for reduced trim as per actual DP across valve & to be installed in next available opportunity.
- **Thermocouples & JB replacement** : Provided 2 nos. of Junction boxes for HTS, LTS & Methanator temperatures. Provided all new tc cables from TC head to New JBs. Diverted all the control room cables from old TC JB to new TC JB. Carreid out necessary cable trays, Cabling, Glanding, terminations work in TC head, JB and in DCS. Finally all the thermocouples were checked.

PREVENTIVE MAINTENANCE JOBS

- **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 by M/s L & T Ltd.as per the AMC. 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 T/C JB with new one for better reliability & performance. (JBT-2)
- Replaced the PRCV-6 vent control valve 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

HITACHI (CO2) COMPRESSOR

- All RTDs and Thermocouples were removed to facilitate Mech. Maintenance jobs. Checked and installed back after mech. Maintenance job was over/ completed.
- Vibration probes and extension cables were removed and checked and installed back to facilitate Mech. Maintenance jobs.
- Followings Trip and Alarm Switches were cleaned, checked and calibrated:-
- LSHH-1804, LSHH-1806, LSHH-1822, LAH-1822, LAL-1824, LAL-1809, PSLL-1801A, PSLL-1801B, PSLL-1801C, PSHH-1843B. PSHH-1843C, PSHH-1839A, PSHH-1839B. PSHH-1839C, PSLL-1838A.PSLL-1838B, PSLL-1838C, PSL-1812, PSL-1813, PSL-1844, PSLL-1818A,PSLL-1818B,PSLL-1818C,PSL-1816.
- Disconnected and removed ZSH-1849, ZSH-1850, ZSH-1851 to facilitate Mech. Maintenance jobs. The switches were checked and installed back.
- TE-1834: RTD was replaced by a new one as the old one was found damage.
- Local Control Panel and PLC Box were cleaned, all wiring connection were tightened
- Followings transmitters were calibrated :-
- LICT-1803, LICT-1805, LICT-1807, LICT-1823. FIC 1801, PI -1802,
- FR-1201, PT-1809, PT-1805.
- All junction boxes were cleaned, terminal tightened.

CONTROL/ MARSHALLING ROOM

- Following annual preventive maintenance of DCS, was carried out, by Yokogawa representatives : Cleaning of Cards, Software backup of FCS and all ICS, Batteries Voltage of all ICS and FCS were taken. Functionality checking of FCS and all ICS by diagnostic software and found to be O.K.
- Engineering work in DCS System was carried out for new control valve HICV-1405.
- Water-in-carbamate Analyzer's signal wires were connected directly to DCS, to reduce wiring length and easy wiring traceability, as they were originally routed through vibration monitoring panel.
- Annual preventive maintenance and Panel cleaning & checking of OMRON PLC was completed by M/s Omron PLC's authorized service engineer. CPU Battery voltage were checked and found alright. PLC working was checked and connectivity with monitoring PC was checked and found O.K. Back UP of the PLC program was taken.
- A M S System for daily log sheet and alarm recording system PC was checked. Previously reported problem's solutions / required modifications were completed.
- Cleaning of wood ward Governor Console and Antisurge controller was carried out.

- Radiac Relay unit for LR- 1201 and its spare were calibrated.
- Radioactive source of LRC-1201 and LR- 1201 were removed to facilitate mech. Maint. Jobs.
- New Radioactive source of LR-1201(1400mCi) was installed. Annual preventive maintenance and System check up was completed by M/s Berthold's authorized service engineer.
- Evaluation unit for the autoclave Re-calibrated by M/s Berthold's authorized service engineer as new radioactive source was installed.

OTHER PLANT JOBS

- Replacement of old CS pipe air header with SS pipe header.
- Installation of and signal cabling for new control valve HICV-1405 was completed (For diversification of vent gases of Urea solution tank & ammonia water tank to first evaporator condenser)
- LRC-1201 and LH-1201 detectors were removed and installed back to facilitate Mech. Maintenance jobs.
- 9 nos. HP Thermowell removed, hydro tested, and all thermowell were re-fixed.
- F I – 1141 Shifting as per technical scheme and preventive maintenance of turbine flow meter for cooling water return line flow was carried out.
- Following ISO Quality affecting instruments were calibrated:-
- PT-5303, PT-4405, PT-1121, PT-1145, PT-1201, PT-1202, PT-1422, PT-1421, PT-1105, PT-1802, SI-1401A, SI-1401B, FT-1201.
- 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
- All Plant J. B. 's terminal were tightened.
- Following Transmitters were calibrated.
- LRCT-1421. PT-1282, PT-1481, LT-1481, LT- 1701 A & 1701 B LICT-1203, LICT-1235,. LRCV-1201. PT- 1202. LT-1202. PT -1201C.
- 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, PSLL-1101, LSL-1357,
- Coordinated with Production/ Maintenance persons for miscellaneous plant Jobs related to instruments.
- Instrument air header was flushed at various points

WEEP HOLE CHECKING OF HP VESSELS

- Coordinated with production persons for weep holes tubing. New tubing was provided as per requirement from production department.
- Coordinated with production persons and mech. Maint. People for weep holes checking to detect leakage, if any, in the liner of Autoclave. New tubing and air feeding provisions were provided as per requirement from production department.

CONTROL VALVES

Complete overhauling of the important valves was carried out as detailed below :

- LRCV-1201 –Control valve was dropped from line and following jobs carried out. Diaphragm checked. Plug and seat were replaced by spare ones. Gland packing and sleeve replaced by new. Control valve was boxed up in line and Valve stroking was carried out.
- HICV-1201 The valve was dropped from line, over all maintenance was carried out including 1..diaphragm changed with new one, 2..Plug & Seat were replaced by spare good one (repaired). C/V body was replaced by spare good one (repaired). Gland packing and sleeve were replaced by new. Control valve was boxed up in line and calibration carried out and put in line.
- PICV-1130 Control valve was dropped from line. Plug was lapped and cleaned seat was fabricated from aluminum as soft seat in place of graphite Teflon, as the Teflon was not giving sufficient long life. Provided new gland packing. Control valve was boxed up in line. Calibration carried out and put in line.
- HICV-1222 B – Control Valve was opened from line. Actuator link and baffle was repaired/ modified. Hand jack assembly was repaired. Control Valve was overhauled. C/V was boxed up in line. Calibration carried out and put in line.
- N/C Ratio meter – Diaphragm of Monoblock valve was checked and replaced by new one and put in line.
- Actuator of Prill Divert three-way valve was replaced by spare one (Repaired).Teflon seat and packing rings was replaced by new one.
- PRCV-1201 Control Valve was opened from line. Plug and Seat lapping was carried out. Control Valve was overhauled. C/V was boxed up in line. Calibration carried Out and put in line.
- PRCV-1202 Control valve was opened from line. Machining done on plug & seat. Control valve assemble work done. Provided new Gland packing. Control valve was boxed up in line. Calibration carried out. CS Air tubing changes to SS
- LRCV- 1421-Control Valve was opened from line. Machining was done on plug and Seat . Diaphragm was checked. C/V was assembled. Gland packing was replaced by new one. C/V was boxed up in line. Calibration carried out.
- FICV-1102- Control Valve was opened from line. Soft seat was replaced with new one. General overhauled, calibration carried out and put in line.
- HICV-1207 - Control Valve was opened from line. Control Valve was overhauled.
- PIC-1353 - Control Valve was opened from line. Control Valve was overhauled.
- PICV-1129 - Control Valve was opened from line. Replaced its flange gaskets and calibration of valve completed.

- PICV-1202 - Control Valve was opened from line. Control Valve was overhauled, diaphragm and gland packing replaced. Stroking of valve completed.
- PRCV -1504 Control valve was opened from bonnet. Plug, seat was repaired / modified. Provided new gland packing. Control valve assembled and boxed up in line. Calibration carried out.
- TICV-242- Control Valve was opened from line. General overhauling carried out, diaphragm checked and found alright. Valve boxed up in line and calibrated.
- FICV-1202 Control Valve was opened from line. General overhauling carried out. The plug was modified / repaired to suit the valve assembly and performance of the valve. Diaphragm replaced. Valve boxed up in line and calibrated.
- FICV-1385 Control Valve was opened from line. Machining was done on plug Diaphragm was checked. C/V was assembled. Gland packing was replaced by new one. The control valve put in line and calibration carried out.
- PICV-1979A Control Valve was opened from line. Control Valve was overhauled, diaphragm was checked, gland packing replaced. Stroking of valve completed.
- PICV-1979B Control Valve was opened from line. Control Valve's gland packing replaced. Carried out hydro test ,assembled and stroking of valve completed
- PICV-1105 Control Valve was opened from line. Control Valve was plug and seat inspected seat plug lapping done,. diaphragm checked and gland packing replaced. Stroking of valve completed

PARTIAL OVERHAULING

Partial overhauling of some of the important control valves listed below was carried out. Trim parts were inspected gland packing and gaskets were replaced as per requirement. The valves boxed up and calibration completed:
FICV-1281, FRCV-1201, FRCV-1421, HICV-1352, HICV-1422, LCV-1235, LICV-1201, LICV-1203, LICV-1281, LICV-1502, PICV-1130, LICV-1203,HICV-1211, PICV-1201, PRCV-1504, TICV-1101, TICV-1352, TRCV-1202

STROKE CHECKED AND CALIBRATED FOR THE FOLLOWING VALVE

FIC-4801, FICV-1204, FRCV-1421, LRCV-1421, PIC-4801 & PICV-1128

UTILITY & OFFSITE PLANT

BOILER PLANT

CONROL ROOM JOBS

- Cleaning of DCS & PLC panels & and checking of hardware functionality were done under the CAMC Contract. Following jobs were carried out.
  - Redundancy check of DCS and PLC were done. Found o.k.
  - DCS/PLC trip logic was checked.
  - DCS / PLC Back-up was taken in CD.
  - Installed communication card for DCS to PLC communication**.**
  - Oil burner related Graphic / logic was removed from DCS / PLC
  - Installation / commissioning of new Syn. Gas/ RLNG dual burner related Graphic / logic & necessary modification job was carried out by service engr. from YIL.

FIELD JOBS

- Installation / commissioning of new Syn. Gas/ RLNG dual burner related instruments was done. Necessary cable tray & cable laying, glanding and termination in local JB / marshalling cabinet was carried out. Calibration of all new PT, FT, Press. switches, Control valves and Ball valves was also carried out. Complete loop checking of all newly installed instruments thr'o DCS was carried out in presence of commissioning engr. from TBW.
- Installed new thermocouples ('K' type -19 nos.) for Super heater coil metal temp. measurement after replacement of Super heater coil tube.
- Following Pressure switches were relocated (after RLNG heat exchanger)as required by process people.
- PSL-25, PSN-26 & PSH-26
- LSHS related all instruments were removed from line.
- Following field switch set value were checked
- LSLL-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 DRUM :
- EYE-HYE Electrodes were checked and tighten all the terminals.
- High tech make steam drum level indicator electrodes were checked and tighten all the terminal
- Press.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.

CONTROL VALVES

Following control valves were removed from line for complete overhauling.

- Inspection/maint. of Seat/Plug, valve positioner, I/P Convertor, Actuator diaphragm, Gland packing, cleaning of Air supply regulator ,replacement of gasket as required, c/v stroke checking etc.)
- LCV - 4201 and PCV-3064B
  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.)
- TCV-4, PICV-5151, LCV - 4, LCV - 371, DCV - 601,
  Following control valve's preventive maintenance was carried out. (General cleaning & c/v stroke checking.)
- PICV - 50, PCV – 2, PCV- 3064A LCV – 3055A/B, LCV – 3051A/B, LCV - 3053A/B ,LCV-3058A/B,PCV-3065A/B,PCV-3009,PCV-3015, FCV- 1 FCV-2, TCV-2, LCV-3,

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.

D.M. WATER TREATMENT PLANT

- **DCS RELATED JOB :**
  - Engineering station for D.M.Plant and Boiler were seperatly asigned.
  - Cleaning of DCS panels & checking of hardware functionality were done. Redundency check of DCS was done. Found o.k.

- **2 x 60 KVA UPSS :**
  - Installation and commissioning of new 'EMERSON' make 2 x 60 KVA UPSS was carried out in presence of Service engr. from EMERSON Network Power System Ltd. Performance of UPSS was checked with both the water and resistive load.
  - Power from FUJI make Ammonia plant UPSS was disconnected in Urea plant and EMERSON make UPSS's power was connected with rea, Boiler, DM and I.G.plant.

NH3 STORAGE

- Cleaning of Tata Honeywel PLC was carried out. Checked PLC programme by connecting PLC with PC.

COOLING TOWER

- Q- 4411 (Elliott Turb.) All radial vibration probes , speed pick-up probe, local THI & PI were removed & reinstalled to facilitate mech. maint.
- LT-01, Hotwell level transmitter of H-4411(Surface condensor) was replaced with new 'V-Automat' make leveltrol.
- LIC-01, Hotwell level controller of H-4411 (Surface condensor) was replaced with new 'Yokogawa' make electronic controller.
- All the three level switches (LSAL-01, LSAH-01 & LSHH-01) of H-4411 (Surface condensor) were cleaned & calibrated.
- Techogen. of Q-4402 & Q-4403 were cleaned, checked and fixed back.
- R.W. inlet flow element (ANNUBAR) was removed from line. Same was cleaned & 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.
- Power cable from new (Emerson make)UPSS room to control panel laid.
- Cleaning of control panel & tightening of all terminals inside panel was carried out.

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.
- Installed new UPSS power distribution box with MCB for future use. Attended all running jobs.

WEIGH BRIDGE (40 MT)

- Ashbee make Weigh bridge platform alignment by water leveling was carried out by service engr. from Ashbee. Replaced 3 nos. of load cells with new one as they were found giving higher/lower mv at no load condition.
- Calibration of weigh bridge was carried out with standard weights.
- Stamping of weigh bridge got done.
- Painting of platform was also carried out.

B & MH. PLANT

- POWER BUILD MAKE AUTOMATIC BAGGING M/C (P/S No. 1,2,3,4,7, 8, 9A, 10A & 10B)
  - Checked wiring terminals in the main panel, local panel, Solenoid boxes, and loadcell boxes.
  - Cleaned and checked CSC-25, relays board, fuses, and all sensors.
  - Checked functioning and calibration of all Packer Scales.
  - All solenoid valves were overhauled.

- J.**R.S.L MAKE AUTOMATIC BAGGING M/C NO:9B (Computpak) AND MIMIC PANEL OF CONVEYOR BELT**
  - Cleaned the local panels and PLC Panels and tightened all wiring terminals of local / PLC Panels.
  - All oil lubricators were overhauled.
  - WEIGH SCALES (Mettler-Toledo make)
  - Cleaned the weighing scales and Digital Indicators.
  - Calibrated all weighing scales.
  - Weigh scale platforms were cleaned & painted.

- **BELT WEIGHER SYSTEM**
  - 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. Above activities were carried out by service engr. from EMTIC in our presence.

- **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 positioner. Cleaning of sampling system and calibration of Ammonia analyzer.

ELECTRICAL

AMMONIA PLANT

- Preventive maintenance of transformers TR-21, 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.
  - Measurement for Insulation resistance, BDV of transformer oil.
  - 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.

- Overhauling of transformer TR-6 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 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 outgoing terminals.
  - Cleaned the feeder compartments.
  - Replaced damaged/ worn out contacts, etc.

- Overhauling of following motors was carried out:
- 104J, 104 JA, 104 JT, 104 JTA, 107 JT, 118 JB, 170-J, 170JA, 106-J, 101-BJ and 116-JB

- Preventive maintenance of actuators carried out for the following MOVs and tested with their interlocks (If any): SP1, SP3, SP4, SP5, SP70, SP152, and SP158 & SP159.

- Existing Limit torque actuator of MOV SP151 & SP-156 have been replaced with new Rotork actuators and modified the control wiring accordingly.

- Preventive maintenance of TMG Breakers installed in MCCs was carried out.

- Testing and calibration of power analyzer installed in MCC-16 for 117J syn-gas compressor has been carried out.

- Three heating elements were found damaged in PGR heater and was taking more time to reach desired temperature. The three defective elements replaced with new elements.

- Testing and calibration of protective relays installed in MCCs and substations were carried out.

- Provision for emergency power made for condensate pump 112JB.

UREA PLANT

- 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 connection.
  - Measurement for Insulation resistance, BDV of transformer oil.
  - 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 in the feeders.
  - Cleaned the feeder compartments.
  - Replaced damaged/ worn out contacts, etc.

- Overhauling of following motors was carried out:

  P-1408, P-1501, M-1402/1&2, M-1419, M-1421, M-1401/A&B, K1401/1, 2, 3 & 4, P-1204/A, M-1403/1, 2 & 3, P-1815A,P-1817, P-1302 D, P-1506, M-1703, P-1814

- Preventive maintenance of actuators of following MOVs was carried out:

  MOV1501, MOV1203, MOV1202, MOV1801 & MOV1102

- Existing Limitorque actuator of MOV-1201 is replaced with new Rotork actuator and modified the control wiring accordingly.
- Preventive maintenance of TMG Breakers installed in MCCs was carried out.
- Installation & testing of new spare motor in M-1403/1 conveyor.
- Replacement & testing of new scrapper motors, M-1402/1&2.
- Replacement of Radiators & Radiator valves of TR- 7A.
- Preventive maintenance of rope switches installed on Conveyors Nos. M-1419, M-1421 & M-1403 train.
- Shifting of power supply of following MOVs to the Emergency section in MCC-6.

  MOV1501, MOV1203, MOV1202 & MOV1101

- Testing and calibration of protective relays installed in MCCs and substations were carried out.

OFFSITE & UTILITY PLANT

OFFSITE PLANT

- Preventive maintenance of transformers TR-1A, TR-1B, TR-1C, TR-4A, TR-4B, 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.
  - Measurement for Insulation resistance, BDV of transformer oil were 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 were replaced.
- 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:
  - Checking the tightness of cable & wiring terminals in the feeders.
  - Cleaned the feeder compartments.
  - Replaced damaged / worn out contacts, etc.
  - Tightness of the bolts of bus bars in DG Panel was checked.
- Overhauling of following motors was carried out:

  P-2161, P-6117B, K-5201, P-3102C
- 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.
- Preventive maintenance jobs were carried out in 11 KV MPSS:
  - Checked the tightness of outgoing terminals.
  - Cleaned the feeder compartment of both Jyoti and Siemens panel
  - Replaced damaged /worn out contacts, etc.
- Preventive maintenance and overhauling of HT Jyoti Breakers installed in 11KV MPSS were carried out.
- Preventive maintenance of TMG Breakers installed in MCCs was carried out.
- Testing and calibration of protective relays installed in MCCs, DG set and EHVSS/MPSS were carried out.

UTILITY PLANT

- 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.
  - Measurement for Insulation resistance, BDV of transformer oil were 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 the transformers were attended and damaged gaskets were replaced.

- Overhauling of transformer TR-8 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-1, MCC-2, MCC-2A, MCC-2B/2E, MCC-2F and MCC-13 was carried out and the job details are as under:

  - Checked the tightness of cable & wiring terminals in the feeders.
  - Cleaned the feeder compartments.
  - Replaced damaged / worn out contacts, etc.

- Overhauling of the following motors was carried out:

  RAH motor, P-5120, P-5113, P-4403, P-4401/B, P-4412, P-4411/A, P-5118B, P-5118A, P-5119, P-5117, P-5111/A, P-5111/B, P-5112/B, P5112/A

- Existing Limit torque actuator of P-4401-B and P-4402 is replaced with new Rotork make actuator and modified control wiring accordingly.

- Replacement of MCC-1, Section-B with new Siemens panel:

  - Removing and shifting of old panel from existing location and all power and control cables disconnected from old MCC panel.

  - Installed new panel in place of old one and reconnected all power and control cables. Testing and commissioning has been carried out.

- Preventive maintenance of TMG Breakers installed in MCCs was carried out.

- Testing and calibration of protective relays installed in MCCs and substations were carried out.

B&MH PLANT

- Preventive maintenance of transformers TR-5A and TR-5B was carried out and the job details are as under:
  - Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
  - Measurement for Insulation resistance, BDV of transformer oil were 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 were replaced.
- 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 outgoing terminals.
  - Cleaned the feeder compartment.
  - Replaced damaged /worn out contacts, etc.
- Overhauling of following motors was carried out:

  P-2163, P-2704/3, M-2137, M-2122/A2, M-2122/A1, M-2110, K-2161, M-2117, M-2116/1, M-2116/2, M-2116/3, M-2116/4, M-2116/5, M-2112, M-2121, M-2122
- Preventive maintenance carried out on all rope switches installed on Conveyors: M2110, M2112, M2117, M2121, M2122 & M2123 and replaced defective one with new.
- Testing and calibration of protective relays installed in MCCs and substations were carried out.
- <u>Non Plant</u>

  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.
  - Measurement for Insulation resistance, BDV of transformer oil were 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 were replaced.
- Preventive maintenance of the all feeder compartment in Fire MCC was carried out and the job details are as under:
  - Checked the tightness of outgoing terminals.
  - Cleaned the feeder compartment.
  - Replaced damaged /worn out contacts, etc.
- Testing and calibration of protective relays installed in MCCs and substations were 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 namely ACCMON car manufactured by M/S. ACE CALDERYS LTD. (cost RS. 70 to 80,000 per tone)

- Repairing of damaged refractories lining of header with ACCMON car high tech castable material

PRIMARY REFORMER

- Repairing of Refractory lining work and removal of old damaged refractory.

- Dismantling of insulating bricks and replacing of ceramic fiber z section module insulation and ceramic fiber blanket for wall no. 3 & 4.

- 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

UREA PLANT

PRILL TOWER SCRAP FLOOR

- Dismantling of old epoxy coating and providing new epoxy coats
- Damaged acid proof brick repairing.

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 16 numbers of conveyor supports.

OFFSITES & UTILITY PLANT

BHEL BOILER AREA

- Grouting work for 2nos. new burner.
- Flooring of primary coil area by ACCMON car high tech. castable material.
- Repairing of super heater drum refectory.
- Repairing of damage hot insulating brick.
- Repairing of boiler top drum refectory by ACCMON car high tech. castable material.
- Repairing and replacement of damaged AC sheets.
- 4 meter HT. refractory lining job at entrance coil location.

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 new R.C.C wall work at ammonia cooling tower.
- Construction of brick wall work inside the ammonia cooling tower.

B&MH PLANT

RECLAIM MACHINE

- P.C.C work at both sides of rail for reclaim machine

TOP SUSPENDERS AT SILO BELT GALLARY

- 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.

TECHNICAL

COLD AMMONIA FROM STORAGE INLET TO 107- F INSTEAD OF 109- F (REF: AMMONIA SUGGESTION: SS/AMM/020/07)

Cold Ammonia from storage is earlier received in 109-F for plant start-up and during balanced plant operation to maintain flash drums level. This cold ammonia get mixed with hot Ammonia from refrigerant Condenser (127-C) and reduces the hot Ammonia supply temperature to Urea plant to about 20 deg C. Surplus Ammonia from 109-F is let-down to 110-F.

Liquid ammonia from separator (106-F) is letdown to 107-F and from 107-F is further let down to flash drums 110-F,111-F and 112-F for product purification and rundown. The operating pressure of 107-F and 109-F is about 14.0 kg/cm2g (design operating pressure : 17 kg/cm2g).

As a measure of operating flexibility i.e. to improve the hot ammonia supply temperature to urea plant, it was decided to divert cold ammonia from storage to 107-F instead of 109-F.

For this a 2" tapping on Cold Ammonia line from storage to 109-F upstream of the isolation valve is taken and connected it with one isolation valve (plug valve) to 107-F i.e. to 107-F RV inlet line. Orifice type flow meter is also provided on the same line to control / minimise cold Ammonia circulation flow from storage to ammonia plant and back.

Implementation of modification of recycle of cold ammonia from storage tank to 107-F instead of 109-F will facilitate hotter Ammonia supply to Urea plant at ~ 30 deg C and above depending upon the ambient conditions.

IMPROVEMENT IN GAS OUTLET SYSTEM FOR HTS CONVERTER (REF: ENERGY SAVING PROJECT: M/S HTAS PROPOSAL)

In original plant, HTS Converter GAS outlet system was having Elephant Stool. Before plant turn around in March, 2009, pressure drop of in HTS was about 1.06 kg/cm2 at around 1000 MTPD Ammonia Production.

As suggested by HTAS during ESP, alongwith HTS catalyst replacement, Elephant Stool type gas outlet system of HTS Converter is replaced by HTAS design improved gas outlet system in March-April-2009 plant turn. Alongwith new gas outlet, alumina balls loading is also graded type.

The expected pressure drop reduction in HTS with new gas outlet was around 0.5 kg/cm2.

Before implementation of above modification: pressure drop of HTS Converters was about 1.06 kg/cm2

With implementation of above modification: pressure drop of HTS Converters is about 0.35 kg/cm2 . Thus with HTAS design improved gas outlet system and fresh charge of HTS catalyst, pressure drop has reduced by about 0.7 kg/cm2.

This has helped in achieving higher pressure of more than 26.0 kg/cm2g at suction of syn gas compressor even at 1100 MTPD and higher Ammonia Production.

DIVERSION OF 104-E OVERHEAD VAPORS TO 101-B STACK AND SYNTHESIS GAS FIRST STAGE SEPARATOR (105-F) AMMONICAL WATER TO NEW TANK/ SEPARATOR.

Previously, 104-E gases were directly vented to Atmosphere and 104-E condensate had been stopped to Urea Plant due to methanol problem in Cooling Tower along with hydrolyser effluent water. Therefore, to meet the GPCB norms, it was necessary to divert 104-E vent gases to 101-B stack.

THE DETAILS OF THE JOB CARRIED OUT IS GIVEN BELOW :

- Separator 802-F has been removed from NG Booster area and has been installed at new foundation near 104-E as a collection tank for condensate.

- 12 inch pipe line from 104-E overhead to ID fan stack has been modified by providing proper slope from both sides i.e. 104-E & ID fan. A collecting boot is provided at the lowest point of pipe line for collecting condensate formed in pipe line with 2” drain line to drain from collecting boot to new separator cum collection tank.

- Suction lines of condensate pump (175-J/JA) have been modified to transfer condensate from new separator to to hydrolyser in urea plant / effluent.

- To avoid condensation in 12" line, it is double steam traced with LP steam and provided with 40 mm thick insulation. The Tracers has been provided with trap and bypass.

- 1" line has been installed from LCV-10 downstream line to new collection tank with suitable vent.

- I.D. fan stack temp. (TI-0061) thermo couple has been provided near DG-1 (I.D. fan discharge) to show correct I.D. fan stack temperature. Two additional TI have been provided at I.D. fan suction at both sides to know exact flue gas outlet temp. of the LT convection zone outlet with indication in DCS.

INCREASED WATER SEAL HEIGHT OF CO2 KNOCK OUT DRUM (V-1101) (REF: SUGGESTION NO.: SS /UREA/08/08)

CO2 compressor suction pressure is maintained at about 0.2 kg/cm2g. To avoid seal breaking in CO spray cooler and KO drum, 5.2 m water seal is provided for CO2 spray cooler and 2.6 m seal was installed inside CO2 spray cooler sump for CO2 knock out drum.

During plant start-up or upset conditions of compressor anti surge valve opening, problem of seal breaking was experienced. Therefore it was decided and approved to increase the seal height of CO2 knock out drum (V-1101).

Height of CO2 knock out drum seal was increased by 700 mm from 2.6 m to 3.3 m.

Water overflow nozzle of seal pot was also modified accordingly.

With implementation of above modification, the operational flexibility of urea Plant has improved by avoiding the seal breaking on increased CO2 compressor suction pressure due to opening of the Anti-surge valves.

PROVISION OF INLET AND OUTLET ISOLATION VALVES FOR UREA RECOVERY COOLER (H1427) ON PROCESS SIDE (TUBE SIDE) AND COOLING WATER SUPPLY ISOLATION VALVE. (SUGGESTION NO.: SS/UREA/08/21)

In the original design, no inlet and outlet isolation valves for urea recovery cooler (H-1427) were provided on process side (Tube side) and C.W. supply (Shell side).

A problem of H-1427 channel cover gasket leak was experienced during plant start up in April, 2008. It was difficult to isolate the cooler, as there were no isolation valves on process water side and CW supply. H-1427 was isolated by providing blinds on cooler inlet and outlet nozzles and it was bypassed. The process side inlet/ outlet and cooling water inlet/ outlet isolation valves are necessary for cooler isolation.

The scheme for urea recovery cooler (H-1427) is implemented in March-April 2009 Plant Turn Around for isolation of heat exchanger as under:

- Isolation valves provided on process side inlet line & outlet line for urea recovery cooler.

- Isolation valve provided on cooling water supply line to cooler (H-1427).

With availability of inlet and outlet isolation valves on process side (Tube side) and C.W. supply and return lines for urea recovery cooler (H-1427), cooler can be isolated in running plant in case of problem in heat exchanger.

This has improved the operating flexibility of urea plant.

INSTALLATION OF WELDED PLATE HEAT EXCHANGERS (H-1301 & H-1301 A) IN SERIES.

The Welded Plate Heat Exchangers supplied by GEA Ecoflux were installed in series for Desorber feed - effluent heater (H-1301) service in April, 2009 plant turn around. The two Welded Plate Heat Exchangers (H-1301 & H-1301 A) were taken in operation in April 2009 after plant turn around and summary of observations are as under:-

Cold Fluid Side

- Average Cold fluid (Process water) outlet temperature has increased from 117 deg C to 123.7 deg C.
- For average ammonia water flow of about 45000 kg/h, ammonia water is heated from 51.1 deg C to 123.7 deg C.
- For design flow of 49500 kg/h heat exchanger, ammonia water is heated from 49.8 deg C to 124.6 deg C. (Actual delta T=74.6 as against design delta T of 75 deg C).
- Pressure drop across the WPHEs has increased from 0.83 kg/cm2 to 1.22 kg/cm2. The control valve FICV-1303 is in operating range (FICV-1303 remain 65 to 70% open).

Hot Fluid Side

- Hot fluid (effluent water) temperature has reduced from 80 deg C to 69 deg C.
- Pressure drop across the WPHEs on shell side has increased from 0.65 kg/cm2 to 0.97 kg/cm2

With the implementation of above modification average ammonia water temperature increase is 7 deg C this is resulting in saving of about 0.38 Gcal/ h thermal energy. Performance of WPHEs H-1301 is satisfactorily.

STEAM CONDENSATE PUMP (P-1505 A/B) DISCHARGE PIPING LOOP HEIGHT INCREASES IN UREA PLANT.

The above scheme was approved on 06/04/2009 by competent authority to increase the condensate pipe vertical loop height by about 3.5 meter i.e. from existing elevation of 64.5 m to 68.0 m. The scheme was implemented in April 2009 Plant turn around as under:

- Condensate pipe (line No.: SC-1507-3"-B4) vertical loop height was increased by 3.5 m.
- 1" CS line alongwith isolation valve provided at the elevation of 64.5 m.
- Highest vent connection on condensate loop maintained with relocation of isolation valve.

After implementation of above scheme, observations were as under :-

Steam condensate pump discharge pressure has increased by 0.3 kg/cm2 (from 6.5 kg/cm2g to 6.8 kg/cm2g).

With implementation of above scheme, the condensate for flushing in prill machine room is coming with sufficient pressure with one condensate pump operation and operational flexibility has improved as anticipated.

Before Implementation of scheme

Pump P-1505 discharge pressure : 6.5 kg/cm2g
Power Consumption : 15.0 kW

With Implementation of scheme (Steam Condensate piping loop height increase)

Pump P-1505 discharge pressure : 6.8 kg/cm2g (Pr. improvement by 0.3 kg/cm2)
Power Consumption : 14.4 kW (Power saving by 0.6 kWh/h)

Benefits

- **Improved flexibility in urea plant operation with one condensate pump in operation.**

- **Power saving in P-1505**

Normal Plant operation:
Power saving in P-1505 : 0.6 kWh
Cost of power : 6.07 Rs/kWh
Annual monetary saving **: Rs. 28845/annum** for 330 days operation**.**

Power saving due to operation of single pump, It will be required to operate only one condensate pump with implementation of above modification during plant start-up, s/d, upset, prilling s/d, flushing requirement etc.

Power saving due to operation of single pump : 4500 kWh/annum
Annual monetary saving **: Rs. 27315/annum**

Total annual monetary savings **: Rs.56160/annum**

AMMONIA RECOVERY FROM VENT GASES OF UREA SOLUTION TANK & AMMONIA WATER TANK.

Vent stack is provided to release vapours from ammonia water tank (T-1301) / urea solution tank (T-1401), various vents and RVs' at safe height during normal plant operation & plant shut down, start up, emergencies like LP system RV popping, HP system draining etc.

The scheme was approved by Competent Authority on 11/09/2008 to recover ammonia vapour from urea solution tank and ammonia water tank vent gases into first stage evaporator scrubber (V-1423) / first stage evaporator condenser(H-1423).

The scheme was implemented in March-April 2009 plant turn around as under :

- Common vent header (PR-1458-14”-X3) for ammonia water tank & urea solution tank was connected by 2” SS 304 line to first evaporator scrubber vapour inlet (PR-1461-6”-X10) line.
- Redundant 1.5” globe type control valve FICV-1283 having Cv=9, class 300 # is used as HICV-1405 along with up stream & down stream isolation valves and local vacuum/pressure gauge.

The scheme was taken in operation since 06/05/2009 and observations are as under:

- First Evaporator air in bleed control valve (PICV-1422) opening has reduced from about 30 - 40 % to Zero % (PICV-1422 closed). This indicates that vapours from ammonia water tank & urea solution tank vent header is being sucked to first evaporator scrubber vapour inlet inplace of air being sucked thru ejector air inbleed valve PICV-1422.

- As per the vent stack ammonia analysis, about 0.19 MTPD ammonia recovered in V-1423 / H-1423 after implementation of system. The ammonia from vent stack has reduced from 0.72 MTPD to 0.53 MTPD (Please refer Annexure-I).

- Annual monetary benefit with above modification works out to Rs. 6.96 lakhs considering COP of ammonia of Rs. 11100 / MT. (Basis : Weekly Cost of Production Report for the week : 11th to 17th May 2009).

HIGHER SIZE CONDENSATE LINE FOR HP AMMONIA PUMPS (P-1102 A/B/C) PLUNGER PACKING.

1" condensate line was provided from Surface Condensate Pumps (P-1815 A/B) discharge to HP Ammonia Pumps (P-1102 A/B/C) plungers packing. Normally 35 m3/h capacity surface condensate pump (P-1815 B) with 83 m head to be kept in operation to supply condensate at about 8 kg/cm2g pressure.

It was experienced that condensate pressure at the inlet of HP Ammonia Pump plungers was around 6 kg/cm2g. About 2 kg/cm2 pressure drop was observed in 1" condensate line. The lower condensate pressure at water seal flushing system inlet was leading to running of higher surface condensate pump to supply condensate to HP Ammonia Pumps. Design power consumption of higher capacity (52.5 m2/h) Surface Condensate Pump (P-1815 A) is 41 kWh and 35 m3/h capacity Surface Condensate pump (P-1815 B) is 25 kWh.

It was suggested to lay new condensate supply line size of 40 mm NB from P-1815 A/B discharge to individual HP Ammonia Pumps.

The scheme was approved on 31/11/2008 and implemented in March-April 2009 Plant Turn Around. The smaller capacity Surface condensate Pump (P-1815 B) was taken in operation on 28/04/2009.

With the implementation of above scheme,

Condensate pressure at the inlet of HP Ammonia Pumps plungers has increased from 6 kg/cm2g to 6.9 kg/cm2g with operation of 35 m3/h capacity Surface Condensate Pump (P-1815-B).

Power consumption of smaller capacity Surface Condensate Pump (P-1815 B) is 20.1 kWh as against the design power consumption of 41 kWh for higher capacity Surface Condensate Pump (P-1815 A).

This modification has improved the operational flexibility to operate 35 m3/h capacity Surface Condensate Pump (P-1815 B) to supply condensate to HP Ammonia Pumps at sufficient pressure.

REPLACEMENT OF OLD DUEL FUEL (RLNG + LSHS) BURNERS WITH NEW DUEL FUEL (RLNG + SYNTHESIS GAS) BURNERS IN BHEL BOILER.

In BHEL Boiler, 02 Nos. Thermax Babcock Wilcox (TBW) make combination type RLNG / LSHS burners were replaced with Thermax Babcock Wilcox (TBW) make new Dual Gas burners suitable for using combination of RLNG /Synthesis Gas of Ammonia Plant.

Reference P.O. / W.O

- **P.O. No. 9921385** on **M/s Thermax Babcock Wilcox (TBW)** for DESIGN, ENGG & SUPPLY OF NEW DUAL FUEL GAS BURNERS (RLNG + SYN. GAS)
- **WO/KLL/VS/G.ENG/20081346 on M/s Shree Ganesh Engg.** for REPLACEMENT OF EXISTING BURNERS WITH DUEL FUEL (RLNG + SYNTHESIS GAS) BURNERS IN BHEL BOILER

THE JOBS CARRIED OUT FOR BURNER REPLACEMENT ARE BROADLY LISTED AS UNDER:

Dismantling / Removal of Existing Burners and Accessories, LSHS Piping & other piping, Valves, Wind Box Front Wall modifications etc. as per the details given below : (Ref. P&I Diagram No. : D12-1RT-5083P, Rev-2)

- Dismantling of existing LSHS (Fuel Oil) piping with steam line, valves, control valves and all other accessories. Size of LSHS Pipe Line : 50 mm NB, Size of Steam Pipe Line : 40 / 25 mm NB
- Dismantling of Pipe Spool Pieces in existing RLNG lines.
- Cutting / modification of Wind Box Front Wall and burner mounting Angles.
- Dismantling / Removal of 02 Nos. existing burners with all accessories.
- Dismantling of old refractory near burner throat.
- Dismantling of steel structures, supports, platform, ladder etc. as required for erection of burners

Erection of new burners and accessories as per details given below : (Ref. P&I Diagram No. : D12-1RT-6533P, Rev-2 and General Arrangement Drawing No. : D11-1RT-45101, Rev-0of existing boiler tubes:

- Modification of existing Wind Box Front Wall by increasing circular cutout diameter from **1345** mm to **1413** mm & providing ISA 75 Angles for burner mountings .
- Erection of two Nos. new burners with all the accessories.

- Fabrication and erection of Synthesis Gas Line as per Isometric Drawing No. : L15-3RT-18711, Rev-0)
- Fabrication & Erection of Instrument Air Line, Line Size : 25 / 20 / 15 mm NB
- Fabrication & Erection of Air / Steam Line (Non – IBR), Line Size : 25 / 20 mm NB for Synthesis Gas Burner Port Cooling
- Fabrication & Erection of Nitrogen Line (Line Size : 25 mm NB) for purging
- Providing (Fabrication & Erection) Tapping for Instruments as per P&I Diagram, General Arrangement Drawing & Isometric Drawings.
- Erection of control Valves, Isolation valves, flow orifices etc as per P&I Diagram, General Arrangement Drawing & Isometric Drawings.
- Fabrication & Erection of supports for the new fabricated pipe lines and air duct, platforms, ladders etc. as required from free issue steel members & plate
- Application of new refractory at burner throat area

Inspection & Testing :

- Root DP of all joints was carried out by IFFCO / representatives of IFFCO.
- For all pipe line fabrication jobs, 10% weld joints were radio-graphed by IFFCO / representatives of IFFCO.
- Hydro-test, cleaning , flushing / blowing of pipelines was done.

The following Reference Drawings furnished by M/s TBW were used :

- P& I Diagram for Firing System (Drg. No. : D12-1RT-6533P, REV-1)
- General Arrangement of Burner Piping (Drg.No.D11-1RT-45101,Rev 0)
- Isometric Drawings for Burner Gas Piping (Drg.No.L15-1RT-46211,Rev 0)
- Drawing for Modification in Existing Wind Box (Drg. No. L12-3RT-18711, Rev 0)
- Arrangement of new Burner (Drg. No. L11-1RT-45042, R-1)
- P&I Diagram for previous Firing System (P&I Diagram No. : D12-1RT-5083P, Rev-2)
- Assembly & Details of Previous Wind Box & Burner Box (Drg. No. L12-1RT-23341, R-0)

PROVISION OF BYPASS TO CONTROL VALVE (LCV-17) AT THE INLET OF DM WATER STORAGE TANK.

In existing system, DM water from water treatment plant at the rate of 150 m3/h is sent to DM water storage tank with the help of DM Water Supply Pump (P-4209 A/B). In 6'' inlet line to DM water storage tank, 4'' level control valve (LCV-17) is provided.

To facilitate sufficient DM water transfer from WTP plant to DM water storage tank without running of booster pump (P-4209 A/B), following modification has been carried out:-

- 6'' bypass line to control valve LCV-17 at the inlet of DM water storage tank has been provided with one isolation valve.

Now, during regeneration of SBA / MB units, DM water is required as power water etc. It can be made available by throttling DM water inlet tank level control valve (LCV-17) and / or its bypass valve. The booster pumps (P-4209 A/B) will be kept stopped during normal plant operation and it will be possible to transfer sufficient DM water directly to DM Water storage tank with available head of degasser water pump.

With the implementation of above scheme, monetary benefit of Rs. 11.12 lakhs per year can be achieved with total stoppage of DM water booster pump (4209-A/B).

RELOCATION OF PRESSURE SWITCHES FROM UPSTREAM OF R-LNG HEATER TO DOWNSTREAM OF R-LNG HEATER IN R-LNG LINE TO BURNERS OF BHEL BOILER

Tappings for Pressure Switches PSL-25 / PAL-25, PSH-26 / PAH-26, PSN-26 / PS-26 and Pressure Transmitter PT-25 are relocated at the downstream of Gas Heat Exchanger for correct indication of Burner Pressure and Set point Value of Pressure switches.

One additional PI point as PI-25A is also provided to measure differential pressure across the gas Heat exchanger.

The above modifications have provided better operation flexibility.

FLOW INDICATOR AND RECORDER WAS INSTALLED 4% NAOH TO MB / SMB STREAM REGENERATION (EWR: WT-88)

In existing system, strong base anion resin in SMB and SBA is regenerated in series with 4% NaOH. Rota meter is provided in the discharge line of alkali transfer pump for measuring the 4% NaOH flow to SMB/SBA during alkali entry. The 4% NaOH solution is distributed over strong base anion resin bed in SMB & SBA unit at the rate of about 6m3/Hr.

Orifice meter with electronic smart transmitter has been provided in common discharge line of alkali transfer pumps (P-4205 A&B) for SBA / MB train pumps.

By this modification flow indication and control with DCS, flow trend low/ high flow alarm etc. can be generated in the DCS . This has increased operation flexibility.