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REPORT NO. 28 / 2008

IFFCO

KALOL UNIT

PLANT TURNAROUND REPORT

(MARCH - APRIL - 2008)

INDIAN FARMERS FERTILISER CO - OPERATIVE LIMITED

I N D E X

PREFACE

The Annual Plant Turnaround for the year 2008 was taken from 24th of March, 2008, 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 24th March,2008. This shutdown report contains Plant wise and section wise details of the jobs carried out. Ammonia plant was restarted on 14th of April, 2008 and regular production resumed on 14th April,2008. Similarly, Urea plant shutdown was completed on 14th April,2008.

During Boiler hydrotest of Ammonia plant, tube failure of Primary Waste Heat Boiler 101-CB occurred on 7th of March, 2008. The same was attended by replacement of new tube bundle within the scheduled shutdown period. Plant was restarted in time i.e. on 14th April,2008. Problem in the three part conveyor during start up was attended and Urea plant was restarted on 14th April,2008.

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 21 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 no1 & 2 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.

- The damaged insulation of HT, LT, (accessible area) Distributor Duct and hot well was replaced with new ceramic fiber blanket insulation along with Incoloy 800-H / SS 310 lining.

- The Secondary Waste Heat Exchanger 102-C was replaced with new one after a service life of approx 33 years. The new exchanger was manufactured by M/s L & T, Mumbai. The erection was carried out with 135 Ton Kobelco crane.

- Refrigeration Compressor drives Turbine 105-JT was taken for overhauling.

- New Euroflex make coupling with target plate was installed between 101-JLP to Gearbox for shifting axial probe to Thrust Bearing side.

- PRC-12 was attended, as same was malfunctioning before plant stoppage.

- Outboard side mechanical seal of 104-J was replaced due to seal leakage at the plant stoppage time.

- NRV-ARVs of 115-JA, 115-JB & 104-J, 104-JA, P-110 A/B were overhauled.

- LTS inlet isolation valve (SP-4) was replaced due to wedge struck-up problem.

- A spool pipe piece of steam drum outlet line was replaced.

- Routine preventive maintenance jobs of all rotary machines were carried out.

- 108-C1A, 108-C2A & 130-JC Tube bundle were replaced with new bundles manufactured by M/s PATEL AIRTEMP, A'bad.

- Boilers were offered for IBR inspection and hydrotest. The certificate is valid upto 11.04.2009.

UREA:

- Existing single part Prill tower conveyor system (M-1403) was modified to three part conveyor system.

- Top dome of HP Scrubber (H-1203) was lifted from position for inspection of the shell liner and tube bundle. Top dome was put back in position after NDT examination of the liner which was carried out departmentally.

- 14.45 m long pipe (SS 316L Urea Grade) from autoclave to HP stripper was replaced due to thickness reduction.

- Preventive maintenance of LP case and HP case of Hitachi CO2 compressor, gear box & siemens turbine was carried out.

- Routine inspection of Autoclave (V-1201), HP Condenser (H-1202) & HP Stripper (H-1201) was carried out.

- Preventive maintenance of Prill cooling system, ID fans & Scrapper was carried out.

- Routine maintenance of all LP vessels was carried out.

OFFSITES:

- All cooling water pumps, BFW pumps and turbines were taken for Preventive maintenance.
- Major overhauling of Elliott Turbine (Q-4411) was carried out.
- 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, Vadodara and a committee of IFFCO Officials duly nominated by GM.
- Complete revamping of Urea New Cooling Tower cells (H-4404/1 to 3) was carried out.
- Brick wall open channel and 3 nos. of partition walls were made to facilitate the complete revamping of ammonia cooling tower cells (A1 to A3) 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-4401 A/B) Size &rating 900 mm x 150 # was carried out.

B & MH:

- Overhauling of Reclaim machine was carried out.
- All Conveyors and drive Gearbox were taken for preventive maintenance. Replaced the complete length of conveyor belts of M 2110, M 2121, M 2122 & M 2122 A
- All packer scales and stitching machines were overhauled. New weighing machine installed at packer scale No.9A.

ELECTRICAL:

- All the feeders of MCC panels ware thoroughly cleaned. Burnt out/ damaged components of feeder were replaced. Tightness of connector was checked.
- Bagging plant MCC-4 new panel installed and commissioned at new location in bagging plant.
- Preventive maintenance of all the transformers was carried out. Marshaling boxes were checked. Insulation resistance between HV to earth, LV to earth and Between HV and LV windings were checked and recorded. Oil leakage of OLTC of TR-1B, was attended and filtration of oil was carried out. Oil having low BDV values in transformers was filtered.
- Complete Overhauling of TR-2A & TR-7A was done by lifting the core. Radiators and radiators valve were replaced in TR-7B.

- Servicing of all the Siemens make HT VCBs and LT ACBs of L&T and Siemens make were carried out. Closing and tripping time of all the VCBs were checked and calibrated.

- Electrical equipments of three part conveyor system in urea plant successfully installed and commissioned.

- All the critical motors installed at various locations in plants were overhauled. Terminal box of all HT motors were checked. Motor of P-1352/A changed to higher rating and feeder modification carried out to suit the higher rating motor.

- All the MOVs were thoroughly checked in various plants.

- Actuators of following MOVs were replaced by ROTORK actuators with wiring modifications.

- SP-154, SP-4 in ammonia plant, MOV-1102 in urea plant and P-4401/A in cooling tower area.

- Preventive maintenance carried out on all rope switches installed on conveyors.

INSTRUMENTATION:

AMMONIA:

- PEAK-150 GOVERNER FOR 101BJT: Installed new Peak-150 Woodward governor and Driver in control room and Magnetic Pick-up probes on the Turbine and necessary cabling, JB. mounting, wiring work was carried out. Finally checked the operation of ID Fan through Peak-150 and same found satisfactory. All the work was carried out as per requirements of supplier service engineer and Mech.Maint.

- Provided new Radar Type level measurement system for underground Naphtha Drain tank (LI-2801). Associated field Cabling work and Engineering in DCS were carried out.

- Replaced old pneumatic level transmitters of LIC-105 (PGR -B3B Level) with New Guided wave Radar type level transmitter. Necessary cabling & glanding jobs carried out. Calibration was checked. Related engineering jobs carried out in DCS also alarm & Trip setting was done with new SMART electronic transmitters for better reliability & performance. (LIC-1,13,3,101)

- Old Battery Bank of UPSS was replaced with new one. (Total cells 175).Electrolyte was filled, and then two cycles of charging and discharging were carried out. And finallly put in line .This has improved reliability of UPSS.

- 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.

UREA:

- A new Mass Flow meter was installed in place of Turbine Flow meter for liquid Ammonia flow measurement. Associated cabling and Engineering were carried out to connect the instrument to DCS. Then the instrument was commissioned as per the procedure.

- 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.

- New PC based alarm and Report management system was installed and commissioned to replace the obsolete serial printers of DCS.

- 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.

BAGGING PLANT:

- Installation & commissioning of new PBL make automatic bag filling machine in place of JRSL make bag filling m/c No.9Awas carried out. New panel was taken in service and checked performance, found satisfactory.

- Road Weigh Bridge and weighing machines were overhauled and calibrated.

UTILITY AND OFFSITE:

- The obsolete control valve FCV-01 was replaced with new control valve.

- Maintenance of control valves was done.

- Three new control valves for LSHS temperature control were commissioned.

- Installation of additional Node in DCS for SSNNL job was carried out by engineer from M/S Yokogawa India Ltd.

CIVIL:

- Civil works for modification of conveyor belt M-1403 in Urea plant.
- Replacement of damaged waterproof plywood sheets for Cooling towers deck slab.
- Repairs & Maintenance of bitumastic linings and acid alkalis proof brick lining for B & MH, scrapper floor, transfer tower floor etc.

- Providing and applying epoxy monolithic plaster for B& M H Plant, Urea Plant, Prill cooling system etc.
- Providing and applying IP-Net protective coating for silo conveyor no.-2112, B&MH Plant, Urea Plant etc.
- Providing & applying epoxy painting to RCC Structure of bagging plant transfer tower, Prill Cooling systems, urea plant area.
- Shifting of debris etc from various locations at plant site.
- Repairs of refractory lining work for Primary, Auxiliary Reformer and BHEL boiler.
- Replacement of damaged AC sheet for various areas at plant site.
- Providing and applying Tar plastic to damaged wooden membrane of cooling tower.
- Construction of open channel for maintenance of ammonia side cooling tower.
- Refractory works for 102-C waste heat exchanger.
- Replacement and maintenance of burner blocks in Auxiliary boiler.
- Maintenance of insulation lining on east and south side wall of primary reformer.
- Castable refractory repairing works in LT and HT zone.
- Support for header valve in cooling towers.
- Miscellaneous works e.g. construction of cable trenches etc. in MCC-4

TECHNICAL:

AMMONIA:

- Installation of Control Valve (TICV-145) on LP Steam supply line of LNG Pre-heater of Auxilary Boiler.
- Tapping of Syn.Gas line to BHEL Boiler and related piping job in Ammonia plant.
- Tapping for installation of pressure actuation pumps.
- Removal of steam line connected to NG / NG Booster Compressor Turbines.
- Provision of full capacity bypass of FRCV-485.

UREA:

- Installation of independent ejector system for Pre-Eveporator taken into operation.
- Provided control valve at cooling water outlet of H-1207, CCS-II Cooler.
- Relocation of condensate pot (V-1204) level control valve (LICV-1204) for recirculation heater.
- Installations of rupture disc on CCS-II outlet from HP Scrubber to avoid sudden pressure shoot up in CCS-II.

OFFSITE:

- Hook up of new Cooling Water return headers and risers of Ammonia & Urea Cooling Towers.
- Interconnection of Ammonia and Urea Cooling Water return headers.

PLANT TURNAROUND MARCH - APRIL - 2008

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	Mill Wright Fitter	18
2	General Fitter	754
3	Rigger	941
4	S.S. Rigger	2338
5	Fabricator	106
6	Grinder	169
7	Gas Cutter	98
8	Welder (HP)	53
9	Welder (ARC)	18
10	Carpenter	30
11	Mason	52
12	Machinist	00
13	Draftman	00
14	Master Rigger	00

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

SHUT DOWN RELATED CONTRACT

SR. NO.	PLANT	WO NO. & DATE	JOB DESCRIPTION	VENDOR'S NAME
1	Ammonia (Mech)	20070185 22-02-08	Supply & application of ceramic fibre Z-section module in Primary Reformer.	M/S.Loyds Insulation Ltd
2	--do--	20070163	Overhauling & Testing of Relief Valves in Amm. Urea, Offsite plant.	M/S.Tyco Valves & Controls Ind. Pvt. Ltd.,Baroda
3	--do--	--	Major overhauling & PM of rotating equipment in Ammonia. ,Urea,& Offsite.	M/S.Turbo Engineering Servicies, Hyderabad
4	--do—			M/S.SPIC SMO, Mumbai
5	--do--	20070027 11-02-08	Scaffolding & blinding jobs.	M/S.Ram Bahadur & Co., Allahabad
6	--do--	20070178 22-02-08	Ceramic fibre insulation in convection zone of Primary Reformer.	M/S.Unifrax Ind. Ltd,Mumbai
7	--do--	20070189 23-02-08	Erection of new 102-C.	M/S.Shree Ganesh Engg. Co.,Ahmedabad
8	--do--	9921203 31-10-07	Retrofitting of governor of 101-BJT.	M/S.Goodwill Governors Services,Mumbai
9	--do--	20070151 20-02-08	Euroflex Coupling between 101-JLP to GB.	M/S.Euroflex Transmission Ind. Ltd,Hyderabad
10	Urea (Mech.)	9920377 30-03-07	Supply of Three Part Conveyor Sstem. (M-1403)	M/S Elecon Engg., V.V.Nagar
11	--do--	-- do --	Erection of Three Part Conveyor System. (M-1403)	M/S EMTCI, V.V.Nagar
12	Offsite (Mech.)	9921507 31-12-07	In-situ Valve repairing.	M/S.EFCO Machinary,Hyderabad
13	--do--	9921421 22-01-08	In-situ gland packing.	M/S.EFCO Machinary,Hyderabad
14	--do--	20070196	Servicing & overhauling of HP / MP steam safety valves.	M/s.Flotech Servicing,Surat
15	--do--	14/00815	Painting of outside surface of 42" CW line	M/s.Vaidehi , Baroda
16	B&MH (Mech.)	9921483 12-01-08	Contract for Overhauling of Reclaim Machine	M/s EMTICI, VV Nagar
17	--do--	9920457 04-04-07	Contract for Overhauling ofTracking Roller.	M/s Hosch Eqts, Kolkota
18	--do--	9919985 26-12-06	Jointing and Vulcanising of Conveyor Belts/Pully.	M/S.J.K.Rubber works,Ahmedabad
19	--do--	9920534 13-04-07	Servicing of Armstrong stitching machine.	M/s.Gabbar Engg. Co. Ahmedabad.
20	Workshop (Mech.)	20070071 14-02-08	Preventive overhauling of BHEL LOCO.	M/s.Eastern Equipment Enterprise,Kolkatta

21	Civil	9921271 20-12-07	Repairs & Maintenance of bitumastic lining, acid and alkalis proof brick lining in strong/ weak effluent pit and HCL storage tank in water treatment plant, Prill tower- top floor, Bagging Plant and other plant area.	M/s Indochem Engrs Co.. Ahmedabad
22	--do--	9921342 22/11/07	Epoxy painting to RCC structure of B&MH plant transfer tower, Prill Cooling Systems and Hydrolizer of Urea plant area, RCC columns, pedestals & other structures in plant.	M/s. Vaidehi,Baroda
23	--do--	9921389 03/12/07	Shifting of debries / malvas etc from various location at plant site.	M/s. Gayatri Const.,Shertha
24	--do--	9921286 20/12/07	Epoxy monolithic plaster on RCC Supenders, walkway for converyor, beams, columns and staircase of transfer tower of silo building and misc work in B&MH building & Urea plant.	M.s. Indochem Engrs Co. Ahmedabad
25	--do--	24/01418	Providing and applying IP Net protective coating on RCC wall of Conveyor gallery, RCC structures of Urea Plant, B & MH & other structures.	M/s.Krishna Chem.Ltd,Mumbai
26	--do--	9921270	Repair of damaged AC sheets of cooling towers, reformer and other area in plant.	M/s. Perfect Handlers Gandhidham
27	--do--	9921315	Miscellaneous civil work for making foundation of conveyor belt at urea plant.	M/s. Pawan Construction, Ahmedabad
28	--do--	24/01424	Relocation of existing ventilators and fixing of AC sheets in loading area of Bagging plant.	M/s.Roshni Construction,Ahmedabad
29	--do--	24/01423	Strengthing and retrofitting of RCC column, slab by jackketing and repairing of flooring in Bagging plant.	M/s.Prerna Construction,Gandhidham
30	--do--	20070114	Construction of Open channel near Ammonia plan cooling tower.	M/s.Gayatri Construction,Shertha
31	--do--	20070374 27/03/08	Maintenance of damaged cooling tower deck covering of plywood sheets.	M/s.Sudama Furniture Products Pvt. Ltd, Ahmedabad
32	--do--	20070209 10/03/2008	Removal and rebuilding of plaster in bagging plant.	M/s.Prerna Enterprises, Kandla
33	Inspection	9921368 18/02/08	Radiography work.	M/S NDT Services,A'bad
34	--do--	9921370 01/12/07	Insitu-Metallography Work.	M/S TCR Advanced Engg.Ltd,Vadora
35	--do--	9921384 08/01/08	Dye-penetrant Work.	M/S NDT Services,A'bad
36	--do--	9921382 08/01/08	Ultrasonic Thickness Measurement Work.	M/S NDT Services,A'bad
37	--do--	9921383 26/11/07	Magnetic Particle Inspection Work.	M/S NDT Services,A'bad

38	--do--	9921392 20/12/07	Ultrasonic Flaw Detection Work.	M/S NDT Services,A'bad
39	Electrical	9921396 18-12-07	Replacement of MCC- 1 Sec.B.	M/s.Siemens Ltd,Baroda
40	--do--	20070122	Revamping of MCC-4 in B&MH Plant.	M/s.Sundram Electrical
41	--do--	9921023 06-09-07	Replacement of MOVs in Cooling Tower.	M/s.Rotork Control India Ltd
42	--do--	9921449 31-12-07	Replacement of MOVs in Amm. & Urea plant.	M/s.Rotork Control India Ltd
43	--do--	20070115 21-02-08	Maint.of transformer at Plant & Township.	M/s.Voltamp Ltd
44	--do--	20070069 20-02-08	Servicing of Siemens HT VCBs.	M/s.Siemens Ltd
45	--do--	20070155 18-02-08	Servicing of L&T Air circuit brackers.	M/s. L & T Ltd,Mumbai
46	--do--	9921596 12-10-08	Servicing of Siemens LT Air circuit breackers.	M/s.Siemens Ltd
47	Instrument	9919902 10/01/2007	Preventive maintenance of Ammonia, Urea and utility plants DCS.	M/s.Yokogawa India Ltd., Baroda
48	--do--	9920145 05/03/2007	Maintenance of Control Valves.	M/s.Hi-tech Controls, Vadodara
49	--do--	9921476 20/12/07	Occasional temporary jobs.	M/s.Saiyad & Co., Kalol
50	--do--	9918316 12/12/07	Incidental Instrument Maintenance Jobs.	M/s.INTEK Instruments, Himatnagar
51	--do--	9918774 22/02/2006	Skilled Man-power supply for Shutdown.	M/s.A-Z Instrument services, Baroda
52	--do--	9918861 03/04/2006	Preventive maintenance of Ammonia plant HIMA PLC.	M/s.L & T, Navi Mumbai
53	--do--	9921526 14/2/08	Preventive maintenance/ checking of Ammonia Plant UPSS.	M/s.Instrumentation Ltd., Kota
54	--do--	9920264 21/02/08	AMC of Allen Bradley make PLC's.	M/s.PIMA Controls Pvt.Ltd
55	--do--	9919529 22/11/06	AMC for servicing of Analyzers.	M/s.ABB Analytical , Bangalore
56	--do--	9921158 06/10/07	Retrofitting job of Pneumatic Leveltrols.	M/s.Dresser Valves, Mumbai
57	--do--	9917069 23/03/05	Attending Levelstate level monitoring system of steam drum 101-F.	M/s.Hitech Systems & Services, Baroda
58	--do--	9920198 05/02/07	AMC for servicing of Belt weigher system.	M/s.EMTICI Engg Ltd. V.V.Nagar
59	--do--	9921265 29/11/07	Replacement of UPS Batteries.	M/s.Syntech Power,Vadodara
60	--do--	9921183 05/10/07	Servicing & maintenance of 40-T weigh Bridge.	M/s.Ashbee Systems

61	Planning	9921280 18-12-07	Annual Rate Contractor for supplying & application of Anti-corrosive paints in Urea & B&MH plant.	M/s.B.Chauhan & Co,Saij
62	--do--	9921152 05-10-07	Annual maintenance contract for Repair/Replacement of Underground Fire Hydrant Line.	M/s.Aneesh Engineers, Kalol
63	--do--	9920281 23-02-07	Annual Rate contract for Fabrication & Erection of piping & steel structure.	M/s.Aneesh Engineers – Kalol
64	--do--	9920285 23-02-07	Annual Rate contract for Fabrication & Erection of piping & steel structure.	M/s.J & J Engineers – Kalol
65	--do--	270132 23-02-08	Annual Rate contract for Fabrication & Erection of piping & steel structure.	M/s.Smitha Engineers – Kalol
66	--do--	9921457 20-12-07	Opening & Box-up of Heat Exchangers in Ammonia ,Urea and Offsites plants.	M/s.General Engineering Works, Bharuch
67	--do--	20070152	Assisting IFFCO during Breakdown/Plant Turnaround jobs.	M/s.General Engineering Works, Bharuch.
68	--do--	20070153	Assisting IFFCO during Breakdown/Plant Turnaround jobs.	M/s.Ram Bahadur & Co,Pali
69	--do--	9921620 29-02-08	Annual Rate Contract for Hydrojet cleaning of Heat Exchangers.	M/s.Deluxe Hydroblasting Services,Mumbai
70	--do--	1600258	Rate contract for carrying out various insulation jobs.	M/s.Balaji Insulation, Mumbai

AMMONIA PLANT

AIR COMPRESSOR TRAIN (101-J)

101-JT Air Compressor Drive Turbine Preventive Maintenance:

Turbine was decoupled and both ends Journal bearings and Thrust bearings were inspected and found in good condition. Gauss readings of thrust end shaft journal (7.8) were found to be above limit and hence were reduced below 3 gauss. Bearing clearances were taken and found within the design range. The governor drive gears at front end of the turbine were also overhauled.

101-JT Governor overhauling:

The 8 ½ CM governors was taken for overhauling. Both ends ball bearing (SKF 7309 BEBJ) of the governor stem were found in damaged condition and hence replaced by new bearings. The housing / collar had scorings and hence were replaced by new one. Servo Piston assembly was overhauled. The servomotor power piston and O-Rings were replaced by new ones. The clearance between servomotor piston and cylinder was maintained at 0.20 mm. The servomotor power piston was hooked up with the operating gear connecting link after raising the power piston to uppermost/minimum lift position and raising the lifting bar keeping cold clearance of 0.100".

101-JLP Air Compressor Preventive Maintenance:

101-JLP, gear box end was decoupled. Journal bearings and Thrust bearings were inspected and found in good condition. Gauss reading of the thrust bearing base ring, active (10) & inactive (9.4) were found to be above limit and hence reduced below 3 gauss. Bearing clearances were taken and found within the design range. The thrust end oil guard (CF 588 L) was found damaged and was replaced by new one. The entire bag filters as well as Roll-O-Matic filters were replaced.

101-JR Gear Box Preventive Maintenance:

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

101-JHP Air Compressor Preventive Maintenance:

Drive end Journal bearing as well as thrust bearings were inspected and found in good condition. Non drive end journal bearing clearance was measured and found well above design range and hence the bearing pads were replaced. 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. The coupling between 101-JLP to gear box was replaced by new indigenous Euroflex make shim pack coupling.

Installation of new shimpack coupling between 101-JLP to gear box:

We were facing malfunctioning of the axial probe for sensing the rotor axial displacement. This malfunctioning causes the 101-J train tripping and production loss. It was discussed with Siemens, Pune and they opined that this can be sorted out by shifting the probe to thrust bearing side. To relocate the probe we procured modified coupling from M/S Euroflex Hyderabad where in new shim pack flexible coupling was designed and manufactured with a **target plate** for relocation of axial probe to thrust bearing end. This coupling was installed between JLP and GB. The axial probe was shifted from opposite thrust end to the thrust end of LP case. New clamp for the probe was designed and manufactured as per the space available between the coupling guard &coupling. The same was clamped to the coupling guard. A new lock nut for LP case coupling hub was manufactured at central workshop and fitted.

The details of the coupling installation sequence is tabulated below:
It has hydraulically fitted hub on 101-JLP and keyed hub on Gear box shaft end.

101-JLP COUPLING HUB INSTALLATION RECORD

Equipment : 101 JLP to GB		**Coupling make :** Euroflex Transmission Ltd.	
Coupling Hub Location : 101-LP			
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)	9.6	
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	9.6	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	12.9 (Max)	
5.	Calculated Hub / Shaft over hang '**D**' = **C** – **A** (mm)	3.4	
4.	Actual Push '**C**' (mm)	13.7	
6.	Actual **Shaft** Over Hang '**E**' (After final installation) (mm)	4.1	
7.	Hub Lock Nut step '**F**' (mm)	4.0	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	0.1	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.1	
10	Maximum Expander pump pressure (PSI)	23000	
11.	Maximum Pusher pump pressure (kg/cm^2)	60	
12.	Pusher pressure hold up time at final pressure (Minutes)	30	

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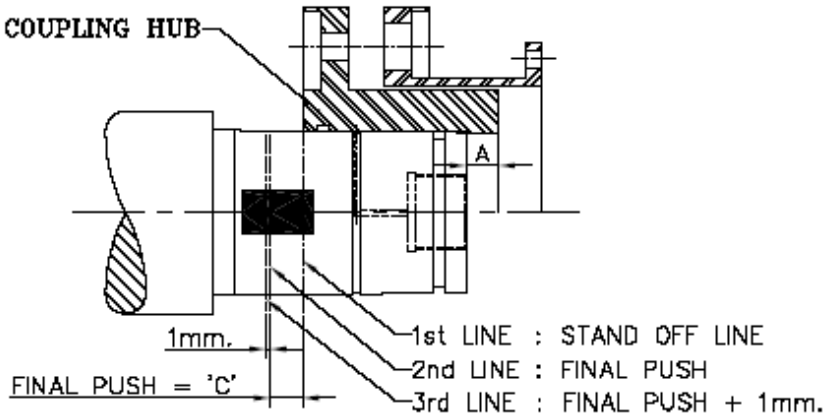
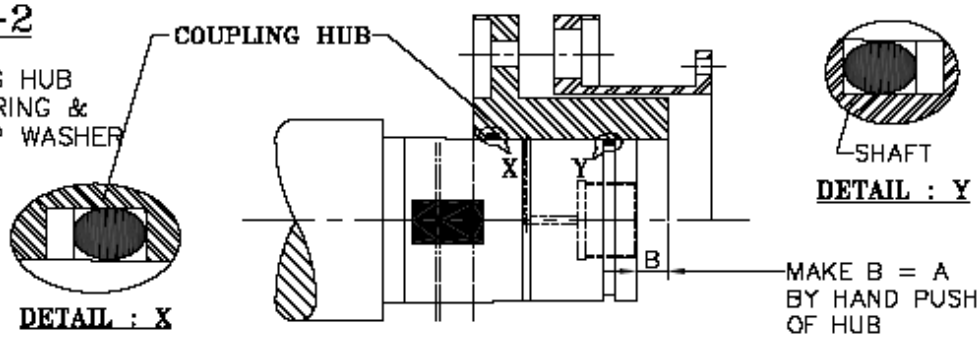
STEP–1

COUPLING HUB WITHOUT O–RING & BACK–UP WASHER



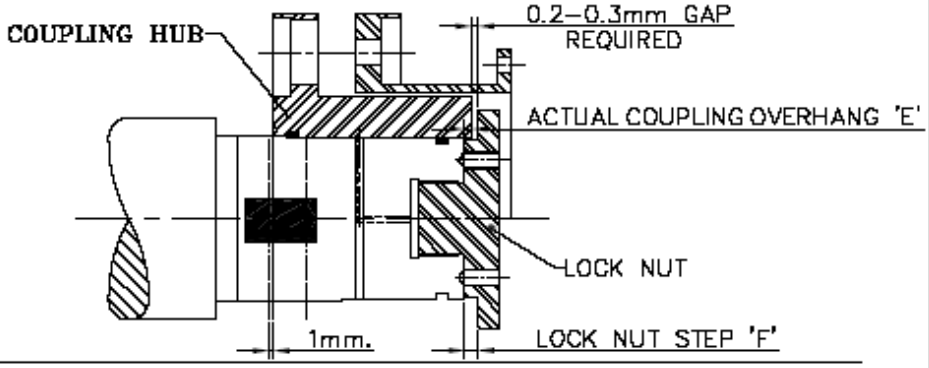
STEP–2

COUPLING HUB WITH O–RING & BACK–UP WASHER



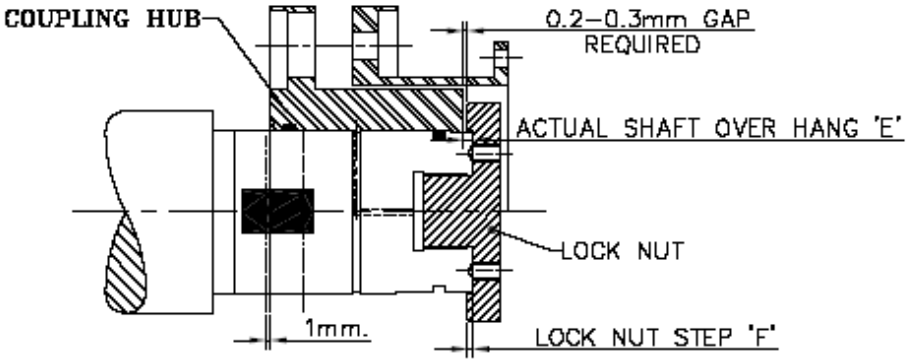
STEP–3A

FINAL POSITION WITH LOCK NUT & HUB OVERHANG

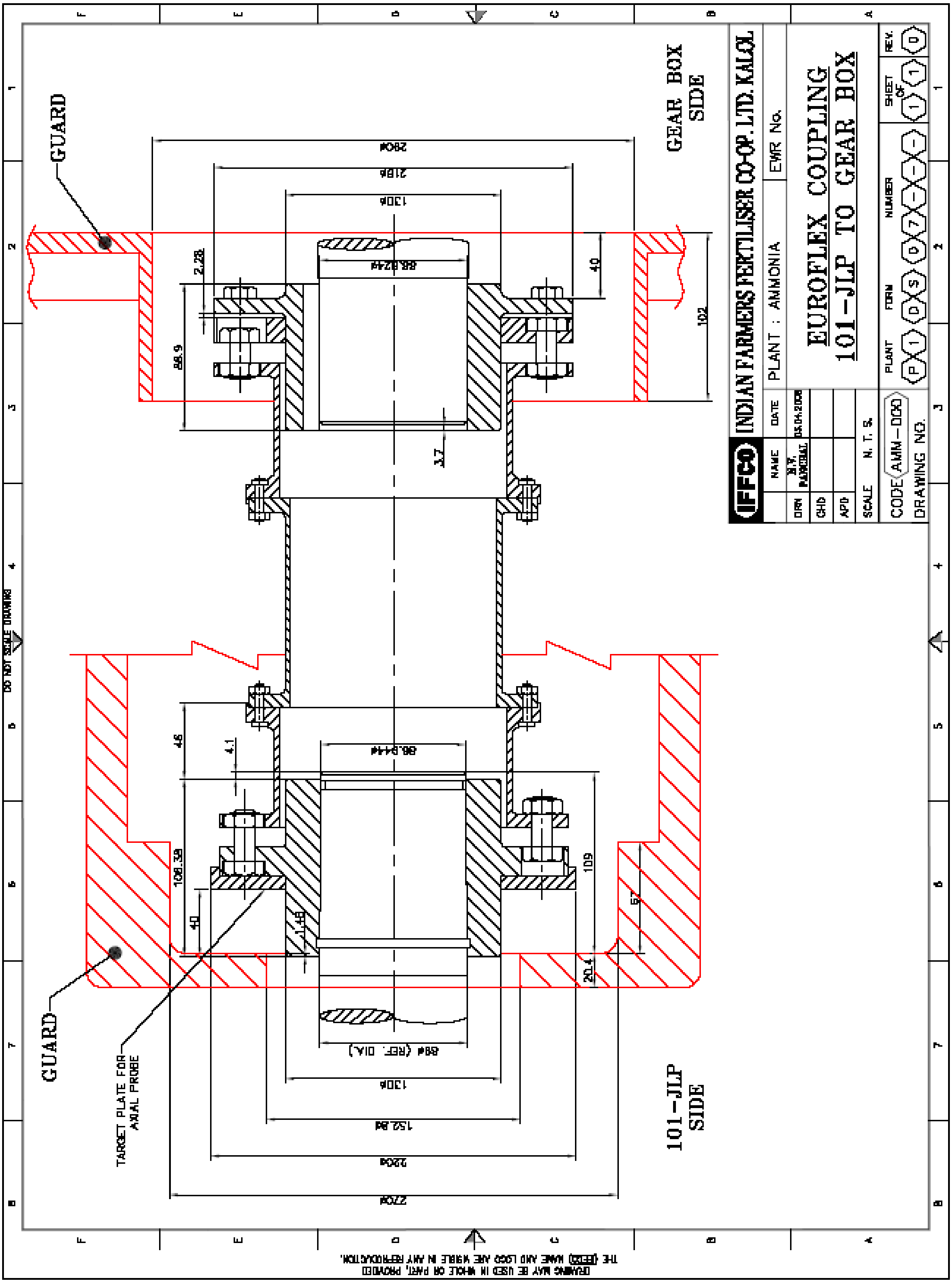


STEP–3B

FINAL POSITION WITH LOCK NUT & SHAFT OVERHANG

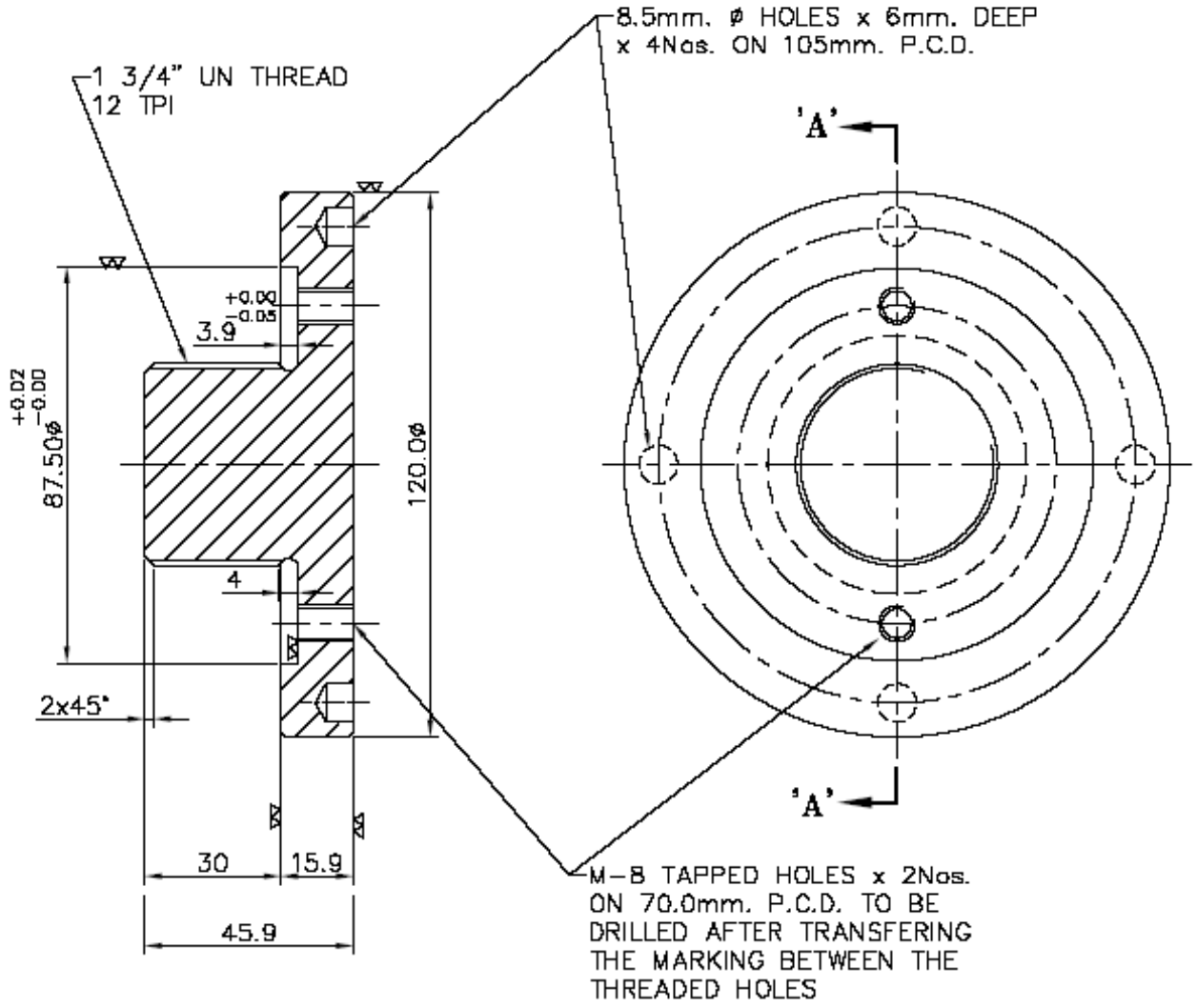


DRN	N.V. PANCHAL	TITLE- COUPLING HUB INSTALLATION PROCUDURE FOR 101/103/105 TRAIN		EWR No.	
CHD					
APD		DRAWING No.	PLANT FROM NUMBER	SHEET OF	REV.
SCALE	N. T. S.	CODE AMM–000	P1 ES 07–––	1 1	0


GUARD
GEAR BOX SIDE
101-JLP SIDE
TARGET PLATE FOR AXIAL PROBE
290ϕ
218ϕ
130ϕ
88.8244ϕ
88.9
2.28
40
102
3.7
46
4.1
88.8144ϕ
108.38
109
40
1.48
57
20.4
88ϕ (REF. DIA)
152.8ϕ
220ϕ
270ϕ
INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
EWR No.
PLANT : AMMONIA
EUROFLEX COUPLING
101-JLP TO GEAR BOX
NAME
DATE
DRN
CHD
APD
SCALE
N. T. S.
CODE
AMM-DOO
DRAWING NO.
PLANT
FORM
NUMBER
SHEET OF
REV.
DO NOT SCALE DRAWING

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

INSTALLATION DATE :- 02.04.2008



SECTION :- 'A-A'

SIDE VIEW

FOR : SHAFT OVERHANG OF 4.1mm.

MATERIAL :- EN-24 FORGED

DRN	N.V. PANCHAL	TITLE - EUROFLEX COUPLING LOCKNUT FOR 101-JLP ROTOR TOWARDS GEAR BOX			EWR No.
CHD					
APD		DRAWING No.	PLANT FROM NUMBER	SHEET OF	REV.
SCALE	1 : 1.5	CODE AMM-000	P 1 E S 0 8 - - -	1 1	0

PRE-STRETCH DATA FOR SHIMPACK COUPLING BETWEEN 101-JLP TO GB

Description			Value	Remarks
Step – I : Calculation				
Hub Flange to Hub Flange (With shafts at extreme ends)	**'A'**		134.92 mm	
Spacer flange to flange length	**'B'**		131.00 mm	
Maximum pre-stretch possible	**'C'** = B - A		3.92 mm	
Design pre-stretch	**'D'**		1.0 mm	
Total shim thickness required	**'E'** = C - D		2.92 mm	
Each Shim Thickness	**'t'**		0.381 mm	
No of shims calculated	E / t		7 No.	
Step – II : After installation				
Flexible element thickness (Design)	**'F'**		10.7 mm	
Gap between Hub Rear end flanges	**'G'**	JLP	11.2 mm	
		GB	11.4 mm	
Pre stretch obtained	**'H'**= G – F	JLP	0.5	Total = 1.2 mm
		GB	0.7	
Difference	**'J' =** H - D		0.2 mm	
Design maximum allowable difference (As per OEM)			0.4 mm	

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	10.511	10.511
101 JLP-JR	---	8.25	8.315	8.315
101 JR-JHP	---	8.25	8.294	8.294
Distance between Hub Face (With Rotor at extreme ends)				
101 JT-JLP	---	10.557	10.57	10.57
101 JLP-JR	---	8.25	8.316	8.471
101 JR-JHP	---	8.25	8.276	8.276
Overhang (Hub / Shaft)				

Description	Position		Design (Inch)	Before (Inch)	After (Inch)
101 JAT	LP End	Shaft	0.057	0.059	0.059
101 JLP	JAT End	Hub	0.00	0.00	0.00
	JR end	Shaft	0.00	0.006	0.161
101 JR	LP End	Hub	0.00	0.005	0.005
	HP End	Hub	0.00	0.023	0.0023
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		0.008	0.008
Oil Guard For Jr. Brg Housing	South	0.015-0.021	0.017	0.017
	North	0.058-0.097	0.078	0.078
Oil Guard (For Seal Housing)	---	0.077-0.109	0.094	0.094
Shaft Diameter	Jr. Brg.	4.993	----	----
Bearing Pinch	Jr. Brg.	---	----	----
Governor End				
Journal Bearing	Mandrel	0.007-0.009	----	----
	Filler / lead wire		0.007	0.007
Oil Guard (For Brg. Housing	South	---	---	--
	North	0.015-0.021	0.017	0.017
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	0.095	0.095
Axial Thrust.	With Top Housing	0.008-0.012	0.012	0.012
	Without top Housing		0.021	0.021
Shim thickness. (Thrust adjusting)	North	---	0.017	0.017
	South	---	0.0945	0.0945
Trip Lever - Plunger Gap	---	0.120-0.130	0.141	0.141

Journal Bearing Pads Thickness - 101 – JT

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	20.65	20.65	20.63	20.63
No 2	20.65	20.65	20.64	20.64
No 3	20.66	20.66	20.64	20.64
No 4	20.66	20.66	20.63	20.63
No 5	20.67	20.67	20.64	20.64

Thrust Bearing Pad Thickness - 101 – JT

Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	15.91	15.91	12.705	12.705
No 2	15.905	15.905	12.71	12.71
No 3	15.895	15.895	12.695	12.695
No 4	15.91	15.91	12.685	12.685
No 5	15.915	15.915	12.69	12.69

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		0.008	0.008
Bearing Pinch	Journal Bearing	------	0.004	0.004
Shaft Dia.	Journal Bearing	4.493	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.015	0.016	0.014
	South	0.013-0.015	0.012	0.013
Oil Guard (For Outer Housing)	North	0.021-0.027	0.018	0.024
	South	0.021-0.027	0.023	0.026
Gear Box End.				
Journal Bearing Clearance	Mandrel	0.005-0.008	NA	NA
	Filler / lead wire		0.009	0.009

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
Bearing Pinch	Journal bearing	------	0.001	0.001
Shaft Dia	Journal bearing	4.493	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.015	0.008	0.008
	South	0.013-0.015	0.008	0.008
Oil Guard (For Thrust bearing)	North	0.002-0.004	0.002	0.002
	South	0.002-0.04	0.003	0.003
Oil Guard (For Outer Housing)	North	0.021-0.027	0.008	0.008
	South	0.021-0.027	0.08	0.08
Axial Thrust	With Top Housing	0.010 - 0.015	0.010	0.010
	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	0.750”	0.750”
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	19.85	19.85	19.92	19.92
No 2	19.85	19.85	19.88	19.88
No 3	19.85	19.85	19.85	19.85
No 4	19.80	19.80	19.83	19.83
No 5	19.85	19.85	19.83	19.83
No 6	19.84	19.84	19.84	19.84
No 7	19.86	19.86	19.86	19.86
No 8	19.87	19.87	19.87	19.87

CLEARANCE CHART - 101-JR

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal Bearing (Low Speed drive gear)	North	0.008-0.010		
	South	0.008-0.010		
Axial Thrust	---	0.014-0.024	0.010	0.010
Journal Bearing (High Speed driven Pinion)	North	0.009-0.011		
	South	0.009-0.011		
Free float	---	---	0.042	0.042
Backlash	---	---	0.005	0.005
Shaft Diameter (Low Speed drive Gear)	North Side Bearing.	---	4.491	4.491
	South Side Bearing.	---	4.4917	4.4917
Shaft Diameter (High Speed drive Gear)	North Side Bearing.	---	3.495	3.495
	South Side Bearing.	---	3.4945	3.4945

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		0.005	0.005
Bearing Pinch	Journal Bearing	------	0.00	0.00
Shaft Dia.	Journal Bearing	2.996	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.016	0.015	0.015
	South	0.013-0.016	0.012	0.012
Oil Guard (For Top Housing)	North	0.015-0.022	0.013	0.014
	South	0.015-0.022	0.015	0.018
Non Drive End				
Journal Bearing Clearance	Mandrel	0.015-0.022		
	Filler / lead wire		0.005	0.005
Bearing Pinch	Journal bearing	------	0.0	0.0

Description	Position	Design Clearances (Inch)	Before (Inch)	After (Inch)
Shaft Dia	Journal bearing	2.996	NA	NA
Oil Guard (For Journal Bearing)	North	0.013-0.016	0.009	0.009
	South	0.013-0.016	0.010	0.010
Oil Guard (For Thrust bearing)	North	0.002-0.004	0.004	0.004
	South	0.002-0.04	0.004	0.004
Oil Guard (For Top Housing)	North	------	------	------
	South	0.015-0.022	0.020	0.020
Axial Thrust	With Top Housing	0.008 - 0.012	0.012	0.012
	Without Top Housing		NA	NA

Journal Bearing Pads Thickness - 101 – JHP

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	0.562”	0.562”	0.562”	0.562”
No 2	0.561”	0.561”	0.562”	0.562”
No 3	0.562”	0.562”	0.561”	0.561”
No 4	0.562”	0.562”	0.562”	0.562”
No 5	0.561	0.561	0.561”	0.561”

Thrust Bearing Pad Thickness - 101 – JHP

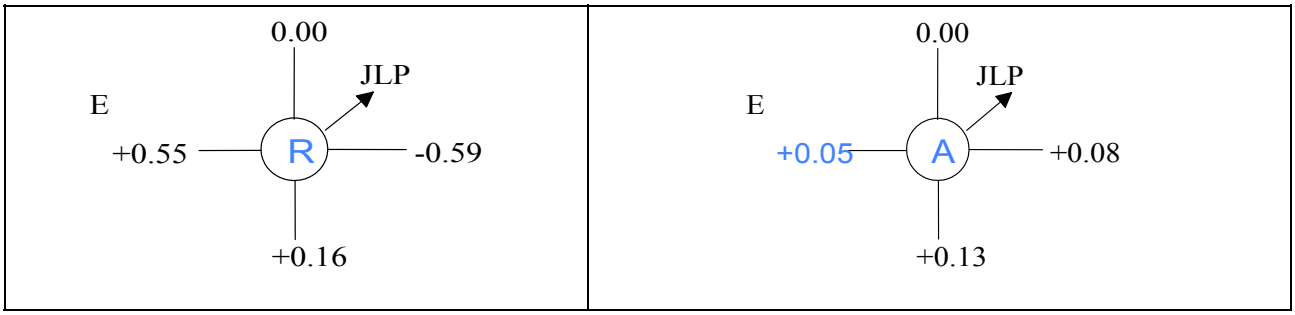
Pad	ACTIVE		INACTIVE	
	Before (mm)	After (mm)	Before (mm)	After (mm)
No 1	12.70	12.70	12.70	12.70
No 2	12.70	12.70	12.69	12.69
No 3	12.70	12.70	12.70	12.70
No 4	12.71	12.71	12.70	12.70
No 5	12.69	12.69	12.69	12.69

Gauss readings : 101-J TRAIN

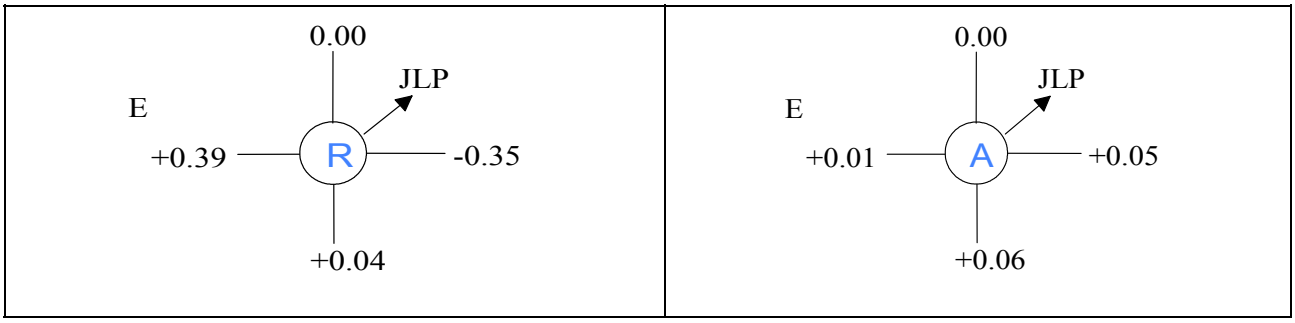
Description	Position	Before (Gauss)	After (Gauss)
101- JT			
Journal Bearing pads	Thrust End	2.7	2.7
	Non thrust end	2.5	2.5
Journal Bearing base ring	Thrust End	2.7	2.7
	Non thrust end	1.4	1.4
Thrust bearing pads	Active	1.2	1.2
	Inactive	0.9-1.8	0.9-1.8
Thrust Bearing base ring	Active	3.0	3.0
	Inactive	2.3	2.3
Thrust collar	----	2.2	2.2
Shaft Journal	Thrust End	1.8	1.8
	Non thrust end	2.8	2.8
101 - JLP			
Journal Bearing pads	Thrust End	2.6	2.6
	Non thrust end	2.2	2.2
Journal Bearing base ring	Thrust End	2.5	2.5
	Non thrust end	2.3	2.3
Thrust bearing pads	Active	1.8	1.8
	Inactive	2.0	2.0
Thrust Bearing base ring	Active	10.0	2.0
	Inactive	9.4	1.8
Shaft Journal	Thrust End	2.8	2.8
	Non thrust end	2.6	2.6
Thrust collar	------	3.0	3.0
101 - JR			
Gear Journal Bearing	North	2.3	2.3
	South	2.4	2.4
Pinion Journal Bearing	North	1.1	1.1
	South	2.2	2.2
Thrust bearing	Active	NA	NA

Description	Position	Before (Gauss)	After (Gauss)
	Inactive	NA	NA
Oil Guard for Above	South	NA	NA
	North	NA	NA
Shaft Journal	Thrust End	1.7	1.7
	Non thrust end	1.1	1.1
101 - JHP			
Journal Bearing pads	Thrust End	2.6	2.6
	Non thrust end	1.3	1.3
Journal Bearing base ring	Thrust End	2.6	2.6
	Non thrust end	1.5	1.5
Thrust bearing pads	Active	0.9	0.9
	Inactive	0.6	0.6
Thrust Bearing base ring	Active	1.3	1.3
	Inactive	2.8	2.8
Oil Guard for Above	South	2.5	2.5
	North	2.4	2.4
Shaft Journal	Thrust End	3.2	3.2
	Non thrust end	2.4	2.4

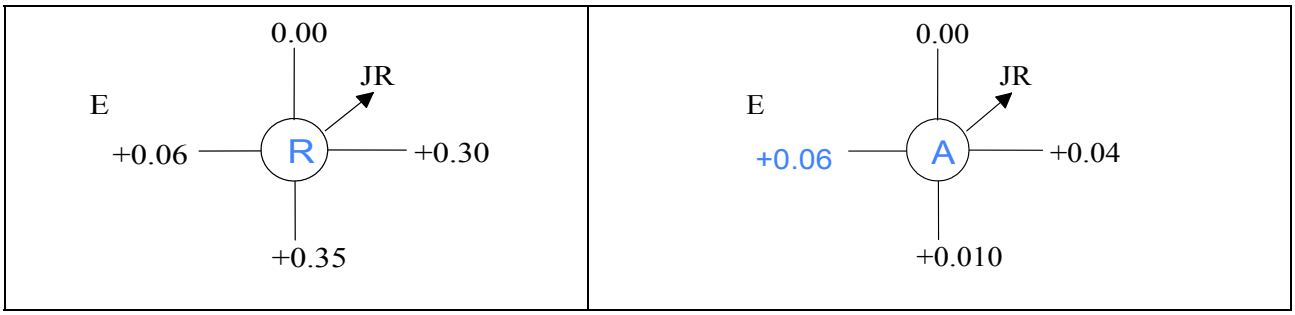
Alignment: **101-JT to 101-JLP** - Before Preventive Maintenance



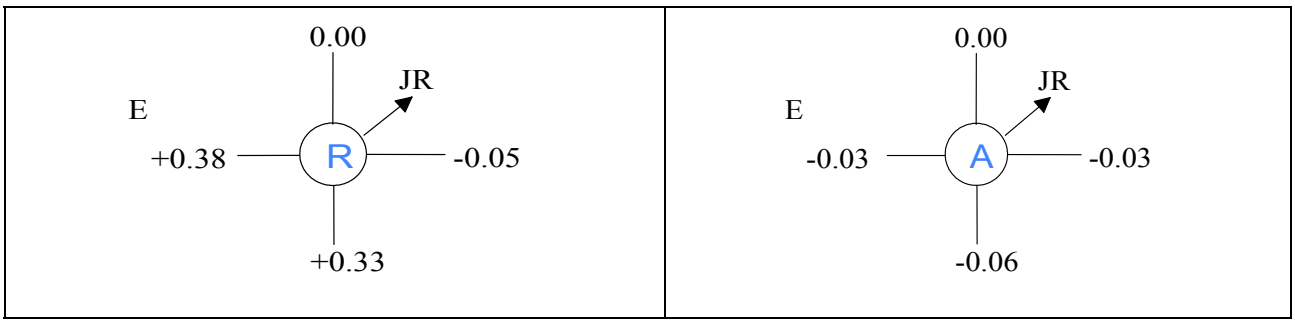
Alignment: **101-JT to 101-JLP** - After Preventive Maintenance



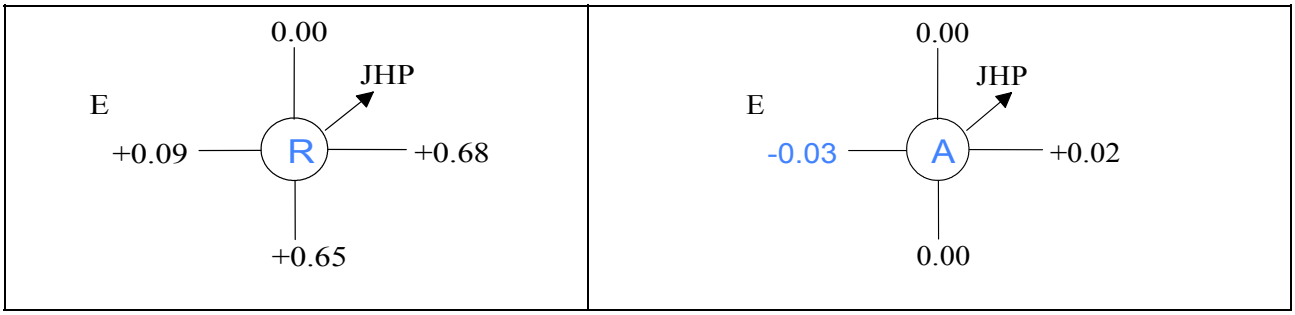
Alignment: **101-JLP to 101-JR -** Before Preventive Maintenance



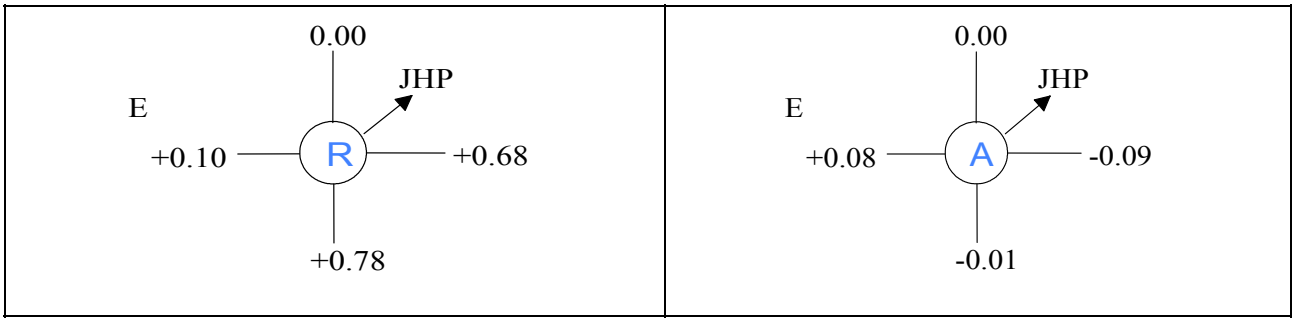
Alignment: **101-JLP to 101-JR -** After Preventive Maintenance



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 the same at shaft journal area of the non thrust end (11.5) and thrust collar (14.6) was found above limit and hence reduced to below 3.0 gauss. Bearing clearances were taken and found within the design range. The governor drive GB at front end of the turbine was also overhauled.

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 the same at the shaft journal area of the non thrust end (10.8) was found above limit and hence reduced to below 3.0 gauss. Bearing clearances were taken and found within the design range. The governor end seal housing was opened to attend steam leakage. The top and bottom half of the labyrinths seal were found in interchanged position. The top and bottom half were relocated to desired position.

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:

The compressor was decoupled and thrust bearing and both end Journal bearing were inspected and found O.K Gauss readings of both end journal bearing pad and base ring, shaft journal area, thrust bearing and thrust collar was measured and found within limit. All pads were Dye Penetration tested and no surface cracks were found. The final journal bearing clearance was measured and found within limit. To get the required axial thrust, 0.3 mm thick gasket was used on end cover seat.

103-JAT nozzle valve overhauling:

During plant operation before the shut down, turbine speed could not be tuned by controller FRC -12. Hence the nozzle assembly was removed for overhauling. The following major activities were carried out:

- The valves were inspected and found in good condition.
- Both the spindles and spacer were inspected and scorings were observed. New spindles were installed and design clearances were maintained.
- The parallelism between lifting bar and steam chest cover gasket face was checked and found OK.
- The parallism between the two spindles was checked and found OK.
- Keeping the lifting lever horizontal, the distance between the lifting bar and the steam chest cover gasket face was adjusted to ensure exactly half travel of lifting bar when the lifting lever is horizontal.
- The total travel of the lifting bar was checked and found more than 1.5" as desired.
- The complete assembly was installed over the steam chest. The lifting bar was lifted by 0.100" (cold bar setting) and the power piston at its lower stop (minimum lift position), the valve gear connecting link was linked with power piston.

103-JAT NOZZLE VALVE SETTING

Sr. No	Record		Design	Before	After	Remarks
Lifting bar and spacer clearance						
1.1	Spacer OD	Opposite steam inlet end (R)		42.85mm	42.85mm	
	L/B bore ID			44.6mm	44.6mm	
	Clearance		**0.064-0.096**	**0.068"**	**0.071"**	
	Spacer OD	Steam inlet end (L)		42.8mm	42.8mm	
	L/B bore ID			42.85mm	42.8mm	
	Clearance		**0.002-0.008**	**0.002"**	**0.002"**	
1.2	Spacer height	Opposite steam inlet end (R)		4.038"	4.038"	
	L/B height			4.027"	4.027"	
	Clearance		**0.003-0.010**	**0.011"**	**0.011"**	
	Spacer height	Steam inlet end (L)		4.037	4.028	
	L/B height			4.027	4.027	
	Clearance		**0.003-0.010**	**0.010"**	**0.012"**	0.30 mm shims added
Spindle parallelism						
2.	Distance between spindle at top (mm)			446.6	446	
	Distance between spindle at bottom (mm)			444.38	445.7	
	Difference (mm)			2.22	0.3	**Parallel**

Sr. No	Record	Design	Before	After	Remarks
Lifting bar parallelism					
3.	Distance between L/B top surface and cover joint face with all valve closed at steam inlet end			9.072”	
	Distance between L/B top surface and cover joint face with all valve closed at opp steam inlet end			9.073”	
	Difference			0.001”	**Parallel**
Lifting bar positioning					
4.	Distance between L/B top surface and cover joint face with all valve closed.			9.08”	
	Total valve travel			1.5”	
	½ of valve travel			0.75”	
	Distance between L/B top surface and cover joint face with L/B at mid position i.e. L/L horizontal			**8.33”**	9.08 - 0.75
Total travel of lifting bar (mm) : Steam inlet end					
5.1	Distance between bottom flange and L/B at top most position			58.09	
	Distance between bottom flange and L/B at mid position			97.90	
	Distance between bottom flange and L/B at bottom most position			122.13	
	Total travel above mid position			38.81	
	Total travel below mid position			24.23	
	Total float	Min. 40		63.04	**OK**
Total travel of lifting bar (mm) : Steam exhaust end					
5.2	Distance between bottom flange and L/B at top most position			57.65	
	Distance between bottom flange and L/B at mid position			97.52	
	Distance between bottom flange and L/B at bottom most position			122.52	
	Total travel above mid position			39.87	97.52 -57.65
	Total travel below mid position			25.0	122.52 -97.52
	Total float	Min. 40		64.87	**OK**

COUPLING RECORDS 103-J TRAIN

Description	Position		Design (Inch)	Before (Inch)	After (Inch)
DBSE (With Rotor at extreme end position)					
103 JBT - JAT	---			13.118	13.118
103 JAT - JLP	---			17.504	17.504
103 JLP- JHP	---			19.193	19.193
Distance between Hub Face (With Rotor at extreme end position)					
103 JBT - JAT	---			12.965	12.965
103 JAT - JLP	---			17.435	17.435
103 JLP- JHP	---			19.204	19.204
Coupling Hub / Shaft Overhang					
103 JBT	JAT End	Hub		0.1125	0.1125
		Shaft		---	---
103 JAT	JBT End	Hub		0.0405	0.0405
		Shaft		---	---
	JLP end	Hub		0.0539	0.0539
		Shaft		---	---
103 JLP	JAT End	Hub		0.0181	0.0181
		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	NA	NA
	Filler / lead wire			0.010	0.010
Oil Guard (For Jr. Brg Housing)	South	C	0.008-0.014	0.008	0.008
	North	------	-----	-----	-------
Bearing Pinch	Jr. Brg.			0.0025	0.0025
Governor End					
Journal Bearing	Mandrel	A	0.010-0.012	NA	NA
	Filler / lead wire			0.009	0.009
Oil Guard (For Brg. Housing	South	---	---	---	--
	North	C	0.008-0.014	0.007	0.007
Axial Thrust.	With Top Housing		0.008-0.012	0.010	0.010
	Without top Housing			NA	NA
Bearing Pinch	Jr. bearing			0.003	0.003

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	15.85	15.85	12.70	12.70
No 2	15.85	15.85	12.70	12.70
No 3	15.86	15.86	12.70	12.70
No 4	15.90	15.90	12.70	12.70
No 5	15.90	15.90	12.70	12.70

CLEARANCE CHART: 103 – JAT

Description	Position	Dwg. Ref	Design Clearances (Inch)	Before (Inch)	After (Inch)
JLP End					
Journal Bearing	Mandrel	N	0.006-0.008	NA	NA
	Filler / lead wire			0.010	0.010
Oil Guard (For Jr. Brg Housing)	South	C	0.015-0.021	0.086	0.086
	North	---	-----	-----	-------
Bearing Pinch	Jr. Brg.	---	---	0.001	0.001
JBT End					
Journal Bearing	Mandrel	B	0.010-0.012	NA	NA
	Filler / lead wire			0.010	0.010
Oil Guard (For Brg. Housing	South	---	---	---	--
	North	C	0.015-0.021	0.003	0.003
Axial Thrust.	With Top Housing	---	0.008-0.012	0.010	0.010
	Without top Housing	---		NA	NA
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	20.63	20.63	20.63	20.63

Thrust Bearing Pad Thickness: 103-JAT (MM)

Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
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 (MM)

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			0.006	0.006
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”	0.007	0.007
	South	C2	0.008”-0.013”	0.007	0.007
THRUST END					
Journal Bearing Clearance	Mandrel	C1	0.002”-0.004”	NA	NA
	Filler / lead wire			0.008	0.008
Oil Guard (For Journal Bearing)	North	C2	0.008”-0.013”	0.007	0.007
Axial Thrust	With Top Housing		0.015” - 0.022”	0.015	0.016

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			0.007	0.007
Oil Guard (For Journal Bearing)	North	A2	0.0085”-0.0115”	0.0045	0.0045
	South	A2	0.0085”-0.0115”	0.004	0.004
THRUST END					
Journal Bearing Clearance	Mandrel	A1	0.023”-0.033”	NA	NA
	Filler / lead wire			0.006	0.007
Oil Guard (For Journal Bearing)	North	A2	0.0085”-0.0115”	NA	NA
	South	A2	0.0085”-0.0115”	0.0075	0.0075
Axial Thrust	With Top Housing		0.015” - 0.022”	0.018	0.018
	Without Top Housing			NA	NA

Thrust Bearing Pad Thickness: 103 – JHP (MM)

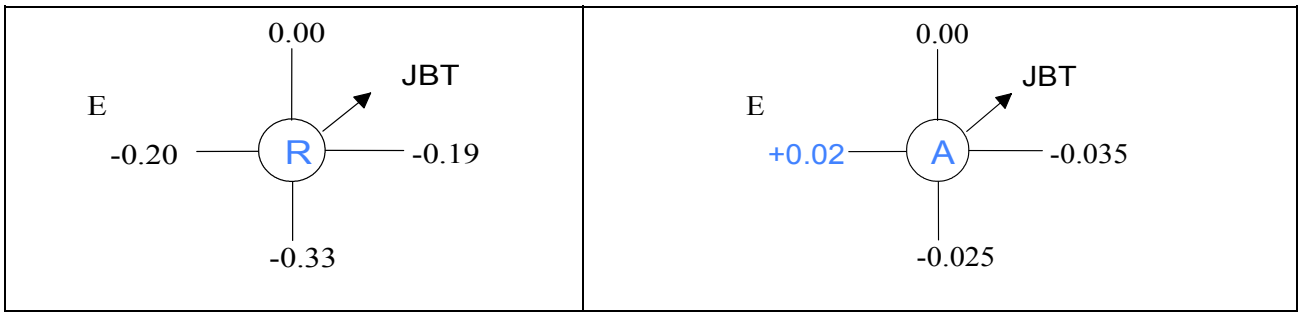
Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	14.26	14.26	Not accessible	
No 2	14.29	14.29	-- do --	
No 3	14.26	14.26	-- do --	
No 4	14.26	14.26	-- do --	
No 5	14.24	14.24	-- do --	
No 6	14.26	14.26	-- do --	
No 7	14.25	14.25	-- do --	
No 8	14.24	14.24	-- do --	

GAUSS: 103-J TRAIN

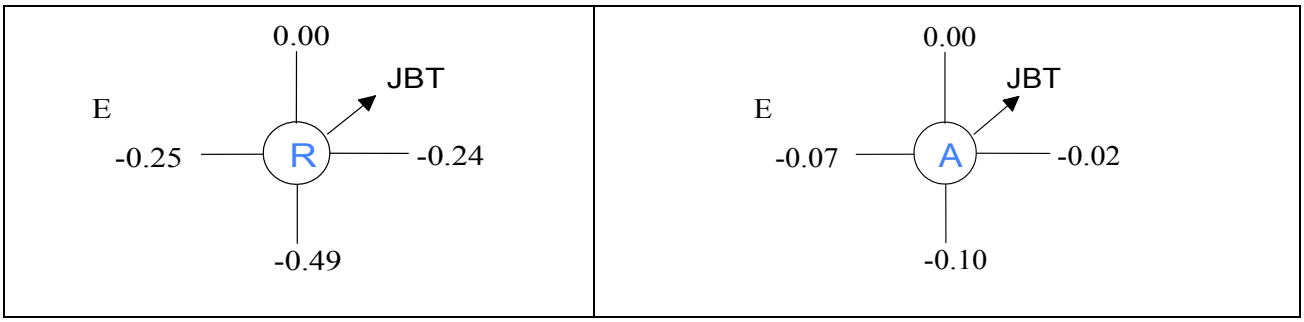
Description	Position	Before (Gauss)	After (Gauss)
103- JBT			
Journal Bearing Sleeve	Thrust End	2.7	2.7
	Non thrust end	0.6	0.6
Thrust bearing pads	Active	2.9	2.9
	Inactive	0.8	0.8
Thrust Bearing base ring	Active	2.8	2.8
	Inactive	NA	NA
Shaft Journal	Thrust End	0.9	0.9
	Non thrust end	10.8	3.0
Thrust collar	---	1.9	1.9
103 - JAT			
Journal Bearing Sleeve	Thrust End	2.0	2.0
	Non thrust end	0.5	0.5
Thrust bearing pads	Active	2.4	2.4
	Inactive	2.4	2.4
Journal bearing base ring	---	2.2	2.2
Thrust Bearing base ring	Active	2.8	2.8
	Inactive	NA	NA
Shaft Journal	Thrust End	2.0	2.0
	Non thrust end	11.5	3.0
Thrust collar	---	14.6	3.0
103 - JLP			
Journal Bearing Sleeve	Thrust End	NA	NA

Description	Position	Before (Gauss)	After (Gauss)
	Non thrust end	2.9	2.9
	Non thrust end	2.2	2.2
103-JHP			
Journal Bearing Pads	Thrust End	1.6	1.6
	Non thrust end	1.4	1.4
Thrust bearing pads	Active	2.3	2.3
	Inactive	2.3	2.3
Thrust Bearing base ring	Active	2.8	2.8
	Inactive	NA	NA
Shaft Journal	Thrust End	2.9	2.9
	Non thrust end	20.3	2.6
Journal bearing base ring	---	1.9	1.9

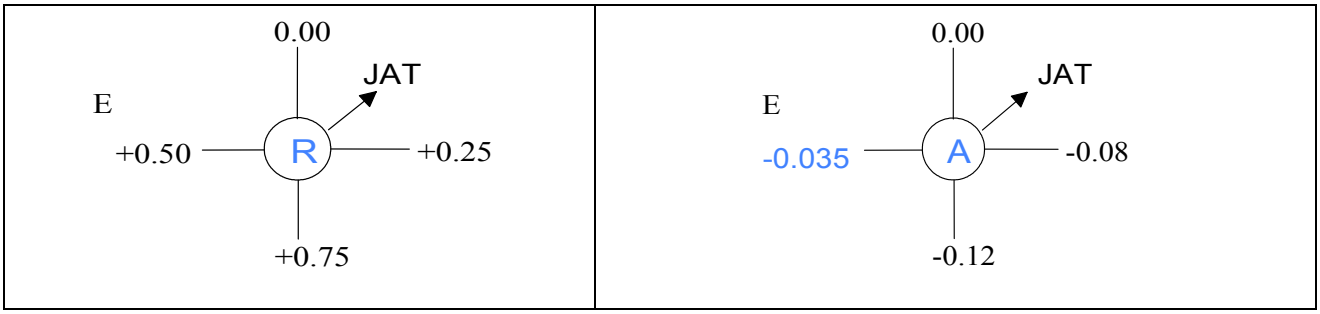
Alignment **103-JBT to JAT (**Before PM)



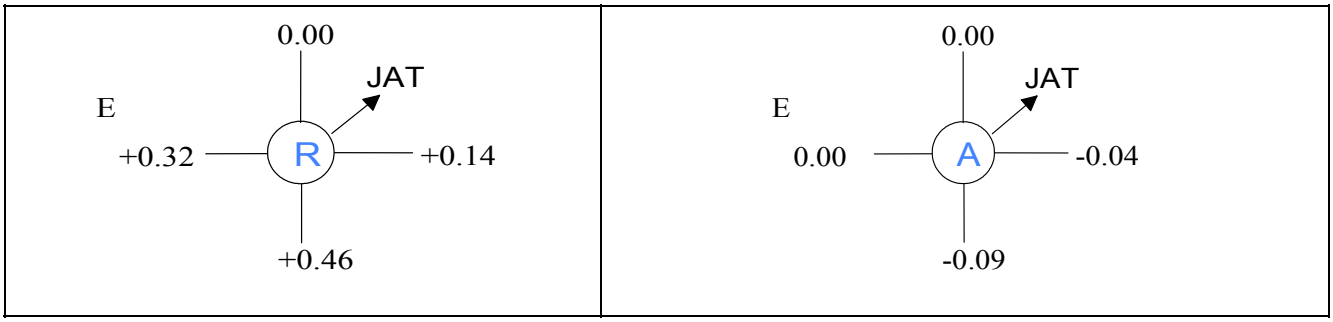
Alignment **103-JBT to JAT (**After PM)



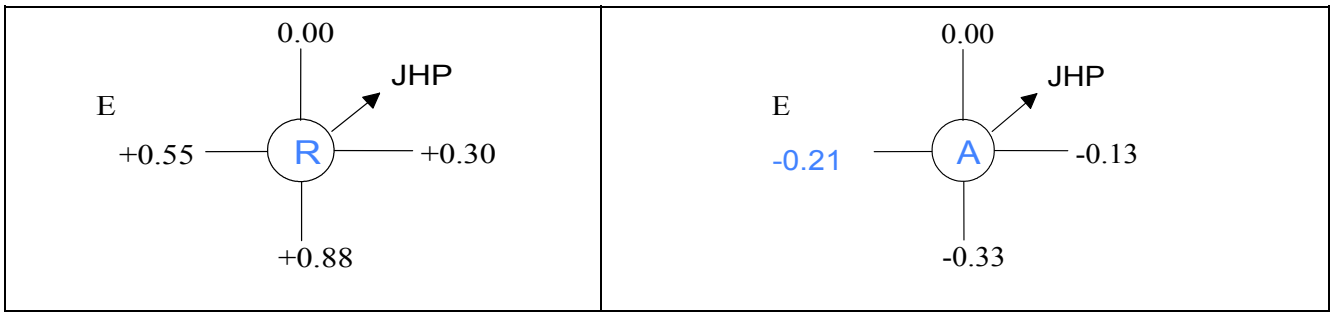
Alignment **103-JAT to JLP (**Before PM)



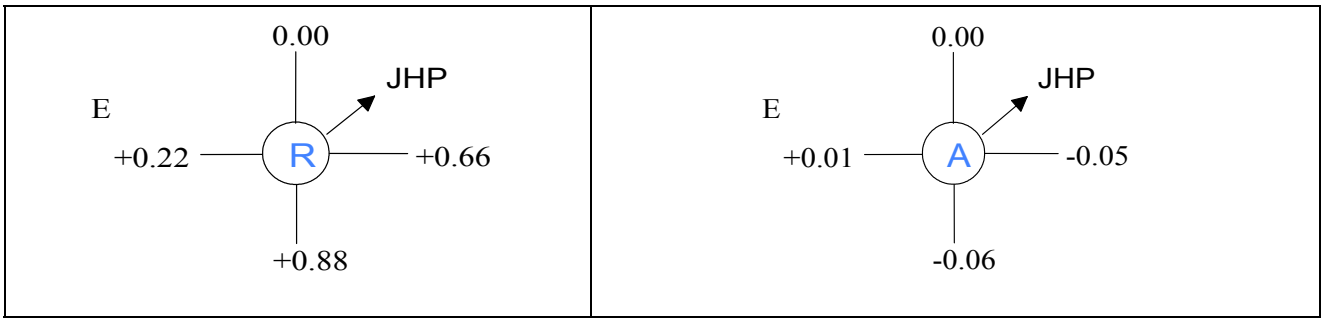
Alignment **103-JAT to JLP** (After PM)



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



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



REFRIGERATION COMPRESSOR TRAIN 105-J:

Drive Turbine (105-JT) and LP case Compressor (105-JLP) were taken for overhauling: Details are as under:-

105-JT Drive Turbine Overhauling:

Following major activities were carried out::

- Exhaust piping removed after locking the bellow in the exhaust piping.
- The casing bolts loosened 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. Removed rotor was replaced with spare rotor because of scoring on taper shaft for coupling fit up.
- All the diaphragms were removed and taken for inspection. Most of the diaphragms were found to be having pitting and erosion. Rotor lifted with the help of crane.

- Coupling hub of LP case was removed by hydraulic pressure. after removing the coupling of 105-JLP scorings marks was observed in the coupling hub as well as the rotor coupling areas. Hence it was decided to replace the coupling. For installation of new spare coupling between 105-JLP and 105-JT, the coupling hub of 105-JT had to be removed. But this could not be possible even after numerous attempts. Coupling slippage was suspected and it was decided to go for a new turbine rotor.

- A spare rotor was issued from the stores and cleaned.

- The new OST assembly did not have any shim arrangement for adjusting the OST value. Hence it was decided to go with the older OST assembly.

- The new spare gear coupling hub was installed. A new coupling hub lock nut was machined at our workshop and installed.

- The new rotor assembly was installed and all the clearances were measured and found within designed value. The nozzle clearance which was on the higher side with the old rotor was found within the design value with this new rotor.

- The governor drive gear assembly clearances were noted and found within desired value.

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

105-JT Governor Overhauling:

The 8 ½ CM governor was taken for overhauling. Both ends ball bearing (SKF 7309 BEBJ) of the governor stem were found in damaged condition and hence replaced by new bearings. The housing / collar had scorings and hence were replaced by new one. The servomotor power piston O-Rings were replaced by new ones. The piston had scorings and the piston to cylinder clearance had increased to 0.33 mm. Hence it was replaced by new one. The clearance between servomotor piston and cylinder was maintained at 0.15 mm. The top bushing(24) and stop collar(22) of piston(23) were replaced by new one. The sketch of the new and old piston was made by drawing section.. The servomotor power piston was locked with the operating gear connecting link after raising the power piston to uppermost/minimum lift position and raising the lifting bar, by cold clearance of 0.100".

105-JLP Refrigeration Compressor Overhauling:

The compressor was taken for overhauling and the following major activities carried out:

- Both side couplings were decoupled.

- The casing bolts were loosened by using Sweeny torque machine. Lifted the top casing half and lifted the rotor assembly from bottom half.

- Both ends coupling hub were removed. The bearing and mechanical seal assembly housing was removed. Rotor condition found OK and the same was installed back.

- The seal assembly comprising of seal and collar, of the non thrust end was replaced by new assembly as the seals are found to be worn out. The seal collar (mating part) and all 'O' rings of the seals were replaced by new ones at thrust end.

- At thrust end journal bearing pads had scorings and clearance had gone above acceptable limit and hence was replaced by new ones.

- Gauss measurement of the bearing pads, base ring and shaft journal was carried out and found within limit.

- Both ends bearing and mechanical seal assembly was installed.
- Coupling on turbine side was replaced with new gear type lubricated coupling of same make and on thrust side, same coupling hub was installed and locked with coupling lock-nuts on both. The details of the coupling installation records have been tabulated below.
- The complete rotor assembly was installed in the casing and all clearances were measured and found OK. Top casing half placed and boxed up.

105-JR Gear Box 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 Refrigeration Compressor Preventive Maintenance:

Both ends Journal bearing and Thrust bearing were inspected. Scoring marks were noticed in thrust bearing pads and the axial thrust clearance was 0.014" as the active side pads found worn out. These active pads were replaced with new ones. The axial thrust clearance after replacement with new pads was found 0.010". The clearance of oil guard of thrust bearing was 0.008" which is found to be more than the design value and replaced the same with new one.

105-JT GEAR COUPLING HUB INSTALLATION RECORD:

Equipment : 105-JT to JLP		**Coupling make : Zurn**	
Coupling Location : 105-JT			
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)	8.2	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	8.2	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	10	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	1.8	
6	Actual Push '**C1'** (After installation) (mm)	10.4	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	2.2	
7.	Hub Lock Nut step '**F**' (mm)	2.1	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	0.1	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.1	
10	Maximum Expander pump pressure (PSI)	24000	
11.	Maximum Pusher pump pressure (kg/cm^2)	60	
12.	Pusher pressure hold up time at final pressure (Minutes)	30	

105-JLP GEAR COUPLING HUB (TURBINE SIDE) INSTALLATION RECORD:

Equipment : 105-JLP to JT		**Coupling make : Zurn**	
Coupling Location : 105-JLP (JT End)		**Date : 07-04-08**	
Sr. 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)	8.0	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	8.0	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	8.0	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	0.00	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	0.13	
7.	Hub Lock Nut step '**F**' (mm)	0.03	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	0.1	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.1	
10	Maximum Expander pump pressure (PSI)	23000	
11.	Maximum Pusher pump pressure (kg/cm^2)	60	
12.	Pusher pressure hold up time at final pressure (Minutes)	30	

105-JLP GEAR COUPLING HUB (GEAR BOX SIDE) INSTALLATION RECORD:

Equipment : 105-JLP to GB		**Coupling make : Zurn**	
Coupling Location : 105-JLP (GB End)		**Date : 07-04-08**	
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)	7.8	Make B = A by hand push
3.	Wet fit Stand off '**B**' (With 'O'-Ring & Backup washer) (mm)	7.8	
4.	Design Push '**C**' (As per Coupling OEM's Drawing) (mm)	9.5	
5.	Calculated Shaft over hang '**D**' = **C** – **A** (mm)	1.7	
6	Actual Push '**C1**' (After installation) (mm)	10.4	
6.	Actual shaft Over Hang '**E**' (After final installation) (mm)	2.6	
7.	Hub Lock Nut step '**F**' (mm)	2.5	
8.	Calculated Gap between Hub & Locknut = **F**-**D** (mm)	0.1	
9.	Actual Gap between Hub face & Lock nut face = **F** - **E** (mm)	0.1	
10	Maximum Expander pump pressure (PSI)	23000	
11.	Maximum Pusher pump pressure (kg/cm^2)	40	
12.	Pusher pressure hold up time at final pressure (Minutes)	30	

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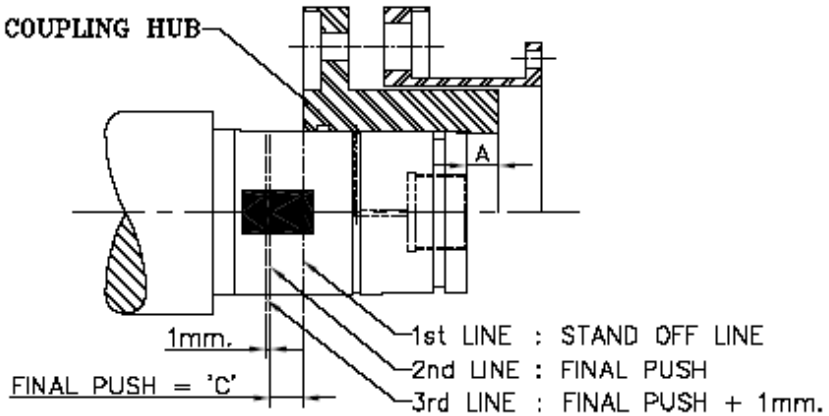
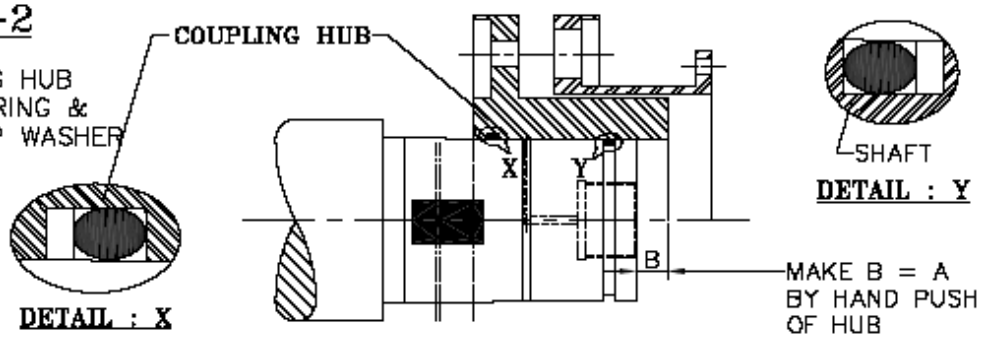
STEP–1

COUPLING HUB WITHOUT O–RING & BACK–UP WASHER



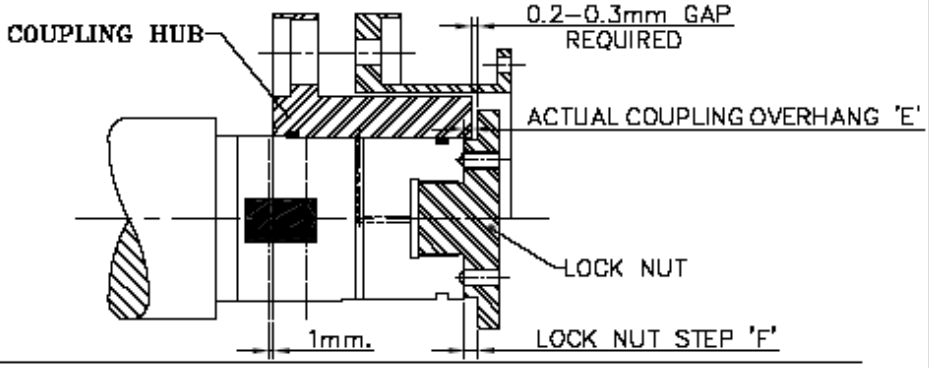
STEP–2

COUPLING HUB WITH O–RING & BACK–UP WASHER



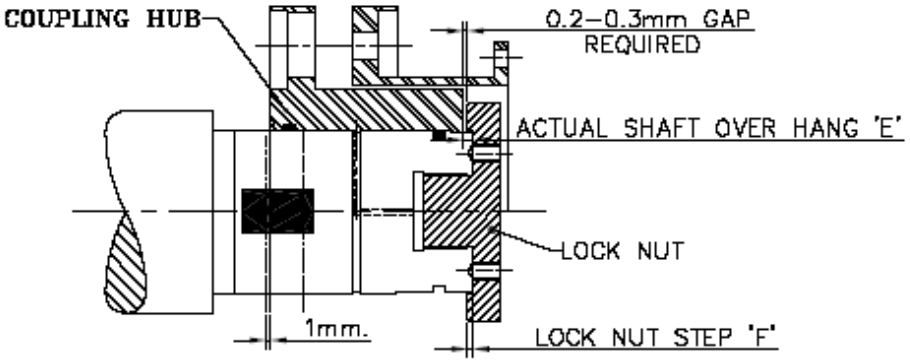
STEP–3A

FINAL POSITION WITH LOCK NUT & HUB OVERHANG



STEP–3B

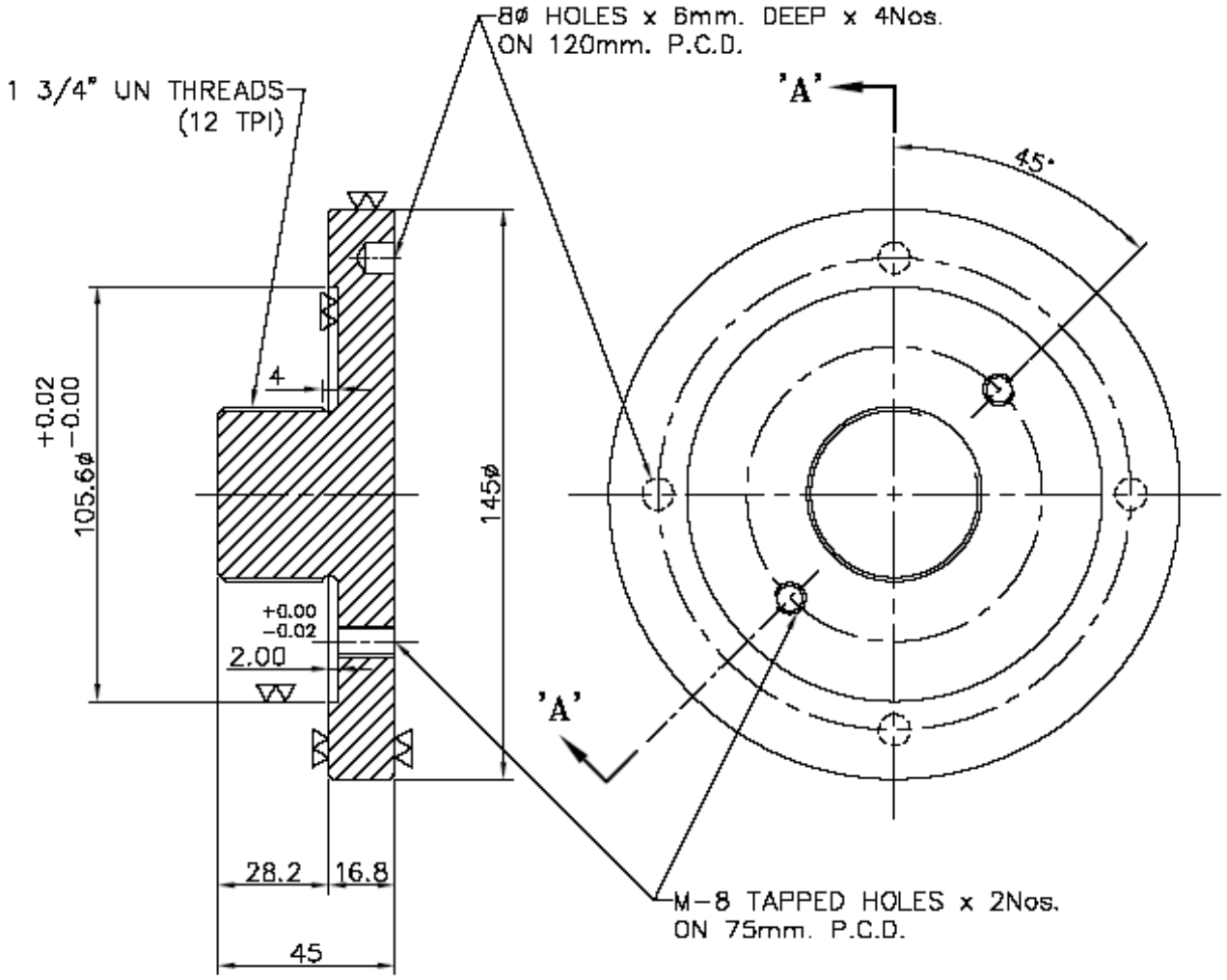
FINAL POSITION WITH LOCK NUT & SHAFT OVERHANG



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

INSTALLATION APRIL-2008



SECTION :- 'A-A'

SIDE VIEW

FOR : SHAFT OVERHANG 2.20mm.

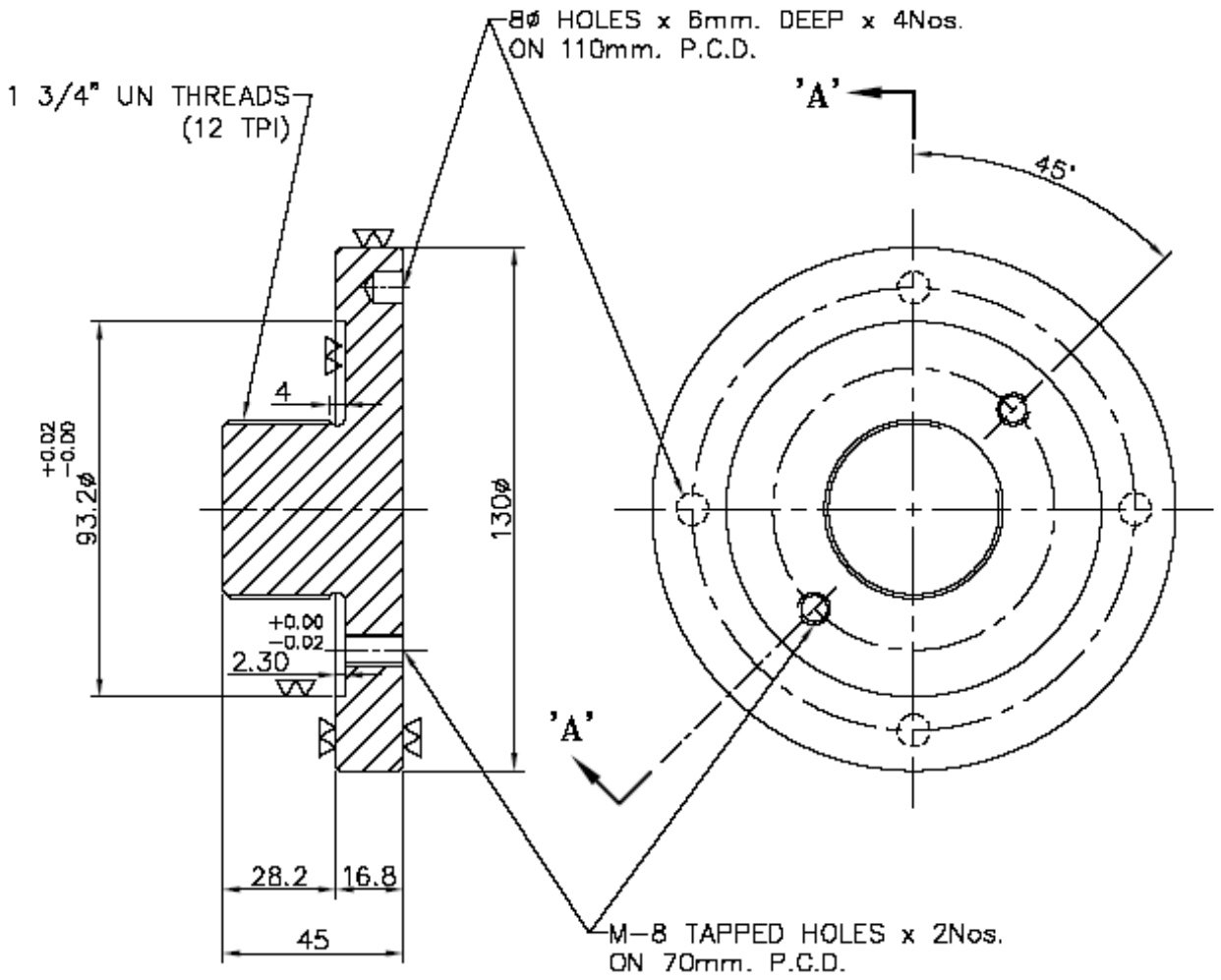
MATERIAL :- EN-24 FORGED

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	P1 ES 08---	1 1	0

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

INSTALLATION APRIL–2008



SECTION :– 'A–A'

SIDE VIEW

FOR : SHAFT OVERHANG 2.6mm.

MATERIAL :– EN–24 FORGED

NOTE :– SMOOTH MACHINING ALLOVER

DRN	N.V. PANCHAL	TITLE- LOCK NUT FOR COUPLING HUB OF 105–JLP ROTOR (TOWARDS GEAR BOX)			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

COUPLINGS RECORDS:

Description	Position		Design (mm)	Before (mm)	After (mm)
Coupling Float (For Gear Coupling Only)					
105 JT-JLP	---			11.55	10.48
105 JLP-JR	---			8.7	7.79
105 JR-JHP	---			12.00	11.88
DBSE (With Rotor at extreme ends)					
105 JT-JLP	---			272.70	272.77
105 JLP-JR	---			265.76	266.16
105 JR-JHP	---			209.25	209.39
Distance between Hub Face (With Rotor at extreme ends)					
105 JT-JLP	---			272.68	275.1
105 JLP-JR	---			267.36	268.65
105 JR-JHP	---			206.97	207.08
Coupling Hub / Shaft Overhang					
105 JAT	LP End	Hub		----	---
		Shaft		2.47	2.25
105 JLP	JAT End	Hub		2.45	----
		Shaft		----	0.13
	JR end	Hub		----	----
		Shaft		1.67	2.60
105 JR	LP End	Hub		----	----
		Shaft		0.02	0.02
	HP End	Hub		0.50	0.50
		Shaft		----	----
105 JHP	JR End	Hub		1.74	1.74
		Shaft		----	----

CLEARANCE CHART: 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			0.010	0.008
Oil Guard For Jr. Brg Housing	South	C	0.015-0.021	0.015	0.020
	North	G	0.058-0.097	0.044	0.061
Oil Guard For Seal Housing	---	D	0.077-0.109	0.085	0.090
Shaft Diameter	Jr. Brg.	---	4.993	4.992	4.993
Bearing Pinch	Jr. Brg.	---	---	NA	NA
Governor End					
Journal Bearing	Mandrel	B	0.007-0.009	NA	NA
	Filler / lead wire			0.010	0.008
Oil Guard For Brg. Housing	South	---	---	---	--
	North	C	0.015-0.021	0.018	0.012
Oil Guard For Thrust Brg.	South	A	0.002-0.04	0.002	0.025
	North	A	0.002-0.004	0.003	0.005
Oil Guard For Seal Housing	---	D	0.077-0.109	0.090	0.073
Axial Thrust.	With Top Housing	---	0.008-0.012	0.014	0.011
	Without top Housing	---		NA	NA
Shim thickness. Thrust adjusting	North	---	---	NA	NA
	South	---	---	0.114	0.114
Nozzle Clearance.	---	---	0.055-0.065	0.043	0.053
Shim thickness. Nz. Cl. adjusting	North	---	---	NA	NA
	South	---	---	NA	NA
Total Float	With Top Housing	---	0.180	5.11	5.05
	Without Top Housing	---		NA	NA
Shaft Diameter	Journal bearing	---	4.993	4.992	4.993
Bearing Pinch	Jr. bearing	---	---	NA	NA
Expansion Key	---	---	---	NA	NA
Trip Lever - Plunger	---	---	0.120-0.130	0.165	0.126

Journal Bearing Pads thickness: 105 – JT

PAD	NORTH SIDE BEARING		SOUTH SIDE BEARING	
	Before	After	Before	After
No 1	20.63	20.63	20.63	20.63
No 2	20.64	20.63	20.63	20.63
No 3	20.63	20.63	20.63	20.63
No 4	20.63	20.63	20.63	20.63
No 5	20.63	20.63	20.63	20.63

Thrust Bearing Pad Thickness: 105-JT

Pad	ACTIVE		INACTIVE	
	Before	After	Before	After
No 1	19.09	19.09	15.90	15.90
No 2	19.09	19.09	15.90	15.90
No 3	19.06	19.06	15.89	15.89
No 4	19.10	19.09	15.90	15.90
No 5	19.09	19.09	15.91	15.90
No 6	19.09	19.08	15.90	15.90

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	0.011	0.011
	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	0.011	0.007
	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	0.014	0.013
	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 (inch)	After (inch) (NEW PADS)	Before (inch)	After (inch)
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	0.014 – 0.016	0.016	0.016
	South	-- do --	0.016	0.016
Axial Thrust	---	0.014-0.024	0.013	0.013
Journal Bearing (High Speed driven Pinion)	North	0.013 -	0.012	0.012
	South	-- do --	0.012	0.012
Free float	---	---	---	---
Backlash	---	---	0.009	0.009
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	0.006	0.006
	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		
	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	0.014	0.010
	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 mm	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	1.6	OK
	Non thrust end	1.0	OK
Journal Bearing base ring	Thrust End	2.0	OK
	Non thrust end	1.4	OK
Thrust bearing pads	Active	0.9	OK
	Inactive	1.2	OK
Thrust Bearing base ring	Active	2.8	OK
	Inactive	1.4	OK
Shaft Journal	Thrust End	3.0	2.2
	Non thrust end	1.9	(12.09) Reduced to 2.2
Thrust Collar	---	6.9	2.4

GAUSS RECORDS : 105 – JLP

Description	Position	Before	After
Journal Bearing pads	Thrust End	2.0	2.0
	Non thrust end	1.7	1.7
Journal Bearing base ring	Thrust End	1.2	1.2
	Non thrust end	1.1	1.1
Thrust bearing pads	Active	1.4	1.4
	Inactive	1.7	1.7
Thrust Bearing base ring	Active	2.2	2.2
	Inactive	2.4	2.4
Shaft Journal	Thrust End	2.7	2.7
	Non thrust end	2.8	2.8
Thrust Collar	----	1.4	1.4

GAUSS RECORDS: 105 – JR

Description	Position	Before (Gauss)	After (Gauss)
Gear Journal Bearing	North	1.6	1.6
	South	1.5	1.5
Pinion Journal Bearing	North	1.8	1.8
	South	2.2	2.2
Thrust bearing	Active	1.3	1.3
	Inactive	1.8	1.8
Oil Guard for Above	South	1.2	1.2
	North	1.4	1.4
Shaft Journal	GEAR (Both ends)	1.8-1.2	1.8-1.2
	PINION (Both ends)	1.3-2.6	1.3-2.6

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	0.6
	Inactive	0.3	0.3
Thrust Bearing base ring	Active	1.2	1.2
	Inactive	3.5	3.5
Oil Guard for Above	South	NA	NA
	North	NA	NA
Shaft Journal	Thrust End	NA	NA
	Non thrust end	NA	NA
Thrust collar		1.8	1.8

IFFCO - KALOL

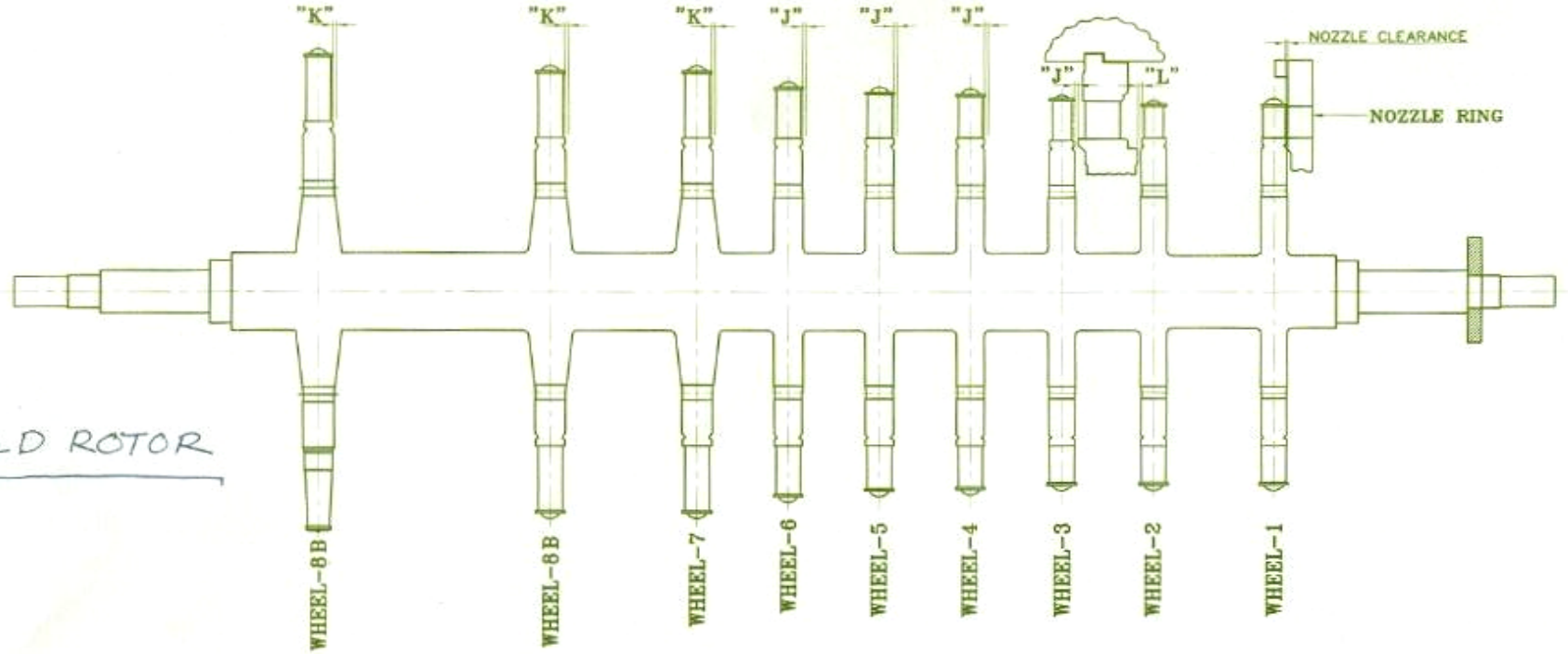
DIAMETRICAL CLEARANCES - 105 JT

REF.	CLEARANCE - INCHES	BETWEEN	REF.	CLEARANCE - INCHES	BETWEEN
A	0.002 TO 0.004	SEAL RING (THR. BRG.) TO SHAFT / NUT	D	0.077 TO 0.109	GUARD TO SHAFT
B	0.007 TO 0.009	JOURNAL BEARING TO SHAFT	E	0.013 TO 0.019	LABYRINTH RING RO SHAFT
C	0.015 TO 0.021	OIL GUARD TO SHAFT	G	0.058 TO 0.097	OIL GUARD TO SHAFT

AFTER (NEW ROTOR)	BEFORE (OLD)		BEFORE (OLD ROTOR)	AFTER (NEW ROTOR)
0.003"	0.005	OIL GUARD - A	NA	NA.
		THRUST BRG.	SOUTH (THRUST END)	
0.002"	0.0025	OIL GUARD - A	NA	NA
0.008'	0.010".	JR. BRG. B	NA	NA.
0.008"	0.010"	OIL GUARD - C	0.008"	0.004"
0.030"	0.032"	RING - D	0.058"	0.043"
0.002"	0.003"	E	0.007"	0.006'
0.004"	0.006"	E	0.013"	0.010"
0.005"	0.006"	E	0.008"	0.009"
0.008"	0.010"	E	0.008"	0.010"
0.005"	0.007"	E	0.014"	0.008"
0.006"	0.009"	E	0.016"	0.010"
0.004"	0.005"	WHEEL - 1 E	0.008"	0.007"
0.002"	0.005"	WHEEL - 2 E	0.012"	0.010"
0.004"	0.007"	WHEEL - 3 E	0.008"	0.006"
0.010'	0.010"	WHEEL - 4 E	0.008"	0.009"
0.006"	0.014"	WHEEL - 5 E	0.008'	0.008"
0.005"	0.014"	WHEEL - 6 E	0.006'	0.004"
0.004"	0.006"	WHEEL - 7 E	0.006"	0.008"
0.004"	0.013"	WHEEL - 8A E	0.008"	0.010"
0.014"	0.014"	E	0.008"	0.003"
0.003"	0.003"	WHEEL - 8B E	0.002"	0.002"
0.002"	0.005"	E	0.004"	0.003"
0.007"	0.009"	E	0.005"	0.005"
0.005"	0.010"	E	0.007"	0.005"
0.045"	0.040"	E	0.045"	0.045"
0.013"	0.015"	RING - D	0.009"	0.007"
0.008	0.010"	OIL GUARD - C	NA	NA.
0.036".	0.017".	JR. BRG. B	NORTH (OPP. THRUST END)	
		OIL GUARD - G	0.027"	0.025"
		COUPLING		

IFFCO :-	
PARTY :-	
Date :-	

DATE :- 28-03-08.



OLD ROTOR

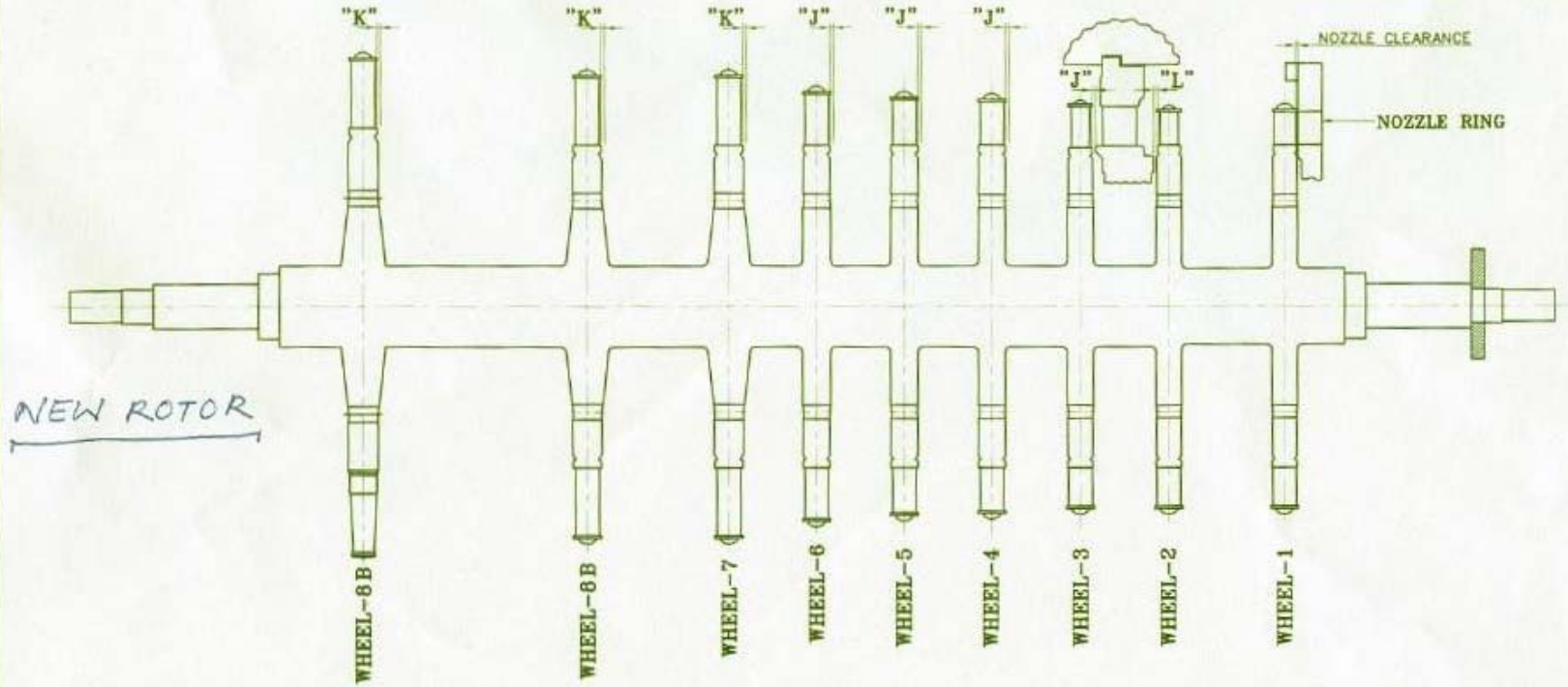
CLEARANCE		WHEEL-1	WHEEL-2		WHEEL-3	WHEEL-4	WHEEL-5	WHEEL-6	WHEEL-7	WHEEL-8 A	WHEEL-8 B
		NOZZLE CLEARANCE	J	L	J	J	J	J	K	K	K
DESIGN		0.055"–0.065"	0.055"–0.065"	0.115"–0.125"	0.055"–0.065"	0.055"–0.065"	0.055"–0.065"	0.055"–0.065"	0.110"–0.120"	0.110"–0.120"	0.110"–0.120"
MEASURED	SILO SIDE [WEST]	0.043"	0.045"	0.174"	0.054"	0.053"	0.041"	0.051"	0.084"	0.113"	0.120"
	COOLING TOWER SIDE [EAST]	0.043"	0.061"	0.365"	0.061"	0.057"	0.049"	0.055"	0.084"	0.115"	0.129"

IFFCO - KALOL

WHEEL TO DIAPHRAGM CLEARANCE (105-JT)

PLANT : AMMONIA

DATE :- 04-04-2008

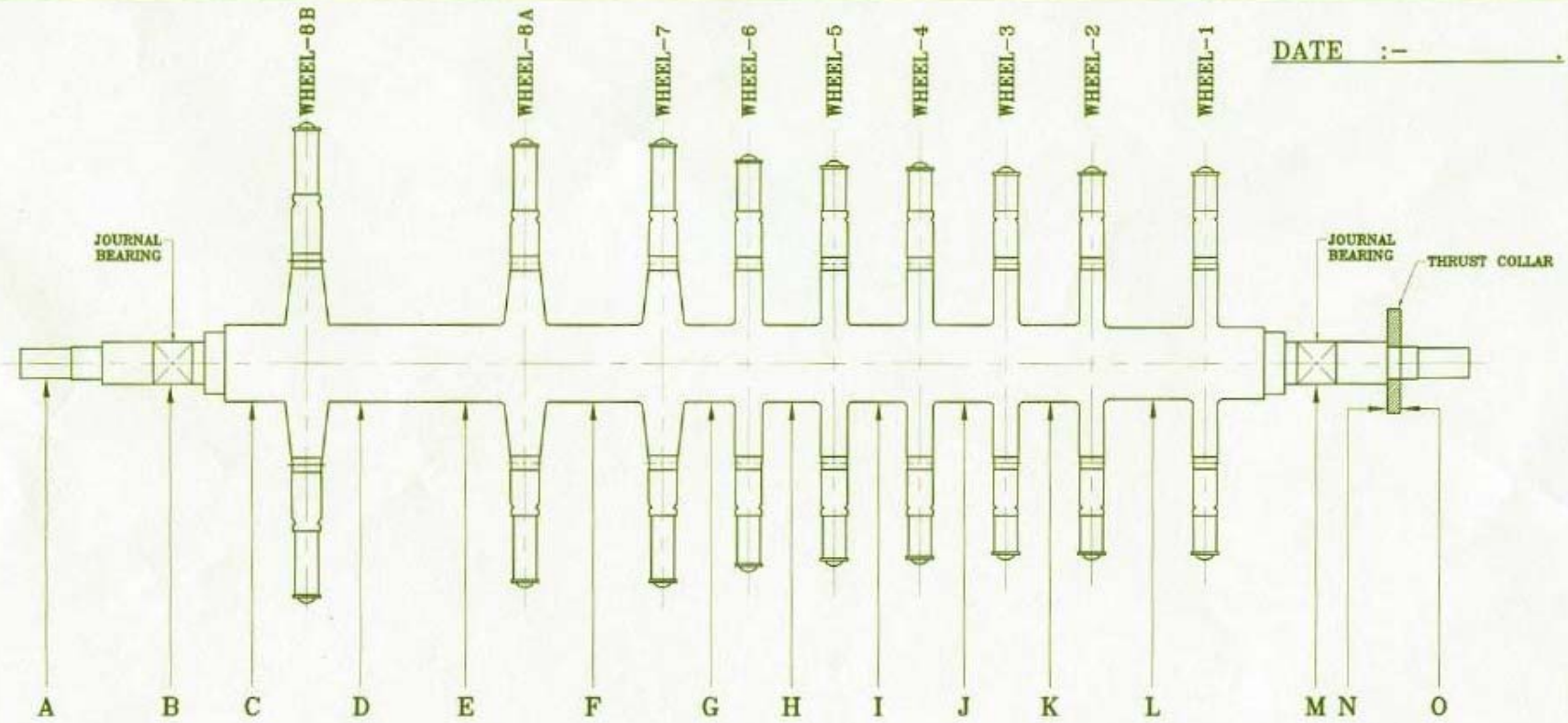


CLEARANCE		WHEEL-1	WHEEL-2		WHEEL-3	WHEEL-4	WHEEL-5	WHEEL-6	WHEEL-7	WHEEL-8 A	WHEEL-8 B
		NOZZLE CLEARANCE	J	L	J	J	J	J	K	K	K
DESIGN		0.055"-0.065"	0.055"-0.065"	0.115"-0.125"	0.055"-0.065"	0.055"-0.065"	0.055"-0.065"	0.055"-0.065"	0.110"-0.120"	0.110"-0.120"	0.110"-0.120"
MEASURED	SILO SIDE [WEST]	0.053	0.044	0.184	0.049	0.053	0.038	0.048	0.077	0.109	0.122
	COOLING TOWER SIDE [EAST]	0.053	0.062	0.365	0.056	0.055	0.045	0.057	0.079	0.111	0.130

IFFCO - KALOL

WHEEL TO DIAPHRAGM CLEARANCE (105-JT)

PLANT : AMMONIA



DATE :- _____.

DESCRIPTION	ROTOR NO.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
EXISTING ROTOR		0.00	0.00	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.00	0.01	0.00
IF NEW ROTOR IS INSTALLED		0.01	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.00	0.00	0.01

NOTE: All dimensions in "mm".

IFFCO - KALOL

RUNOUT RECORD FOR 105-JT

PLANT : AMMONIA

IFFCO - KALOL

DIAMETRICAL CLEARANCES - 105 JLP

REF.	CLEARANCE INCHES	BETWEEN	REF.	CLEARANCE INCHES	BETWEEN
A	0.020 TO 0.026	SHAFT TO GUARD	K	0.018 TO 0.022	BALANCING DRUM TO LABYRINTH
C	0.002 TO 0.004	SHAFT TO GUARD & NUT TO GUARD	N	0.030 TO 0.035	WHEEL TO LABYRINTH
E	0.014 TO 0.017	SHAFT TO HOUSING	R	0.025 TO 0.029	WHEEL TO BUSHING (LABYRINTH)
F	0.006 TO 0.008	SHAFT TO JOURNAL BEARING	T	0.020 TO 0.026	SHAFT TO GUARD
G	0.005 TO 0.007	SHAFT TO BUSHING	H	0.018 TO 0.022	SHAFT TO RING (LABYRINTH)

AFTER	BEFORE		BEFORE	AFTER
0.015"	0.015"	OIL GUARD - A	0.013"	0.013"
NA	NA	OIL GUARD - C	0.004"	0.004"
		THRUST BRG.		
NA	NA	OIL GUARD - C	0.004"	0.005"
NA	NA	BRG. HOUSING - E	0.016"	0.016"
NA	NA	JOURNAL BRG. F	0.011"	0.007"
NA	NA	BUSHING - G	0.007"	0.007"
0.006"	0.006"	RING - H	0.006"	0.006"
0.018"	0.019"	BALANCING RING K	0.013"	0.013"
0.023"	0.024"	WHEEL - 4 N	0.015"	0.016"
0.014"	0.010"	R	0.006"	0.007"
0.024"	0.025"	WHEEL - 3 N	0.022"	0.022"
0.013"	0.012"	R	0.008"	0.008"
0.021"	0.023"	WHEEL - 2 N	0.017"	0.018"
0.010"	0.012"	R	0.016"	0.016"
0.026"	0.028"	WHEEL - 1 N	0.018"	0.018"
0.006"	0.006"	RING - H	0.010"	0.010"
NA	NA	BUSHING - G	0.006"	0.006"
NA	NA	JOURNAL BRG. F	0.011"	0.011"
NA	NA	BRG. HOUSING - E	0.017"	0.017"
NA	NA	RING - T	0.028"	0.028"

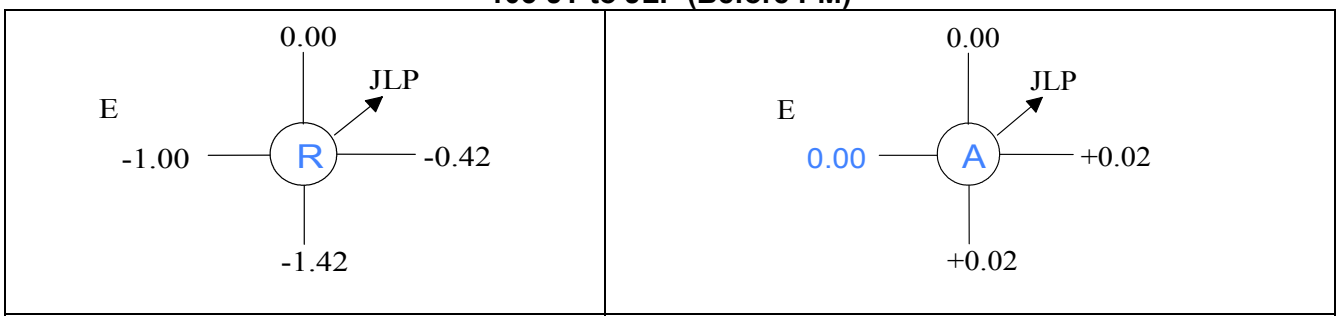
NORTH G.B.

SOUTH TURBINE

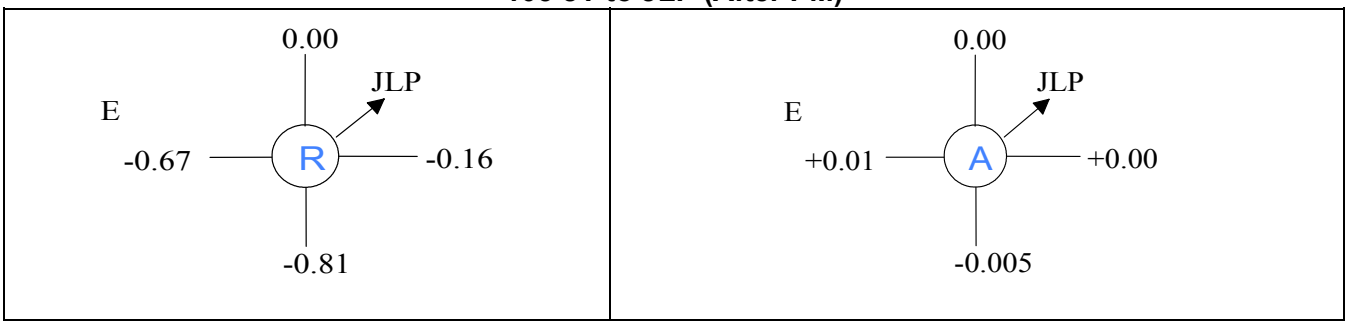
IFFCO	:-
PARTY	:-
Date	:-

PREVENTIVE MAINTENANCE RECORDS: 105-J TRAIN

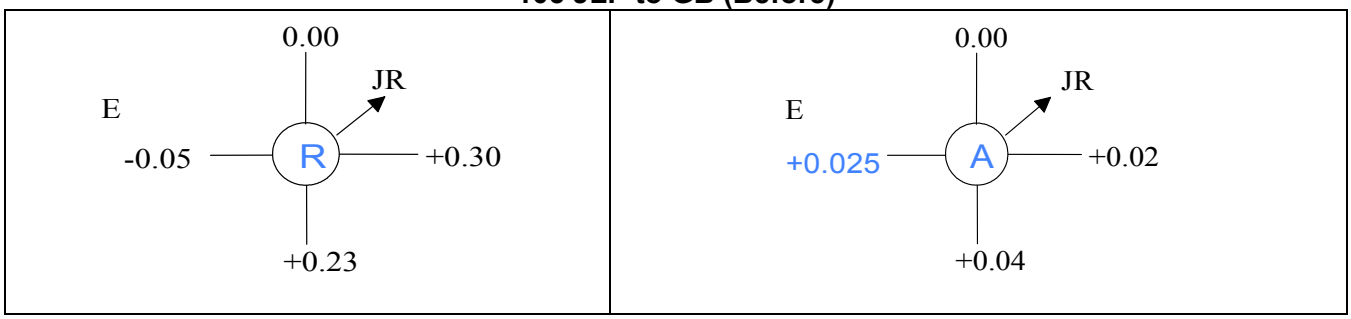
105-JT to JLP (Before PM)



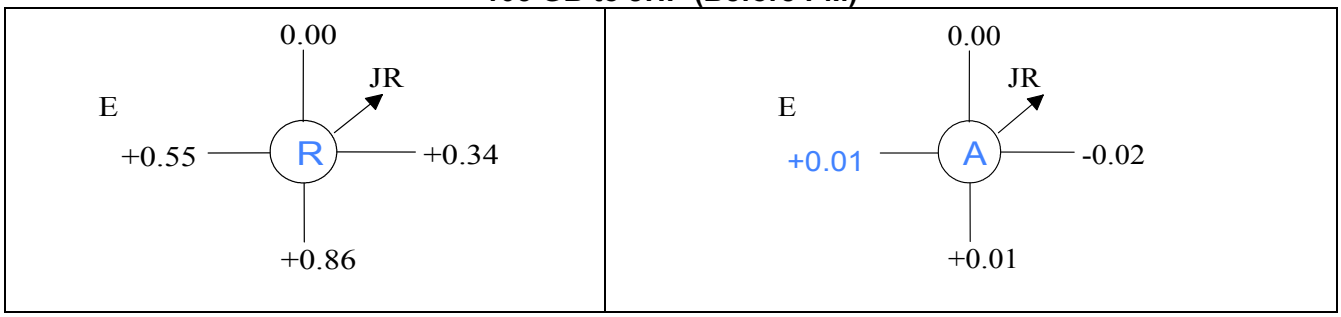
105-JT to JLP (After PM)



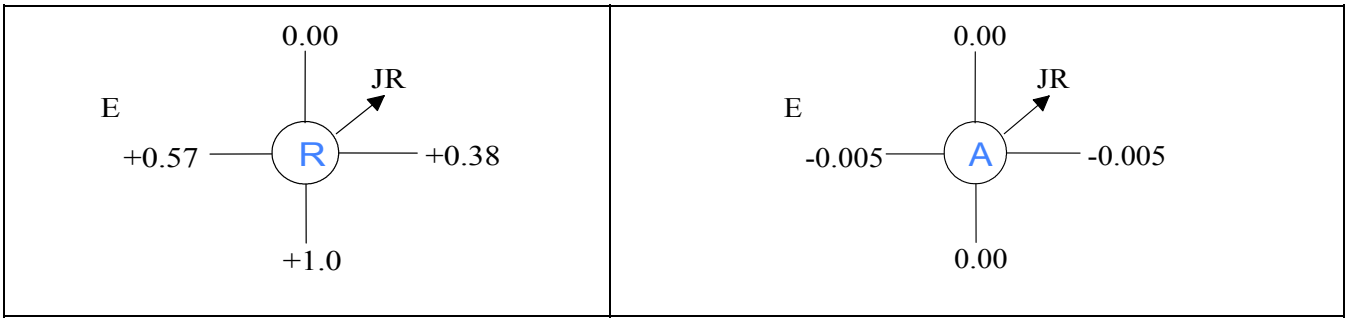
105 JLP to GB (Before)



105 GB to JHP (Before PM)



105 GB to JHP (After PM)



INDUCED DRAFT FAN 101-BJ TRAIN:

101- BJT Drive Turbine 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. All the bearing pads were Dye Penetration tested and no surface defects were found. Bearing clearances were taken and found within the design range. The hydro-mechanical PGPL governor was replaced by new electronic governor.

101- BJ Fan Preventive Maintenance:

Journal bearings and thrust bearings were inspected and found O.K. Gauss reading was taken and found below maximum allowable limit. All the bearing pads were Dye Penetration tested and no surface cracks were found Bearing clearances were taken and found within the design range. 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.

101-BJR Gear box Preventive Maintenance:

The gear and pinion were inspected and found O.K. All the bearings were inspected and found O.K. 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 Inspection:

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		3.0 mm	3.0 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	1.0 mm	1.0 mm
101-BJR (BJT End)	Hub	3.0 mm	3.0 mm

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			0.005	0.005
Oil Guard (For Jr. Brg Housing)	CT Side	---	0.015”-0.0195”	0.010	0.010
	SILO Side	---	0.015”-0.0195”	0.005	0.005
Bearing Pinch	Jr. Brg.	---	---	0.011	0.011
Governor End					
Journal Bearing	Mandrel	---	0.006-0.009	---	---
	Filler / lead wire			0.005	0.005
Oil Guard (For Brg. Housing	CT Side	---	0.015”-0.0195”	0.010	0.010
	SILO Side	----	----	----	---
Axial Thrust.	With Top Housing	---	0.014”	0.013	0.013
	Without top Housing	---		0.013	0013

101-BJR				
Description	**Position**	**Design Clearances (Inch)**	**Before (Inch)**	**After (Inch)**
Journal Bearing (High Speed drive Pinion)	CT Side	0.005”-0.008”	0.005	0.005
	SILO Side	0.005”-0.008”	0.004	0.004
Axial Thrust	---		0.013	0.013
Journal Bearing (Low Speed driven Gear)	CT Side	0.005”-0.008”	0.005	0.005
	SILO Side	0.005”-0.008”	0.005	0.005
Backlash	---	0.013”-0.017”	0.021	0.021
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

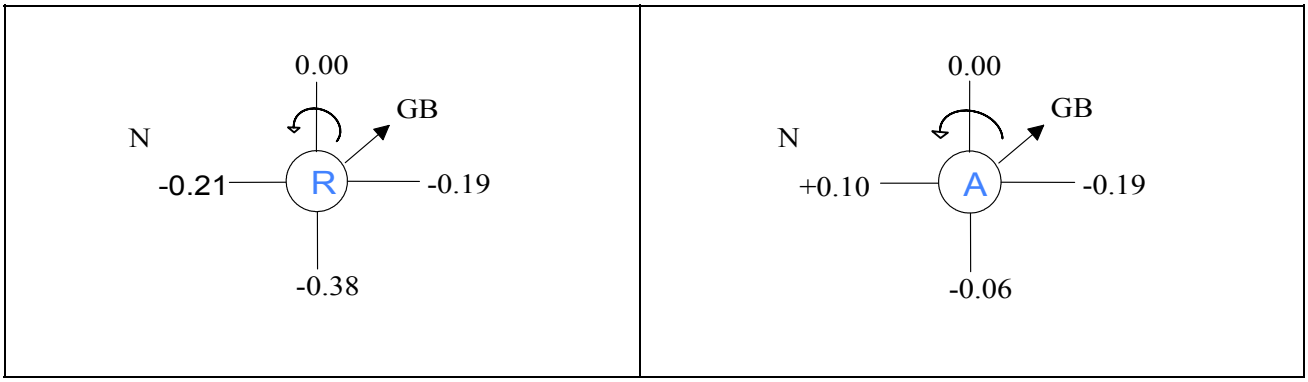
CLEARANCE CHART: 101 – BJ

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			0.0047	0.0047
Shaft Diameter	Jr. Brg.	---	---	NA	NA
Bearing Pinch	Jr. Brg.	---	---	0.0007	0.0007
Free End					
Journal Bearing	Mandrel	---	0.008" - 0.012"	NA	NA
	Filler / lead wire			0.0047	0.0047
Axial Thrust.	With Top Housing	---	---	0.079	0.079
Shaft Diameter	Journal bearing	---	---	NA	NA
Bearing Pinch	Jr. bearing	---	---	0.0011	0.0011

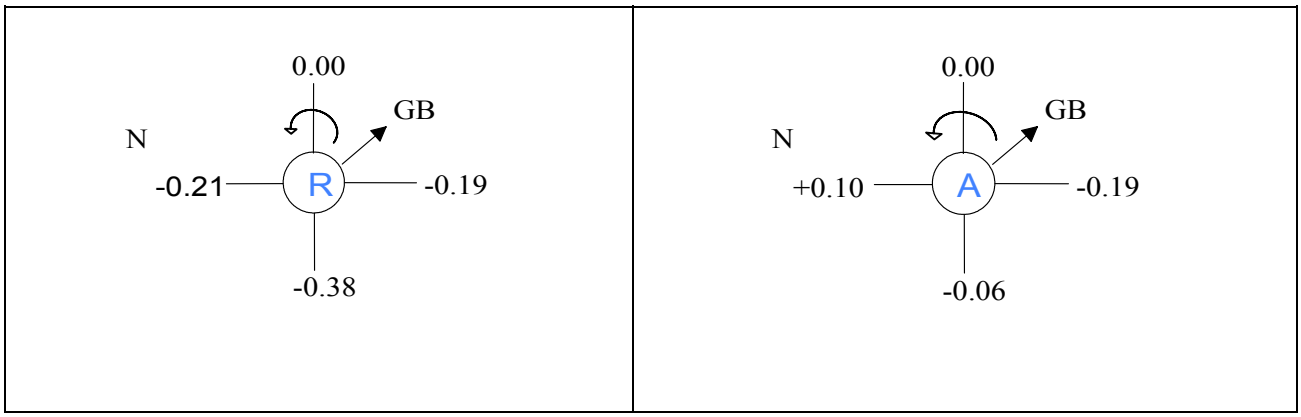
GAUSS RECORDS - 101-BJ TRAIN

Description	Position	Before (Gauss)	After (Gauss)
101- BJT			
Journal Bearing liner	CT Side	2.2	2.2
	SILO Side	2.7	2.7
Shaft Journal	CT Side	3.0	3.0
	SILO Side	2.5	2.5
101 – JR (High Speed drive Pinion)			
Journal Bearing	CT Side	1.6	1.6
	SILO Side	1.8	1.8
Shaft Journal	CT Side	2.7	2.7
	SILO Side	1.2	1.2
101 – JR (Low Speed driven Gear)			
Journal Bearing	CT Side	0.9	0.9
	SILO Side	1.3	1.3
Shaft Journal	CT Side	2.6	2.6
	SILO Side	3.1	3.1
101-BJ			
Journal Bearing	CT Side	1.6	1.6
	SILO Side	1.8	1.8
Shaft Journal	CT Side	3	3
	SILO Side	2.8	2.8

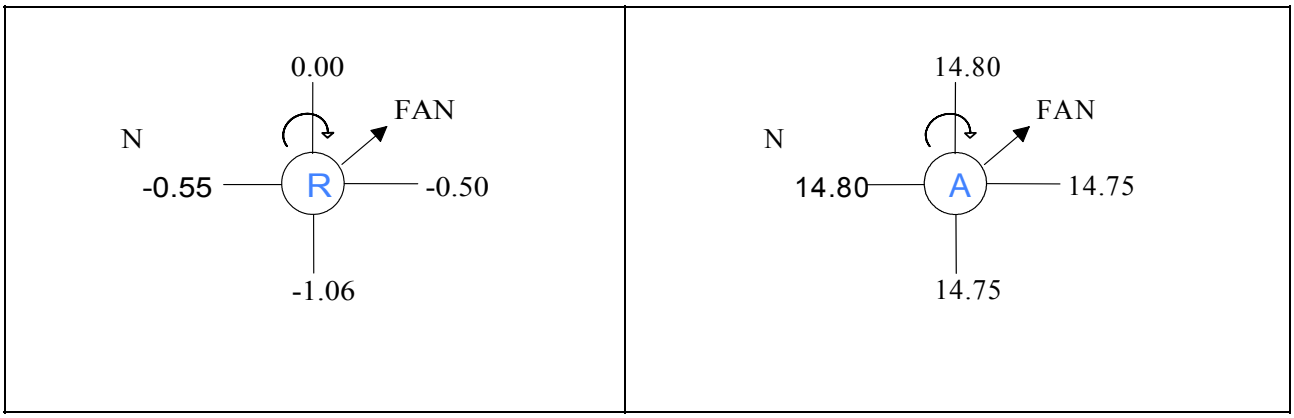
101 BJT to 101 BJR (Before PM)



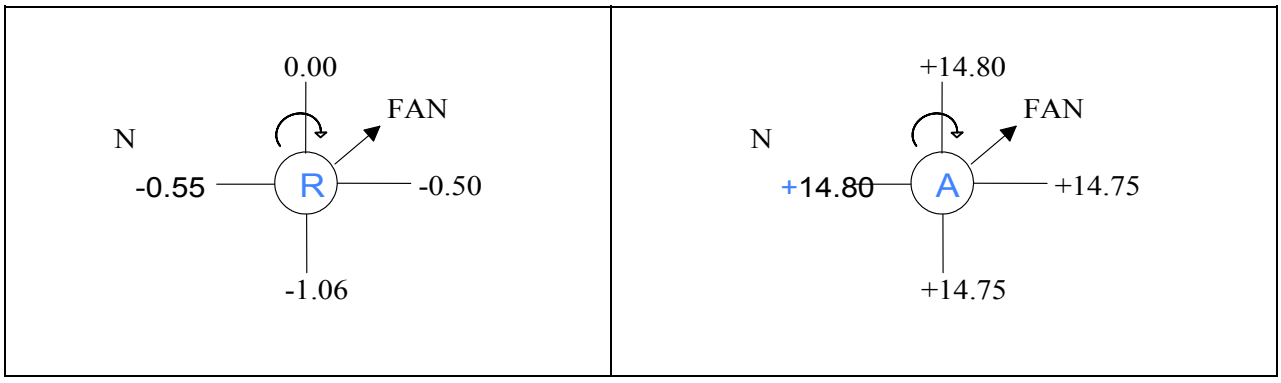
101 BJT to 101 BJR (After PM)



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



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



RETROFITTING OF 101-BJT GOVERNING SYSTEM:

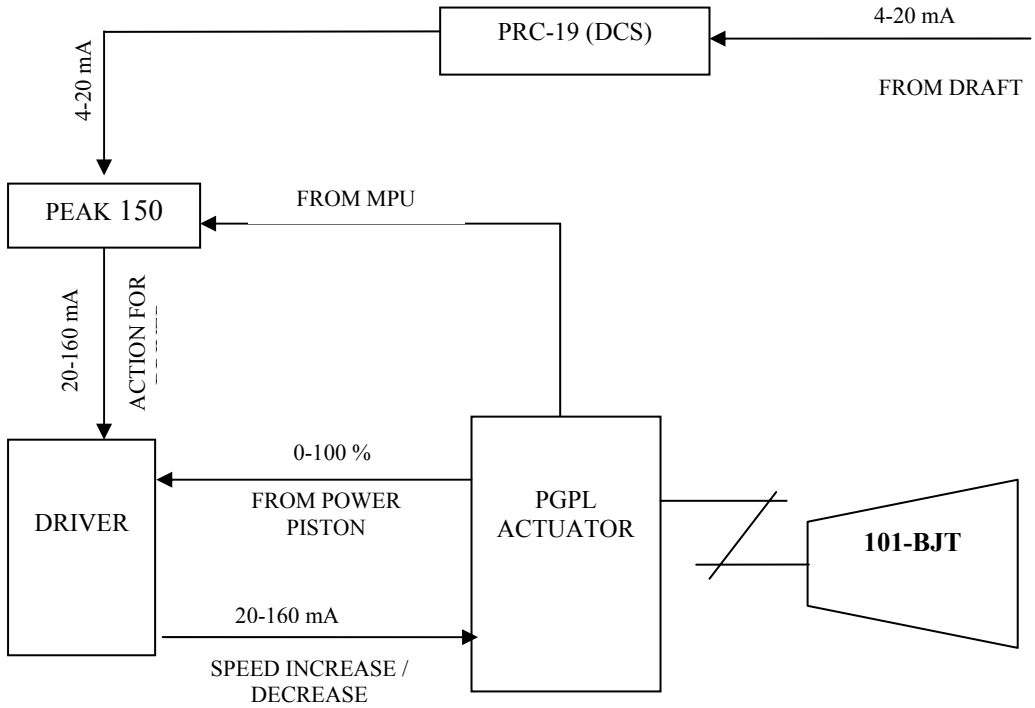
The existing PGPL mechanical governor was showing problem in controlling speed during start up and even in running plant. To have more precise speed control and improved reliability, this mechanical governor was replaced by new electronic governing system comprising of the following.

- PGPL Actuator
- PGPL Driver
- PEAK 150 Controllers
- MPU (2 Nos)
- Toothed wheel for MPU (2Nos)

The actuator assembly was installed in position and the governor drive worm wheel locked. The cooling water lines were connected to the cooler to get a counter flow arrangement. The actuator was filed with SERVO ULTRA 40 oil. Since toothed wheel for MPU was installed on governor shaft, the signal received from MPU was multiplied by a factor of 4.16 (gear ratio) to get the speed of the turbine The PEAK-150 was later hooked up with the DCS/PRC-9 by the instrumentation department. The details of the Governor settings are as follows:

- Gear ratio : Turbine/Gov. = 1/0.24 = 4.16/1
- Minimum governor speed :1600 RPM
- Turbine electrical trip : 4500 RPM
- Maximum governor speed : 4000 RPM
- Turbine Mechanical trip: 4752 RPM

Sketch showing the working of the new electronic governing system for 101-BJT



SEMILEAN SOLUTION PUMP115-JA TRAIN:

115-JA Semilean Solution Pump 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 suction strainer was cleaned. The mechanical seal flushing line strainer was cleaned.

115-JAT Drive Steam Turbine Preventive Maintenance:

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

115-JAR Gear Box Preventive Maintenance:

All the bearings were inspected and found O.K. Both the gear as well as Pinion were inspected and found 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.

CLEARANCE RECORD: 115-JA

Description		Design Clearances (Inch)	Before (Inch)	After (Inch)
Journal bearing (Thrust end)		0.005-0.0098	0.0053	0.0053
Labyrinth seal for above		NA	0.013-0.016	0.013-0.016
Journal bearing (Non thrust end)		0.005-0.0098	0.0056	0.0056
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)	0.013	0.013

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

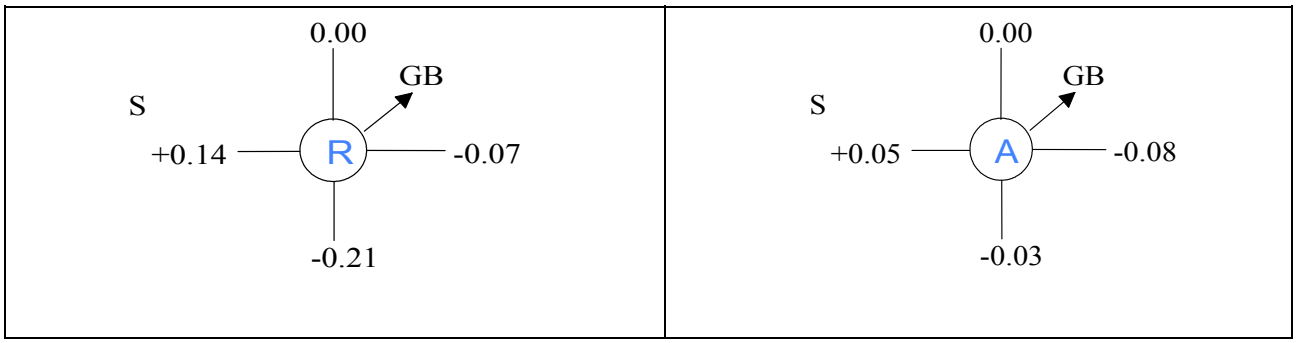
CLEARANCE CHART: 115-HT

Description	Design Clearances (Inch)	Before	After
Thrust end bearing	0.0048-0.0058	0.006	0.006
Opp Thrust end bearing	0.0048-0.0058	0.006	0.006
Axial Thrust	0.010-0.011	0.020	0.020

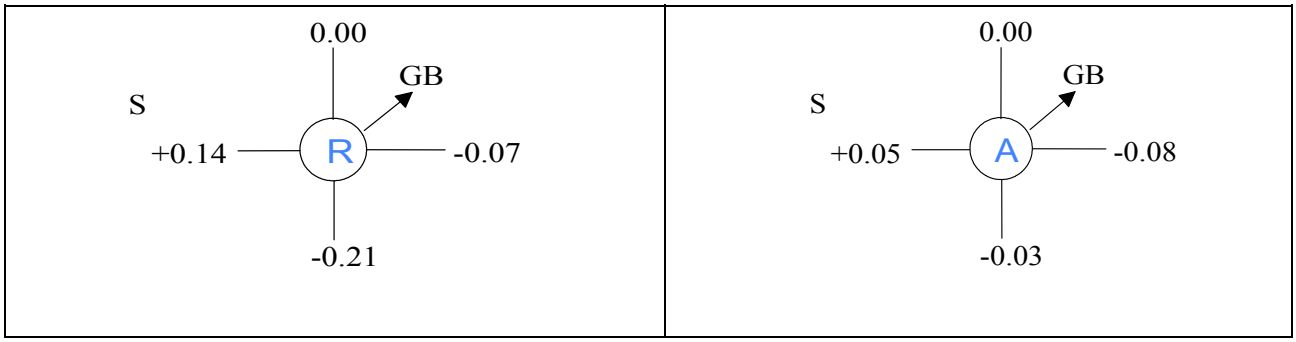
CLEARANCE CHART: 115- JAT

Description		Design Clearances (Inch)	Before	After
Axial Thrust		0.010 – 0.012	0.009	0.009
Coupling side bearing		0.0055-0.008	0.008	0.008
Governor side bearing		-- do --	0.006	0.006
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

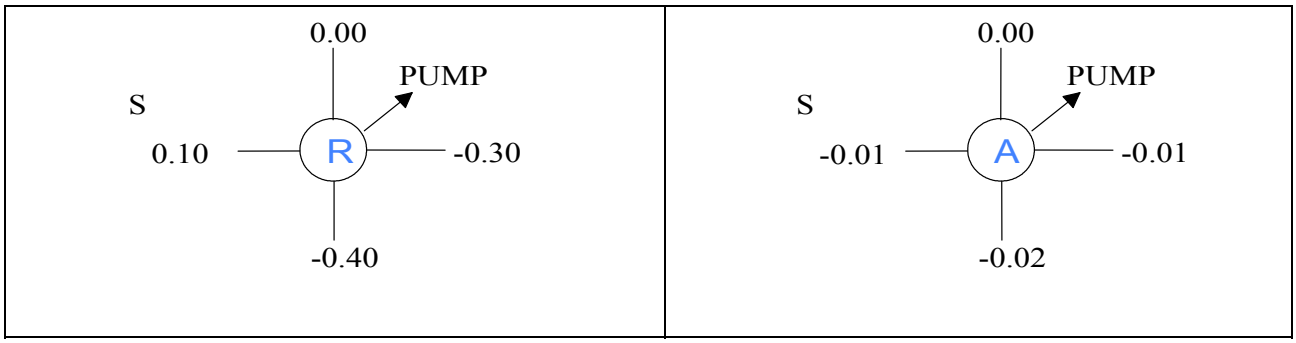
115-JAT to 115-GB (BEFORE)



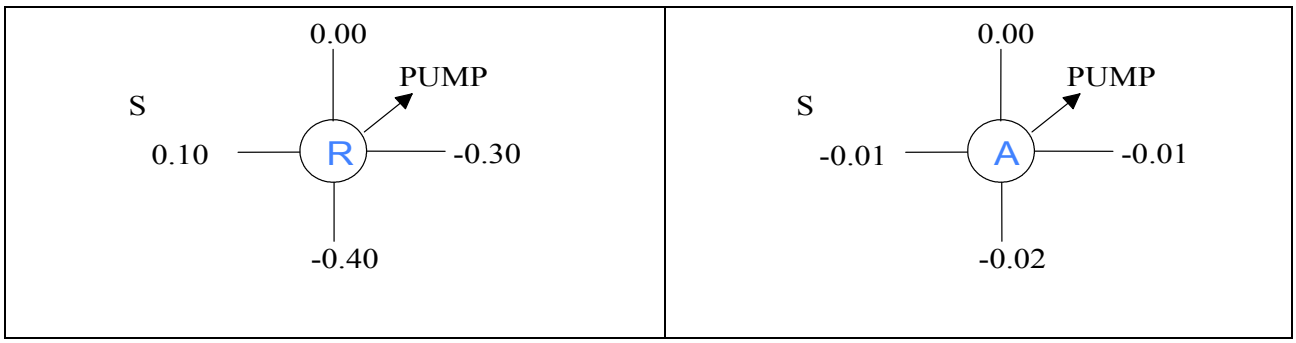
115-JAT to 115-GB (AFTER)



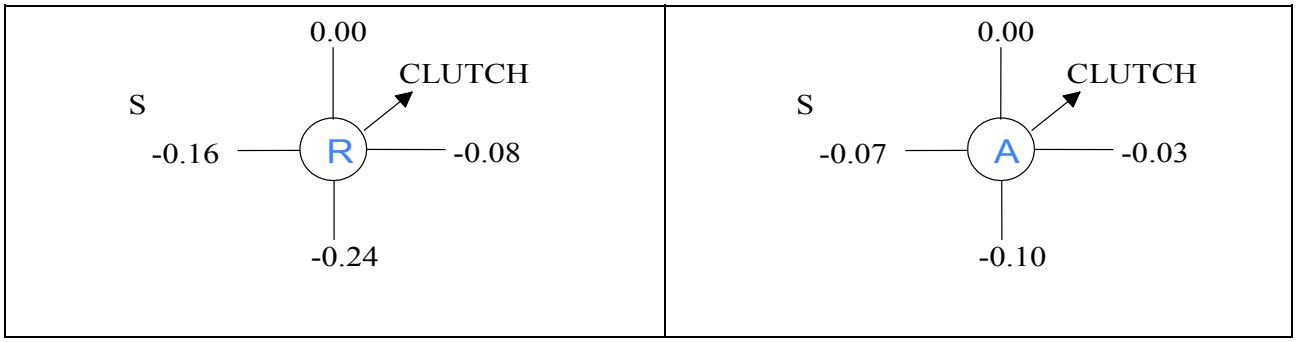
115-GB to 115-JA (BEFORE PM)



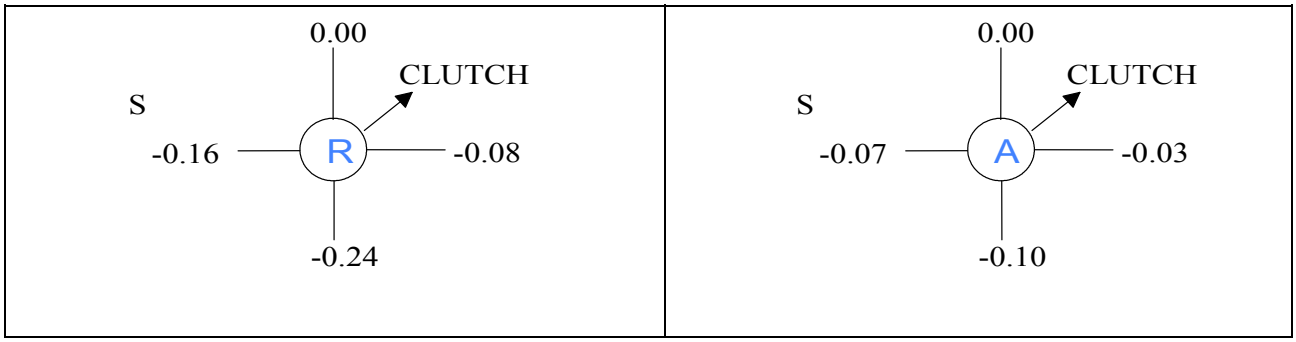
115-GB to 115-JA (AFTER PM)



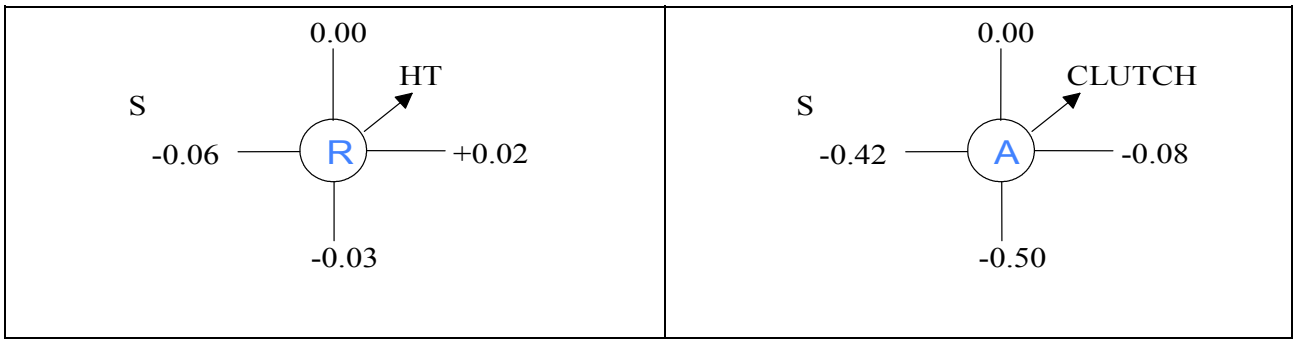
115-JA to CLUTCH (BEFORE PM)



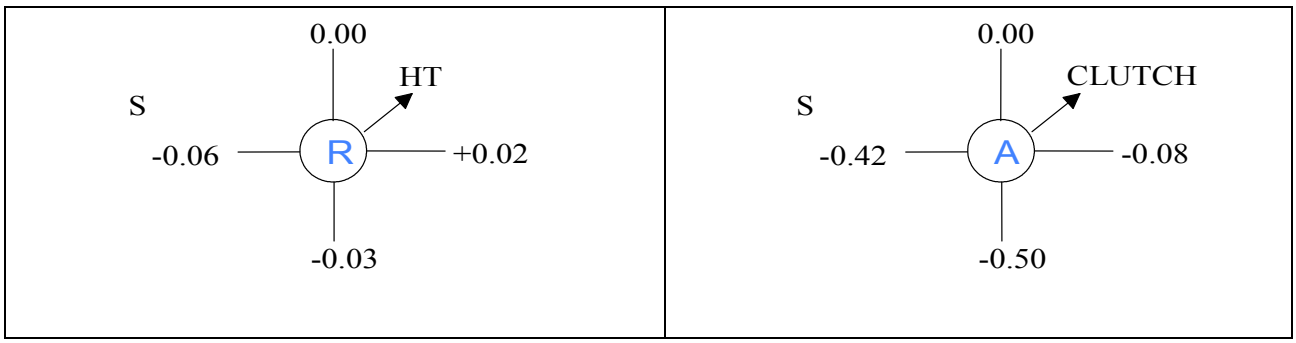
115-JA to CLUTCH (AFTER PM)



CLUTCH to 115-HT (BEFORE PM)



CLUTCH to 115-HT (AFTER PM)



BOILER FEED WATER PUMP, TRAIN 104-JA:

104-JA Boiler Feed Water Pump Preventive Maintenance:

Both ends journal bearing sleeves were inspected and found to have heavy scorings with increased clearance. The sleeves were replaced by new ones. The non drive end mechanical seal leaked during shutdown of the equipment. The complete seal was disassembled. All the O-rings were replaced by new ones. The stationary and the rotating mating rings were replaced by new ones. The mechanical seal was reassembled and installed in position. The lube oil console and filters were cleaned and installed.

104-JAT Drive Turbine Preventive Maintenance:

Coupling end journal bearing clearance had increased to beyond acceptable limit. Hence the bearing was replaced by new one. The axial thrust was measured and found above limit at 0.027". The thrust cum journal bearing was disassembled and the seating area of the active pads was found suppressed. The shim of 0.2mm thickness provided with spacer was cut and removed. The active and non active ends pads were changed and the bearing was reassembled. The thrust was measured at 0.015" which was within the designed value. The low lube oil trip linkages were checked.

Coupling inspection:

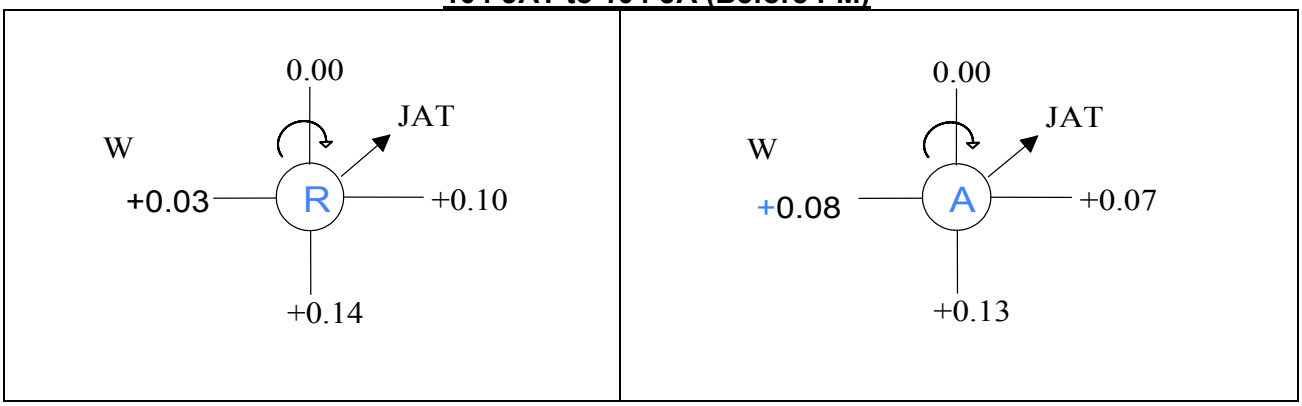
The coupling was inspected and the flexible element found damaged. Few shims had broken and a couple of bush for fastners had come out. Hence a new flexible element was installed and the set of fastners was replaced by new one. The DBSE and coupling hub / shaft overhang was measured and found within limit.

CLEARANCE CHART : 104-J TRAIN

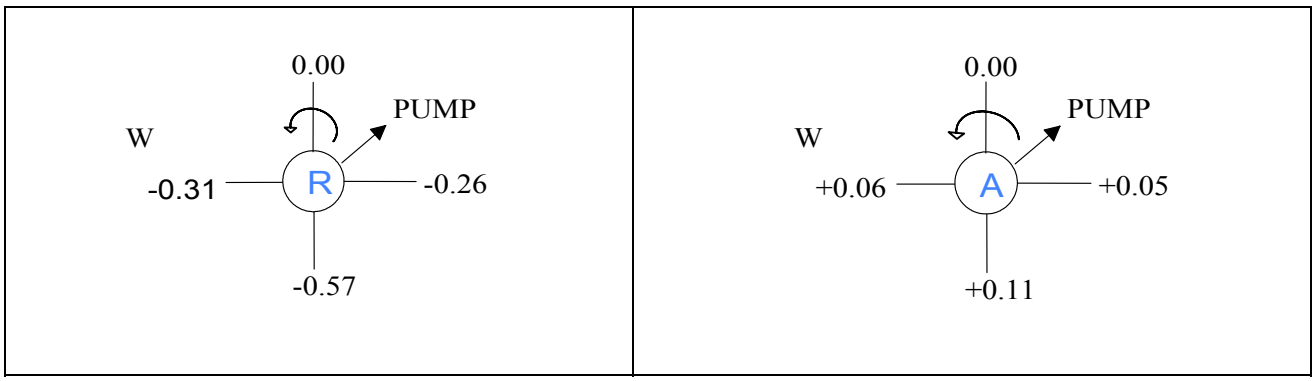
Description	Design Clearance (Inch)	Before PM (Inch)	After PM (Inch)
104-JAT (TERRY TURBINE)			
Journal bearing (Thrust end bearing)	0.005-0.007	0.008-0.009	0.008-0.009
Journal bearing (Opposite thrust end)	0.005-0.007	0.010	0.005
Axial Thrust	0.011-0.0016	0.027	0.015
104 JA			
Journal bearing (Thrust end bearing)	0.006 - 0.008	0.010	0.005
Journal bearing (Opposite thrust end)	0.006 - 0.008	0.010	0.005
Axial Thrust	0.014	0.011	0.011

The alignment readings are as follows.

104-JAT to 104-JA (Before PM)



104-JAT to 104-JA (After PM)



aMDEA PUMP 107-J Train:
107-JT Drive Turbine Preventive Maintenance:

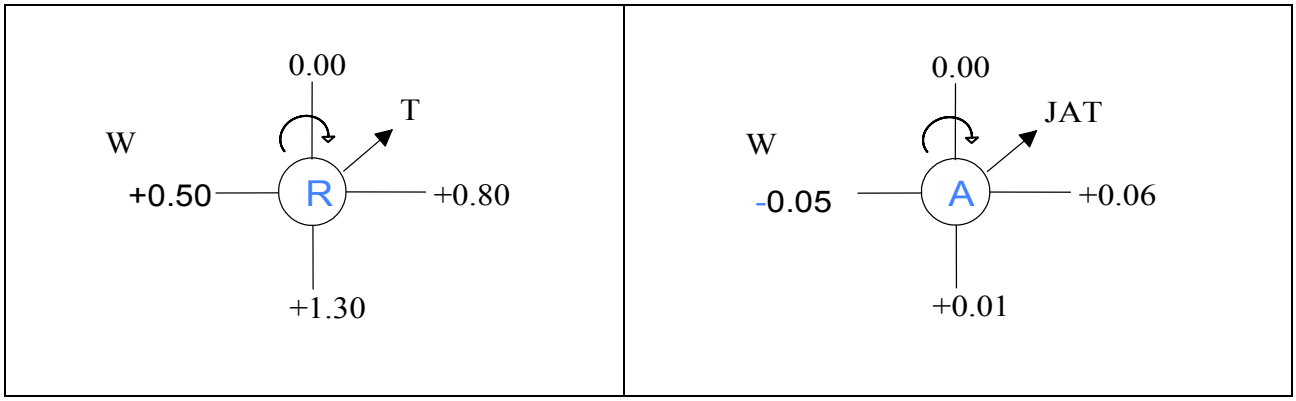
The turbine was decoupled and the coupling was inspected. The pump side flexible elements were found broken and was replaced by new assembly. Both end bearings was inspected and found in good condition. The suction strainers were cleaned. The lube oil coolers and console were cleaned. Gauss measurements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

CLEARANCE CHART: 107-JT (MURRY TURBINE)

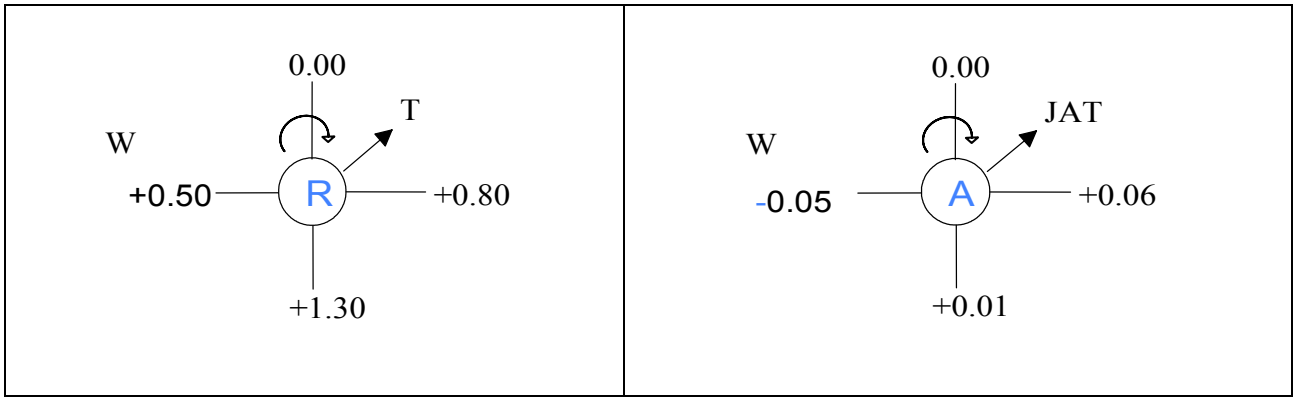
Description	Design Clearance (Inch)	Before PM (Inch)	After PM (Inch)
Journal bearing Thrust end	0.004 – 0.006	0.0065 – 0.009	0.0065 – 0.009
Oil Guard Thrust end - Inboard	0.011” – 0.017”	0.005”	0.005”
Oil Guard Thrust end - Outboard	0.011” – 0.017”	0.006”-0.065”	0.006”-0.065”
Journal bearing Opposite thrust end	0.004 – 0.006	0.0062 – 0.0085	0.0062 – 0.0085
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”	0.057”

GAUSS			
LOCATION		**BEFORE (Gauss)**	**AFTER (Gauss)**
Journal bearing Governor end	Top half	2.4	2.4
	Bottom half	2.3	2.3
	Shaft	3.0	3.0
Journal bearing Coupling end	Top half	2.5	2.5
	Bottom half	1.6	1.6
	Shaft	2.6	2.6
Thrust bearing	Collar	2.7	2.7
	Pad	1.8 - 2.0	1.8 - 2.0

107-JT to 107-J (Before PM)



107-JT to 107-J (After PM)



RECIPROCATING CO_2 GAS COMPRESSOR TRAIN (117-J)

LP Cylinders Overhauling:

The end clearance at TDC and BDC were measured and found OK. Opened the head of both cylinders. The cylinder liners were inspected and found OK. The runout of the piston rod was checked and found OK. Removed the piston for checking seals on piston head. The seal rings and bearing rings were found damaged and hence were replaced by new ones. The bearing ring were heated to a temperature of 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 Overhauling:

The end clearance at TDC and BDC were measured and found OK. The cylinder liners were inspected and found OK. The runout of the piston rod was checked and found OK. Both the cylinders were disassembled. The seal rings and bearing rings on the piston head were found damaged and hence were replaced by new ones. The bearing ring were heated to a temperature of 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 Overhauling:

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

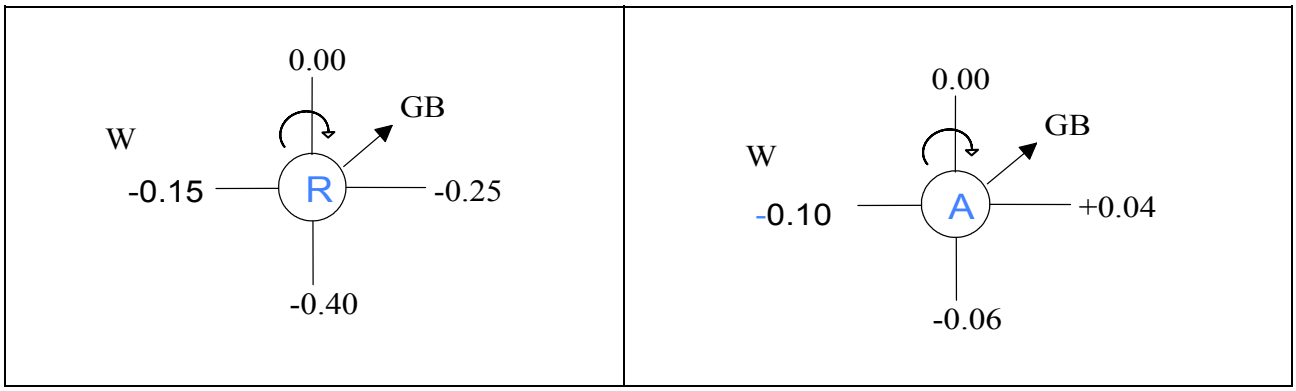
The tube bundle of the interstage cooler was pulled out and cleaned by hydro jetting. The LP and HP flow dampener were checked and found OK. The lube oil strainers were cleaned and reinstalled.

CLEARANCE CHART : 117-J TRAIN

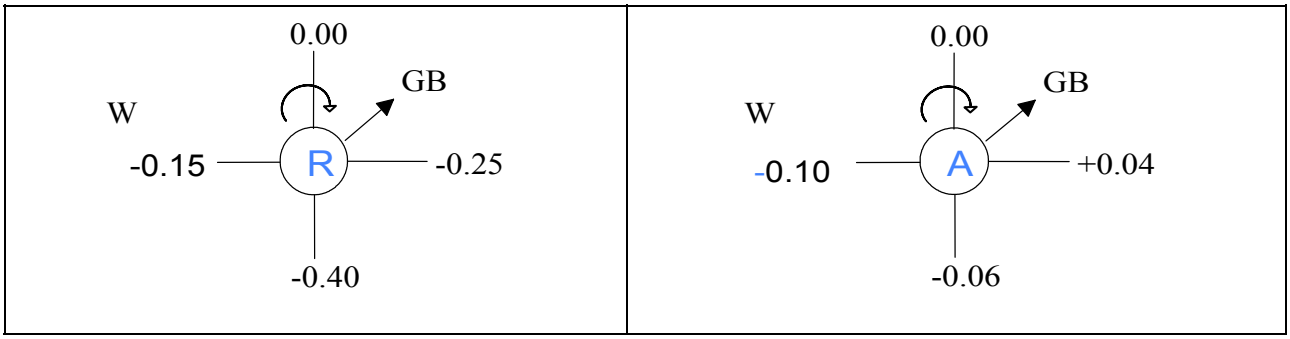
Description	Position		Design clearance(mm)	Before	After
Piston end clr. (Front /**TDC**)	LP	Urea side	2	3.02	3.03
		Ammonia side	-- do --	3.02	3.12
	HP	Urea side	-- do --	3.25	3.01
		Ammonia side	-- do --	3.15	2.72
Piston end clr. (Intermediate /**BDC**)	LP	Urea side	1.5	1.52	1.70
		Ammonia side	-- do --	1.7	1.61
	HP	Urea side	-- do --	1.44	1.42
		Ammonia side	-- do --	1.59	1.45
Main bearing	I	Urea side to Ammonia side	0.08-0.15 (0.3 MAX)	0.19	0.19
	II		-- do --	0.16	0.16
	III		-- do --	0.16	0.16
	IV		-- do --	0.17	0.17
	V		-- do --	0.15	0.15

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

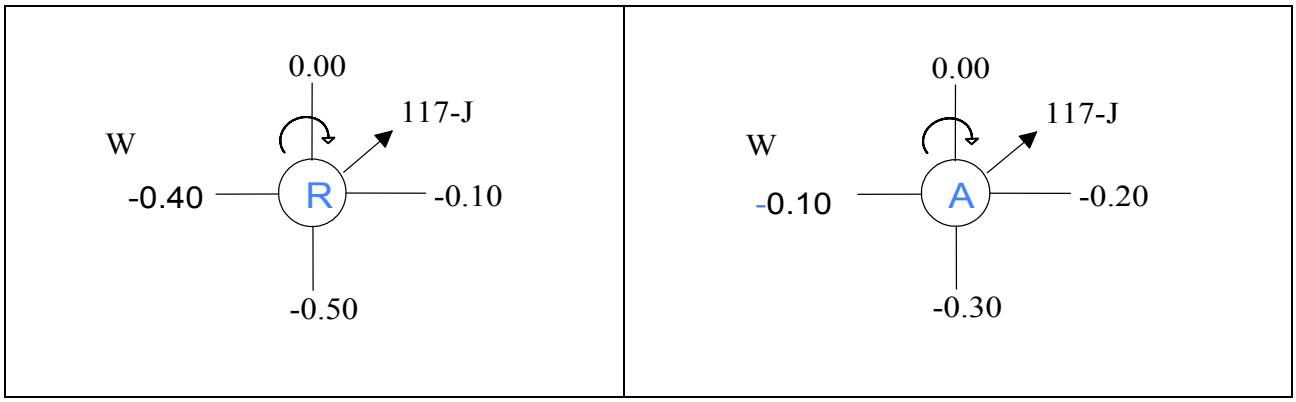
117-JM to Gear Box - (Before PM)



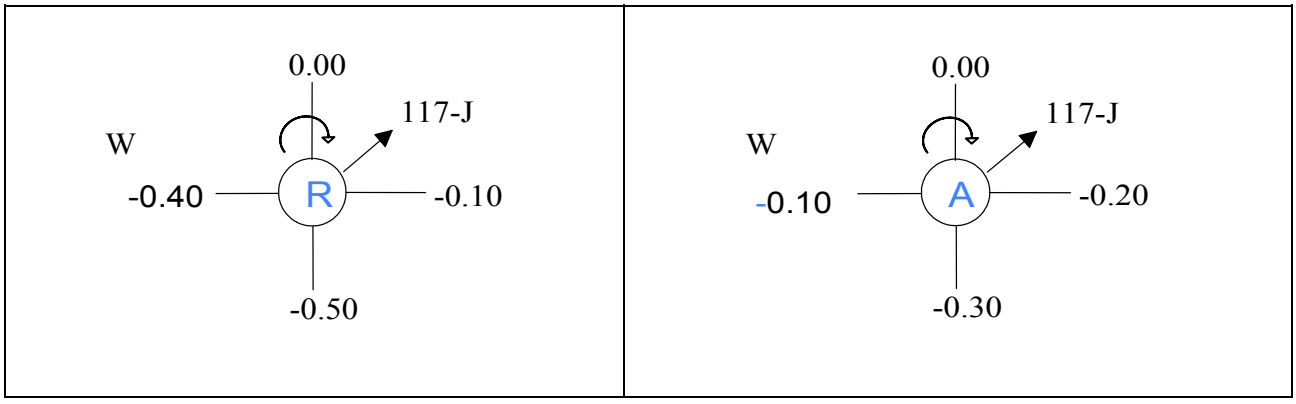
117-JM to Gear Box - (After PM)



Gear Box to 117-J - (Before PM)



Gear Box to 117-J - (After PM)



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 (Kg/cm2)
1	RV – MS 9	4” x 6”	42.2
2	RV – S 7	4” x 6”	14.8
3	RV – LS 1	4” x 6”	12.7
4	RV – 123 CA (2 Nos)	3” x 6”	123.0
5	RV – BFW 1	1.5” x 2.5”	92.0
6	RV – S 26	2.5” x 4”	14.06
7	RV – 103 JAT (2 Nos)	4” x 6”	660
8	RV – 103 JAT	¾” x 1”	660
9	RV – 104 JAT	6” x 8”	0.37
10	RV – 112 CA	1.5” x 3”	10.50
11	RV – 112 CB	1.5” x 3”	10.50
12	RV – 109 F	6” x 8”	19.0
13	RV – 110 F N & S (2 Nos)	3” x 4”	7.0
14	RV – 111 F	4” x 6”	6.3
15	RV – 112 F	4” x 6”	6.3
16	RV-175-J	1 ½ x 2	40
17	RV – 101 D	3” x 4”	43.9
18	RV – 102 D	3” x 4”	43.9
19	RV 101-	4” x 6”	36.9
20	RV – 105 JLO	2” x 3”	5.3
21	RV – 129 C	1” x 2”	8.4
22	RV – 104 D 2	1.5” x 2”	34.10
23	RV – 101 E	1” x 2”	30.6
24	RV – PG 39	4” x 6”	5.3
25	PSV- 111	0.5” x 1”	4.01
26	PSV-177	15” x 20”	57.08
27	PSV-1201	1 ½” x 3”	7
28	PSV-1202	1 ½”x 3”	7
29	PSV-1203	1” x 2”	48
30	PSV-1204	1 ½ “ x 2”	48
31	PSV-1205	3” x 4”	7
32	PSV-1206	1 ½” x 2 ½”	48
33	PSV-1209 A	1” x 2”	42
34	PSV-1210	1 ½” x 2 ½”	48
35	PSV-1212	¾ ” x 4”	7.0
36	PSV-301	1 ½” x 3”	10.0
37	RV 116-JAT	3 x 4	6.1
38	RV – 117 J-1	1 ½” x 3”	5.8
39	RV – 117 J-2	1 ½” x 3”	15..8
40	RV – 117 J-3	1” x 2”	30.2
41	RV – 115 JA- AOP-1	1” x 2”	11.0
42	RV – 115 JB- AOP-2	1” x 2”	11.0
43	RV – 115 JB AOP-1	1” x 2”	11.0
44	RV – 115 JB AOP-2	1” x 2”	11.0
45	RV-104-D1	6” X 8”	35.0

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

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

The following high pressure and medium pressure steam services RV were tested on test bench:

RV-101-F-1: (Middle)

1. Make: Tyco Sanmar.
2. Srl.No: 97-4469.
3. Model:HC-75-IBR—SPL.
4. Size: 2.5" x 6".
5. Service: Steam.
6. Design set pressure: 118.8 $kg/cm^{2.}$
7. Actual set pressure: 115.33 kg/cm^2
8. Reset pressure: 103.8 kg/cm^2

RV-101-F-2: (South)

1. Make: Tyco Sanmar.
2. Srl.No: 97-4468
3. Model:HC-75-IBR—SPL
4. Size: 2.5" x 6"
5. Service: Steam
6. Design set pressure: 117.0 KG/CM^2
7. Actual set pressure: 118.84 kg/cm^2
8. Reset pressure : 107.0 kg/cm^2

RV-101-F-3: (North)

1. Make: Tyco Sanmar
2. Srl.No: 97-4467
3. Model:HC-75-IBR—SPL
4. Size: 2.5" x 6"
5. Service: Steam
6. Design set pressure: 115.3 kg/cm^2
7. Actual set pressure: 117.0 kg/cm^2
8. Reset pressure: 105.30 kg/cm^2

RV-101-B (SUPER HEATER RV.):

This relief valve was steam tested after plant start-up.

1. Make: Tyco Sanmar
2. Sr.No: 99-8141
3. Model:HC-78-IBR
4. Size: 3.0" x 6.0"
5. Service: Steam
6. Design set ressure: 111.80 kg/cm^2
7. Set pressure achieved while floating: 111.00 kg/cm^2
8. Reset pressure achieved while floating: 105.00 kg/cm^2
9. Blow down Percentage: 5.40 %

PSV-986 MP Boiler 107-C RV:

1. Make: TYCO
2. Sr.No: 26 - 0991
3. Model: HSJ/45 – IBR - SEL
4. Size: 4 L 6
5. Service: Steam
6. Design set pressure: 45.0 kg/cm^2
7. Actual set pressure: 45.0 kg/cm^2
8. Reset pressure: 40.50kg/cm^2

PSV-987 MP Boiler 107-C RV:

1. Make: TYCO
2. Sr.No: 26 - 0992
3. Model: HSJ – 45 – IBR - SEL
4. Size: 4 L 6
5. Service: Steam
6. Design set pressure: 46.3 kg/cm^2
7. Actual set pressure : 46.3 kg/cm^2
8. Reset pressure: 41.7kg/cm^2

HP & MP steam RV test details

Sr. No	RV Tag No.	Location	Popping pressure	Reset pressure	Tested on
1.	**RV-101-F-1**	Steam Drum (Middle)	115.33	103.8	Test bench
2.	**RV-101-F-2**	Steam Drum (South)	118.84	107.0	Test bench
3.	**RV-101-F-3**	Steam Drum (North)	117.0	105.3	Test bench
4.	**RV-101-B**	Super heater.	111.00	105.00	***Floated (Steam tested)***
5.	**PSV-986**	107-C	45.0	40.50	Test bench
6.	**PSV-987**	107-C	46.3	41.7	Test bench

MOTOR OPERATED VALVE SP – 4 REPLACEMENT:

The existing valve was showing operational problems. The spare valve and gear box was overhauled at workshop and was installed during the annual turnaround. To match the existing actuator assembly a new bush assembly had to be manufactured at workshop.

HEAT EXCHANGERS:

Tube bundle replacement:

The tube bundle of the following heat exchangers was replaced by new tube bundle:

- **aMDEA solution coolers (108-C1A and C2A) :** New SS 304 tube bundle, supplied by M/s Patel Airtemp, Ahmedabad, was hydrotested at a pressure of 8.1 kg/cm^{2,} in dummy shell and installed.

- **Air compressor interstage cooler (130-C):** New tube bundle installed in SD-06 had leaked during hydrotest in SD-07. 10 Nos tubes of this bundle were plugged during the same period. This bundle was replaced by new tube bundle, supplied by M/s Patel Airtemp, Ahmedabad.

Tube bundle pulling and cleaning:

The following heat exchangers were opened. The tube bundle pulled out for hydro jetting of shell, tube bundle & channel covers were boxed up.hydrotest was carried out as follows.

SR. NO.	EQUIP.	NOS.	NO OF TUBES	TUBE SIDE PRESSURE (KG/CM^2)		SHELL SIDE PRESSURE (KG/CM^2)		REMARKS
				DESIGN	TEST	DESIGN	TEST	
1	115-C	1	649U	29.9		10.6	15.8	58 tubes were expanded to arrest leakage between tube and tube sheet.
2	116-C	1	300U	66.4		10.4	15.8	
3	124-C	1	775 U	158		17.6	26.5	

Tube bundle cleaning by hydro jetting:

SR. NO.	EQUIP.	NOS.	NO. OF TUBE	TUBE SIDE PRESSURE (KG/CM^2)		SHELL SIDE PRESSURE (KG/CM^2)		REMARKS
				DESIGN	TEST	DESIGN	TEST	
1	**105-CA**	1	2790	5.27	8.1	30.9	46.4	
2	**105-CB**	1	2790	5.27	8.1	30.9	46.4	
3	**110-CA**	1	763	5.60	8.1	5.27	8.1	
4	**110-CB**	1	763	5.60	8.1	5.27	8.1	
5	**127-CA**	1	3516	5.60	31.5	21.10	31.5	
6	**127-CB**	1	3516	5.60	31.5	21.10	31.5	

SR. NO.	EQUIP.	NOS.	NO. OF TUBE	TUBE SIDE PRESSURE (KG/CM^2)		SHELL SIDE PRESSURE (KG/CM^2)		REMARKS
				DESIGN	TEST	DESIGN	TEST	
7	**128-C**	1	1200	5.60	NA	8.09	NA	
8	**129-JC**	1	290	2.3	NA	5.29	NA	
9	**131-JC**	1	348	11.90	NA	5.27	NA	
10	**173-C**	1	294	10.60	NA	5.27	NA	

Lube oil coolers taken for hydro jetting:

SR. NO.	EQUIPMENT	NOS.	DESCRIPTION	REMARKS
1.	101-JLC 1,2	2	Lube Oil Cooler For 101-J	
2	103-JLC 1,2	2	Lube Oil Cooler For 103-J	
3	101-BJ LOC	3	Lube Oil Cooler For 101-BJ	
4	107-J/JA LOC	2	Lube Oil Cooler For 107-J/JA	
5	104-J/JA LOC	2	Lube oil cooler for 104-J/JA	
6	115-JA / JB LOC	4	Lube oil coolers for 115-JA / JB	

Surface and gland condensers taken for hydro jetting:

SR. NO.	EQUIPMENT	NOS.	DESCRIPTION	REMARKS
1.	101-JCA/JCB	2	Surface Condenser	
2	101-JCA I/A	1	Condenser	
3	101-JCB I/A	1	Condenser	
4	101-JT GC	1	Gland Condenser	
5	103-JBT GC	1	Gland Condenser	Tube bundle pulled out
6	105-JT GC	1	Gland Condenser	Tube bundle pulled out.

FABRICATION JOBS- CRITICAL:

The following critical fabrication jobs were carried out during the turnaround.

1. Replacement of 300NB X SCH 100, MOC-ASTM A 106 GR.B pipe piece of Steam Drum (101-F) Main Steam Outlet Line (As per QW-201.1 Section IX, ASME BPVC)

In-Situ Metallography conducted on Steam Drum (101-F) Main Steam Outlet Line during Shutdown Oct-2007 in which Microstructural grain boundary degradations in the form of voids & micro-cracks shown in Fig. 2, Fig. 3 & Fig. 4 was observed at the location shown in Fig.1. Hence, replacement of 610mm Length 300NB X SCH 100 pipe piece was carried out during Annual Shutdown April-2008.

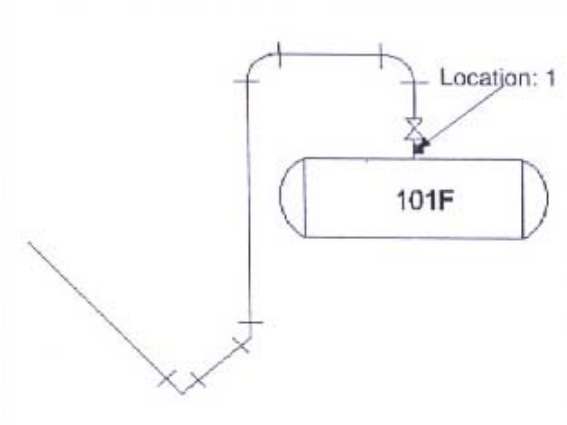


Fig.1

Fig.2

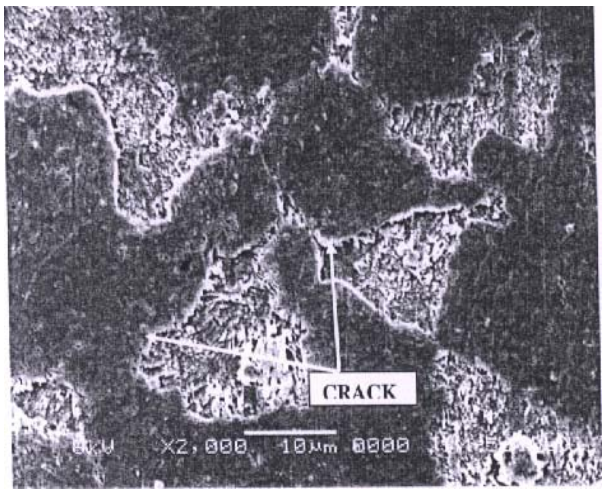


Fig. 3

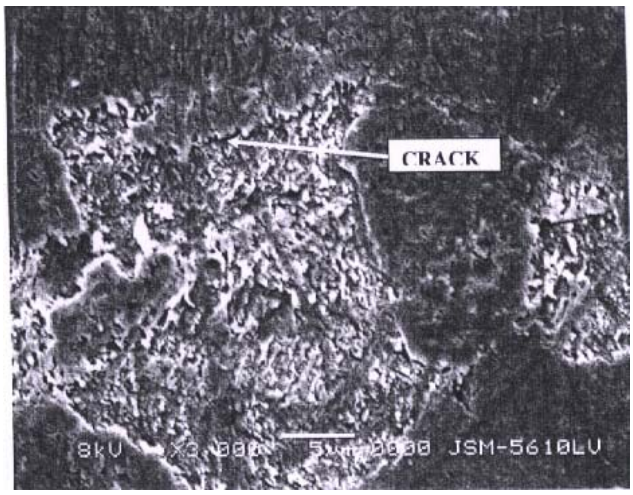
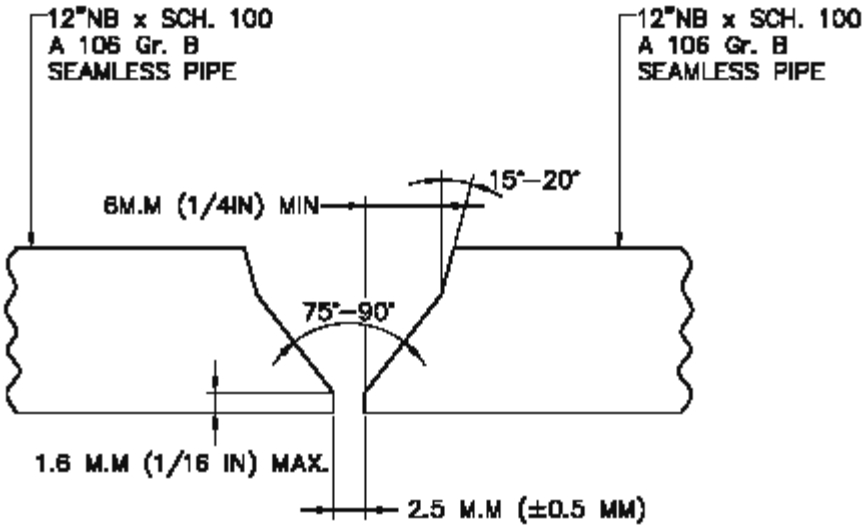


Fig. 4

Pipe Replacement Procedure:

- Approval of replacement of 300NB X SCH 100 pipe piece MOC- ASTM A 106 GR.B was taken from Boiler Inspector.
- The openings of Down-comers were covered with Asbestos & Fire cloth to prevent falling of any foreign particle inside down comers.
- Demister pads were removed adjacent to nozzle of Main Steam Outlet line inside the steam drum.

- The perforated plate (visible after removal of demister pads) was covered with Aluminium sheet to prevent sticking of the hot metallic particles on the same.
- One 250 x 125 mm I Beam was fabricated to lock the main steam pipe line in position before cutting of Pipe line.
- Cut out the pipe piece of around 600mm length by Oxy-Acetylene gas cutting from the self-reinforced nozzle (stub) weld joint (location as shown in Fig. 1).
- Asbestos cloth was put in the opening of steam line over the perforated plate before doing the Edge preparation.
- Removed old weld from the self-reinforced nozzle (stub) edge by grinding.
- Weld edge was prepared on both ends of pipe piece having Double angle 'V' Butt Weld Groove design as per IBR Fig. No. 28(ii) for welding.



Double Angle 'V'
Pipes over 13mm (1/2") Thick
IBR Fig. No. 28(ii)

- DP test was carried out on all edges.
- Removed the Asbestos cloth from the opening after removing the metallic particles through the magnet.
- Fit-up the pipe piece of 602mm **(**610-(4+4) mm**)** length & 24mm thickness with 4mm root gap. It was done by placing a spacing wire of 4.0mm diameter on the bevel edge.
- Manual GTAW+SMAW welding process were used. Filler wire ER 70-S-2 as per SFA 5.18/AWS A 5.18-96 of size 2.4mm for Root & Hot-pass and Electrode E 7018 as per SFA/AWS A 5.1-96 of sizes 2.5mm, 3.15mm & 4mm for Fill-up & capping were used in welding. Argon gas of 10-12 LPM was used for Shielding during GTAW.
- Preheated both the joints around 150 ^{0}C and Inter-pass temperature was maintained at 250 ^{0}C (Max.) by wrapping up electrical heater coils around it.
- Initial & Inter-pass cleaning (slag removal) was done by grinding & brushing.
- DP Test & Radiography was carried out for both Root run & Final weld
- PWHT cycle followed is shown in Fig. 5..
- After PWHT Hardness of joints was measured.

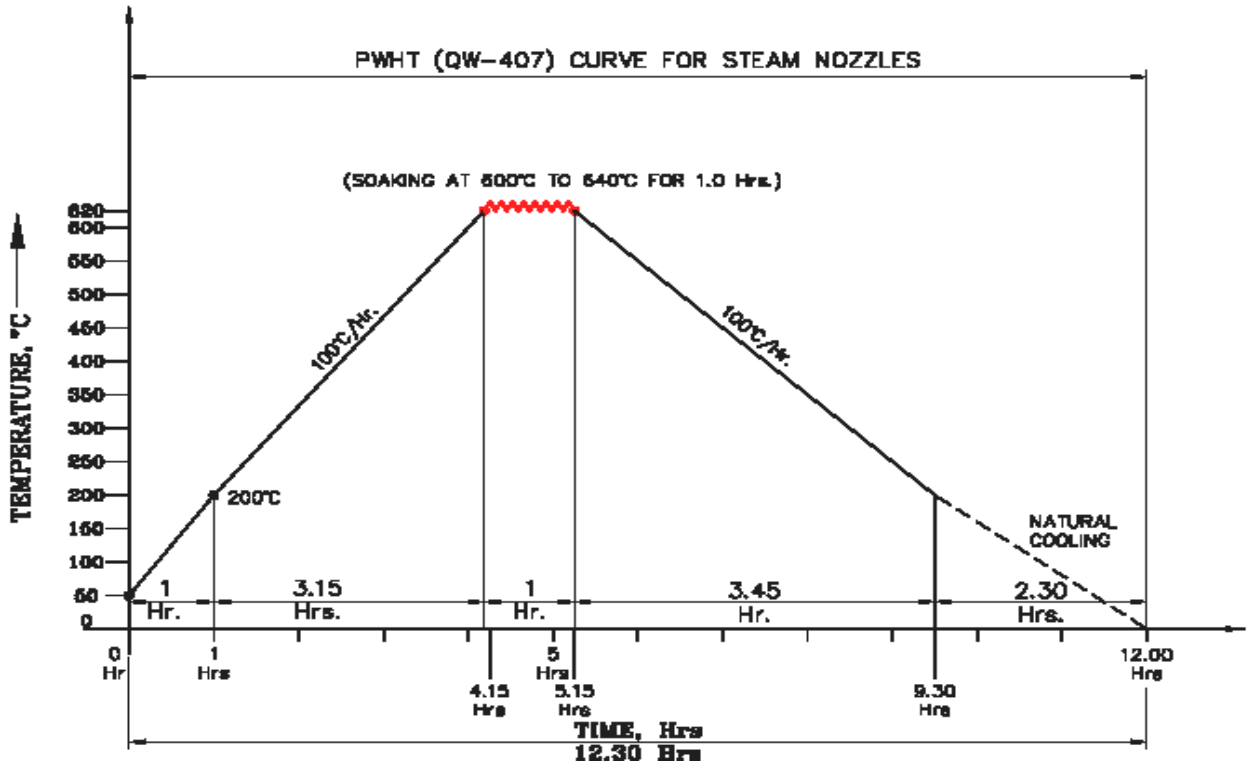


Fig. 5

2. 101-F south side blow down valve was replaced by new valves replaced.

3. 101-F north side level troll top isolation valve (1-1/2" x 1500 # CS angle valve) was replaced.

4. Replaced the isolation valves of LG in steam drum.

5. PIC-5 drain valve replaced.

6. 101-D/ 102-D IN/ OUT valves replaced.

7. MICV-61 U/S trap replaced**.**

8. Provided isolation valve at the outlet of cooling water line of Start-up Heater panel. (Contact Electrical section)**.**

9. Flushing fluid to aMDEA pumps isolation valve was replaced.

10. Pin hole leak of atomising steam line of burner No 707 was attended.

11. Seal flushing line pin hole leak was attended.

12. 38 kg steam to 104-J trap isolation valve, above 123-J was replaced.

13. 105-Kg steam sample 1st isolation valve was replaced.

14. 11 ATA steam trap isolation valve near 180-J was replaced.

15. PT-25 root isolation valve was replaced.

16. H-111 process line passing drain valve replaced.

17. 38 kg steam trap isolation valve near 108-J was replaced.

18. 38 kg steam traps by pass valve (Pre-Reformer - B218) was replaced.

19. FRCV-2 u/s drains valve was replaced.

20. SP-4 by pass valve was replaced.

21. 101-105-J lube oil CS line above console was replaced by SS.

LEAKS ATTENDED

Flange leaks :

Leaks at the following flange joints were attended.

1. 101-F North side LG top flange.

2. 101-JT TTV drain flange.

3. 105-JT steam inlet PI U/S flange.

4. PRC-25 CV upstream flange.

5. 101-JT steam chest west side flange.

6. PIC 14 D/S flange.

7. MICV-16 u/s flange & HICV-11 flange.

8. LICV-485 down stream flange.

9. 101-JT TTV south side flange.

10. 103-JAT nozzle leak off line flange.

11. 107-C vent valve u/s flange.

12. HCV-13A D/S.

13. Eye Hye top flange.

14. LT-485B HP tapping flange.

15. North side LG top isolation valve upstream flange.

16. 107-C south side L.G flange.

17. 3.5 Kg steam to N.G compressor on rack flange.(Above PIC-13A/B)

18. 107-C north side LG flange.

19. 38.0 Kg steam to ARU battery limit valve U/S flange.

20. 107-C vent line 1ST I/V U/S flange.

Valve bonnet leak :

Leak from the following valve bonnet.

1. MS Trap (above 123-J) isolation valve bonnet.

2. PICV-21 bypass valve bonnet.

3. PICV 21 bypass valve bonnet.

4. 120-C drain valve bonnet.

5. 112-C steam outlet PC-21 bypass valve bonnet.

Valve gland leaks:

Gland leak from the following valve were attended. :

1. H.T. Shift converter DM water inlet isolation valve.
2. HIC-1004 down-stream 2nd isolation valve.
3. Steam to NG coil isolation valve above FRC-1
4. Steam inlet line trap isolation valve.
5. The entire blow down valves connected with 101 F hydro testing.
6. SP 158 &159 aMDEA pump discharge valve.
7. All 1st and 2nd isolation valve connected with steam drum.
8. HIC-1004 D/S 2nd isolation valve (at middle platform of radiant zone).
9. TRC-10.
10. Water to HTS bottom isolation valve.
11. 103-J casing inlet line trap isolation valve.
12. 103 JAT steam trap isolation valve.
13. PICV 1027 1st isolation valve.
14. 101-F low level switch top isolation valve.
15. 101-F Eye-Hye top isolation valve.
16. 115-JBT steam inlet valve.

Valve passing jobs:

Passing problems of the following valves were attended:

1. 104-JT turbine isolation valve.
2. 105-JT TTV drain valve.
3. SP-4 valve.
4. Isolation valve for Inert gas inlet to H-111 process line.

PAINTING JOBS:

1. Painting of Primary reformer.
2. ID fan stack and all silencers of Ammonia Plant are to be cleaned by shot blasting and provided with aluminum metal spray coating to avoid atmospheric corrosion.
3. 101-F structures to be painted.
4. Compressor house platforms and structures to be painted.
5. Exhaust pipe of 101-JT to be painted.
6. Painting of start up heater.

7. Air filter 102-L louvers to be cleaned and painted.

8. Exhaust pipe of 103-JAT to be painted.

9. Exhaust pipe of 103-JBT to be painted.

10. Painting of synthesis gas converter.

11. Exhaust pipe of 105-JT to be painted.

12. Painting of 127-CA/CB

13. 130-JC/131-JC to be painted

14. Painting stacks of Pre-reformer area.

PRIMARY REFORMER 101-B RADIANT ZONE:

The panel plate having bulging was replaced by new plate. All elbow and union leaks on atomizing steam line were attended. The damaged burner blocks as per production list were attended. The passing needle valves were replaced. Those air register which were hard to operate were attended.

AUXILIARY BOILER, ITS BURNERS JOBS:

Preventive maintenance of all burners was carried out. External cleaning of tubes was done. The AG and Naphtha filter were cleaned.

Replacement of Secondary Waste Heat Exchanger (102-C)

The new Secondary Waste Heat exchanger was Manufactured at the works of M/s L & T , Mumbai vide PO No 12/01025/KLL/17827OP/9919697 dtd 11.11.2006. The following are the Name Plate Details of New Exchanger:-

Inspection certificate No	PEW/2008/2007	
L & T Project No	10844	
Year of Manufacture	2008	
	Shell side	Tube side
Design Pressure (Kg/CM2 G)	118	34.1
Design Temperature deg C	Shell / Tubes/ T Sht (Bottom, Top) : 330 /400 / 525,400	In/Out : 400/385
Codes	ASME Sec VIII, Div-1, ED-2004/IBR	ASME Sec VIII, Div -1, ED-2004
Inspection Authority	IBR & BVQI	BVQI
Hydraulic Test Pressure Kg/Cm2	177	44.34
Operating Fluid	Steam & Water	Process Gas
Corrosion Allowance (mm)	3	3 (Except Tubes)
Radiography	Full	Full
Heat Treatment	Yes	Yes
Surface area m2	--	237
Total Empty weight (Actual)	33.5 Tons (by Kobelco Crane)	

The details of Material of Construction are as per following Table.

Description /Size	Material	Qty
Bottom Channel Cover	SA 336 Gr F11 CL2	01 nos
Bottom Channel Flange	SA 336 Gr F11 CL2	01 nos
Top Channel Cover	SA 336 Gr F11 CL2	01 nos
Top Channel Flange	SA 336 Gr F11 CL2	01 nos
Bottom Channel / 60 mm thk (Gas side Wetted area)	SA 387 Gr 11 CL2	01 nos
Top Channel / 30 mm thk (Gas side wetted area)	SA 387 Gr 11 CL2	01 nos
Shell / 70 Thk (Water side wetted area)	SA 516 Gr 70	03 nos
Bottom Tube Sheet / 232 mm thk	SA 336 Gr F11 CL2	01 nos
Top Tube Sheet / 165 mm Thk	SA 336 Gr F11 CL2	01 nos
Tubes 25.4 mm OD x 4.191 thk (8 BWG) min x 4028 long	SA 213 GR T11	750 nos
Top Cover Gasket 1355 OD x 1315 ID x 3 mm thk	5 Cr – ½ Mo	01 nos
Bottom Cover Gasket 1359 OD x 1333 ID x 3 mm thk	5 Cr – ½ Mo	01 nos
Stud ,Full Thread Top Channel Cover Size : 1 -5/8" 8UN x 365 LG	SA 193 Gr B7	48 nos
Hexagonal Nut Size : 1 -5/8" 8UN (H= D)	SA 194 Gr 2H	96 nos
Stud ,Full Thread Bottom Channel Cover Size : 1 -1/2" 8UN x 365 LG	SA 193 Gr B7	52 nos
Hexagonal Nut Size : 1 -1/2" 8UN (H= D)	SA 194 Gr 2H	104 nos

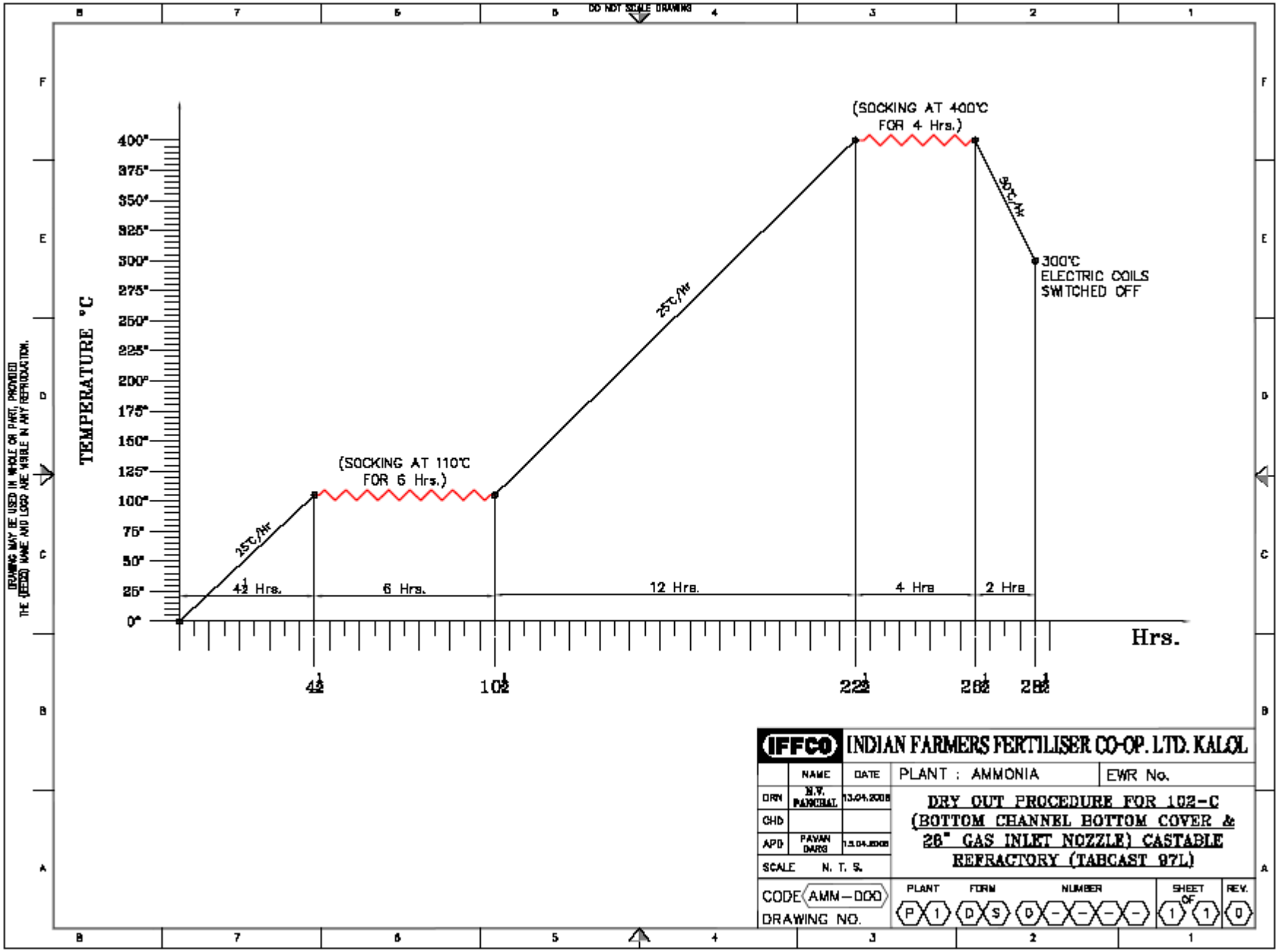
The General Assembly Drawing no 1P-30612 Rev R3 for 102-C of M/s L & T, Mumbai. The services of M/s Shree Ganesh Engineering Co, Ahmedabad was availed for replacement of 102-C vide WO No PO/KLL/MECHA/20070189 dtd 23.02.08

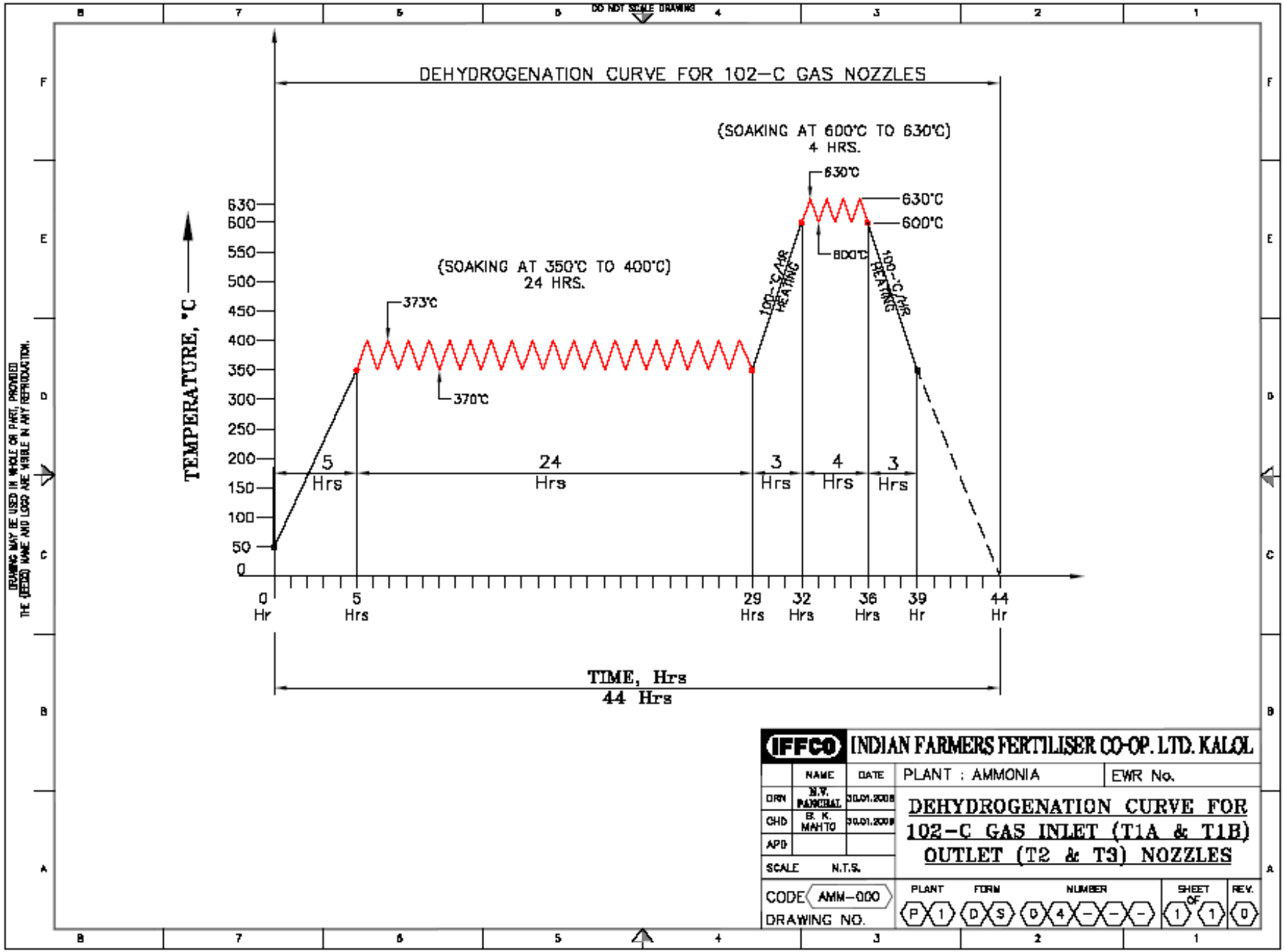
After Plant stoppage, on 25.03.2008 Morning shift, blinds were provided at HTS inlet and Transfer line plug was opened. Simultaneously the structure removal job was taken-up. The platform at the elevation of 40 Ton chain block, Platform at 104-D RV, Two nos Structural Beams on the front portion, Level Indicators on the floor of 101-CB Top Cover Elbow and their platform was removed.

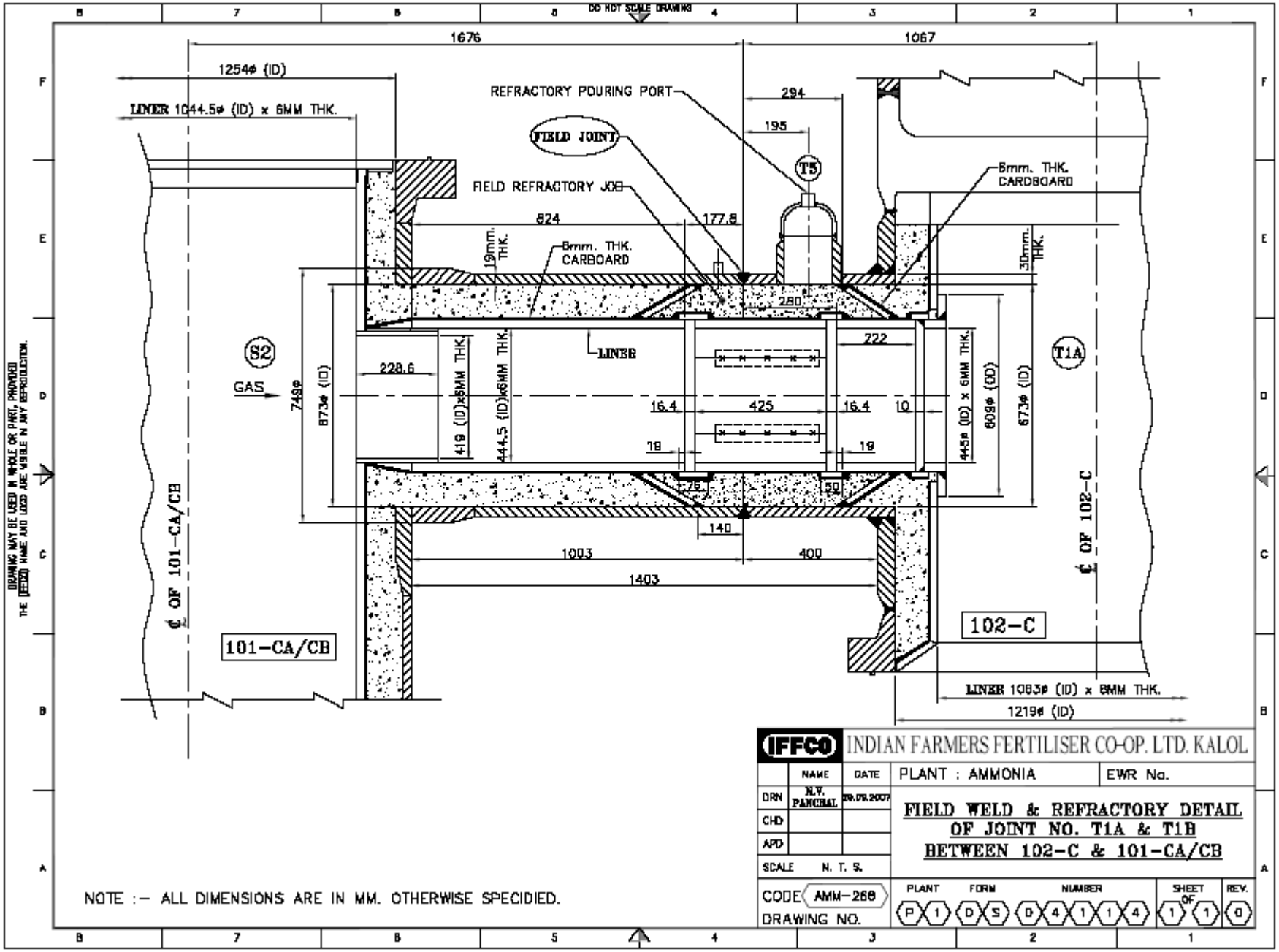
Lifting Lug was available on the Top Cover of old 102-C. The suitability of welding strength of this Lug was verified through M/s L & T for lifting the entire equipment. Further DP & MPI was carried out of weld joint of the lug and found o.k. There was no lifting trunion available on old 102-C. This equipment is mounting on Structural I-beam and Bottle type Spring Jacks, for free thermal expansion in vertical direction. The details of all six nozzles of 102-C with welding requirements are as per following table. These six nozzles connect the 102-C with 101-CA & 101-CB and 101-F.

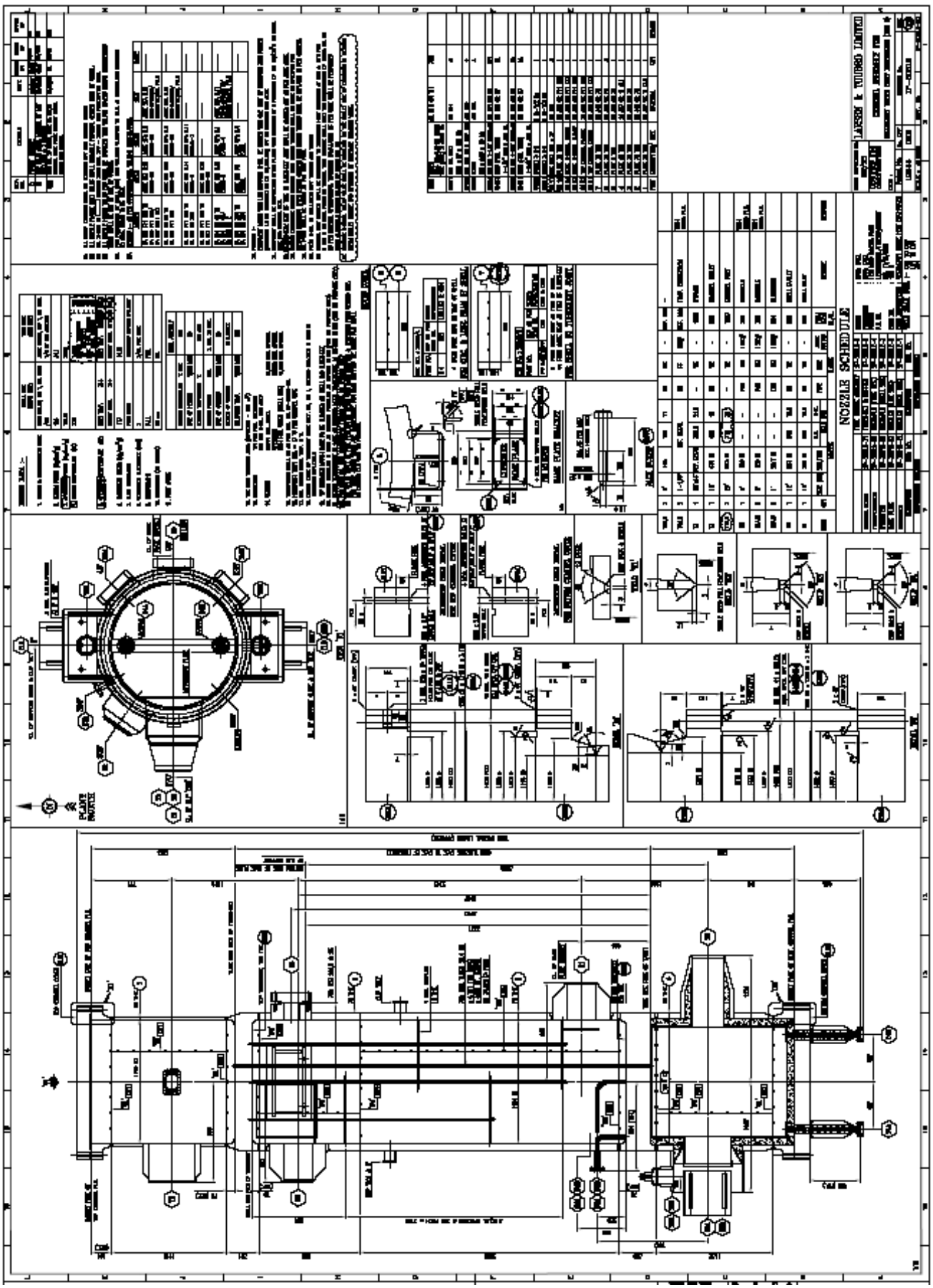
Welding requirement are as per following table. These six nozzles connect the 102-C with 101-CA & 101-CB and 101-F.

Sr No	Description	Size	Nozzle Material	Welding Material	Heat-Treatment requirement
1	T1-A Channel Inlet **{Tube Side / Reformer Gas Side}**	673 ID x 20 mm thk	SA 387 Gr 11 CL2	ER 80-S-B2 E 8018-B2	• De-Hydrogenation of Existing connecting nozzle at location • Pre Heat Temp @150 Degree Centigrade • Interpass Temp @ 250 Degree Centigrade • Post Weld Heat Treatment (Qw-407) @ 720 Degree C (2 Hrs)
2	T1-B Channel Inlet **{Tube Side / Reformer Gas Size}**	673 ID x 20 mm thk	SA 387 Gr 11 CL2	ER 80-S-B2 E 8018-B2	--do--
3	T-2 Channel Outlet **{Tube Side / Reformer Gas Size}**	439 ID x 12 mm thk	SA 336 Gr F11 Cl 2	ER 80-S-B2 E 8018-B2	--do--
4	T- 3 By - Pass Line **{Tube Side / Reformer Gas Size}**	355.6 OD x 21.8 mm thk	SA 336 Gr F11 CL 2	ER 80-S-B2 E 8018-B2	--do--
5	S1, Shell Inlet **{Water Side}**	12” x 19.6 mm thk	SA 266 Gr2 (forgings)	ER 70S-2 & E 7018-1	• Pre Heat Temp @150 Degree Centigrade • Interpass Temp @ 250 Degree Centigrade • Post Weld Heat Treatment (QW-407) @ 620 Degree C , Soaking time :1 Hrs)
6	S2, Shell Outlet **{Water Side}**	12” x 19.6 mm thk	SA 266 Gr2 (forgings)	ER 70S-2 & E 7018-1	--do--

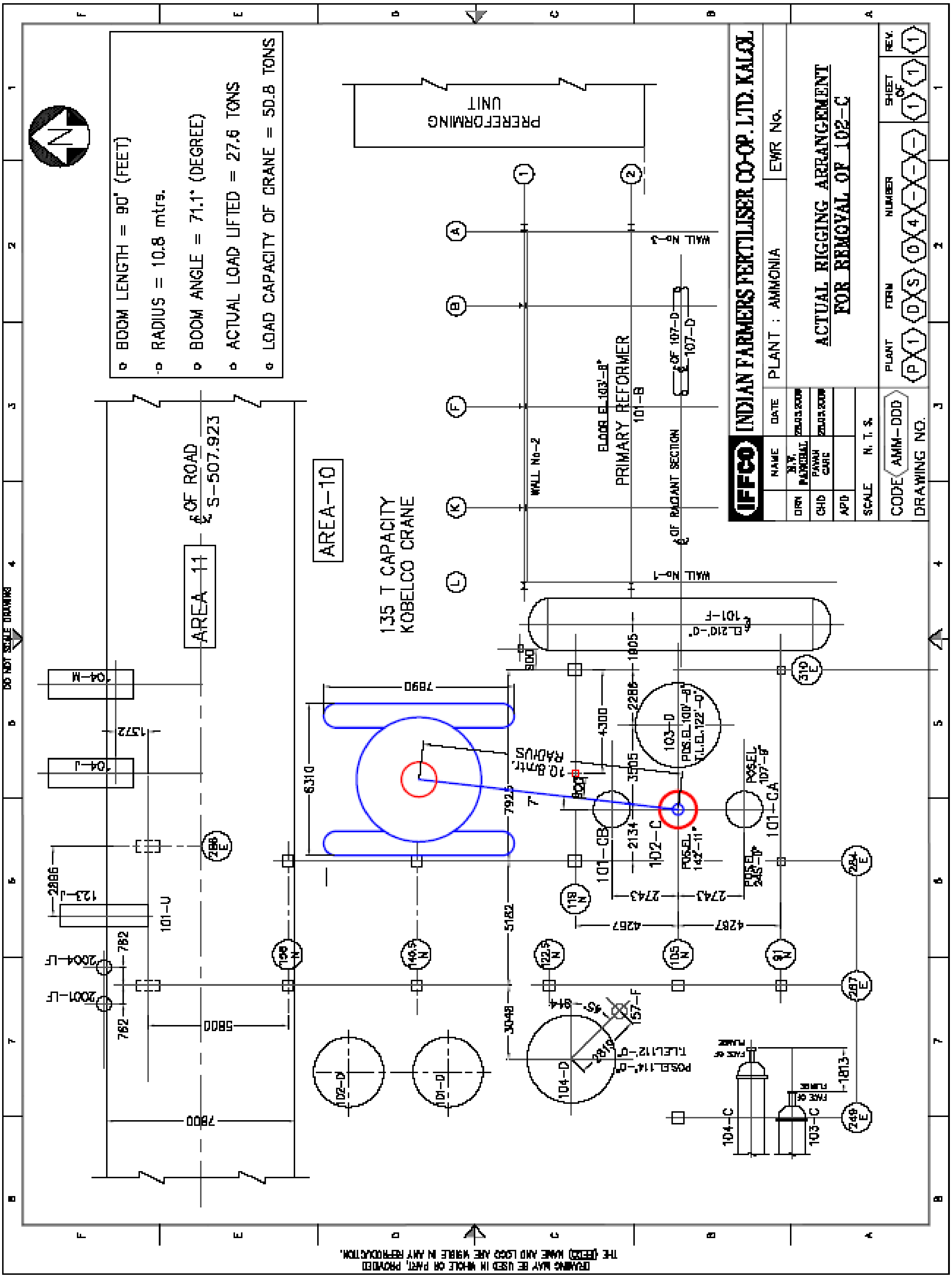

DO NOT SCALE DRAWING
TEMPERATURE °C
400°
375°
350°
325°
300°
275°
250°
225°
200°
175°
150°
125°
100°
75°
50°
25°
0°
(SOCKING AT 110°C
FOR 6 Hrs.)
(SOCKING AT 400°C
FOR 4 Hrs.)
25°C/Hr
25°C/Hr
30°C/Hr
300°C
ELECTRIC COILS
SWITCHED OFF
4½ Hrs.
6 Hrs.
12 Hrs.
4 Hrs
2 Hrs
Hrs.
4½
10½
22½
26½
28½
(DRAWING MAY BE USED IN WHOLE OR PART, PROVIDED THE (IFFCO) NAME AND LOGO ARE VISIBLE IN ANY REPRODUCTION.
IFFCO
INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
NAME
DATE
PLANT : AMMONIA
EWR No.
DRN
H.V. PANCHAL
13.04.2008
CHD
APD
PAVAN DARDI
13.04.2008
SCALE N. T. S.
DRY OUT PROCEDURE FOR 102-C (BOTTOM CHANNEL BOTTOM COVER & 26" GAS INLET NOZZLE) CASTABLE REFRACTORY (TABCAST 97L)
CODE AMM—000
DRAWING NO.
PLANT
FORM
NUMBER
SHEET
OF
REV.
P 1 D S 0 - - - - 1 1 0


DO NOT SCALE DRAWING
DEHYDROGENATION CURVE FOR 102–C GAS NOZZLES
(SOAKING AT 600°C TO 630°C)
4 HRS.
630°C
630°C
600°C
600°C
(SOAKING AT 350°C TO 400°C)
24 HRS.
373°C
370°C
100–°C/HR HEATING
100–°C/HR HEATING
TEMPERATURE, °C
630
600
550
500
450
400
350
300
250
200
150
100
50
0
5 Hrs
24 Hrs
3 Hrs
4 Hrs
3 Hrs
0 Hr
5 Hrs
29 Hrs
32 Hrs
36 Hrs
39 Hr
44 Hr
TIME, Hrs
44 Hrs
DRAWING MAY BE USED IN WHOLE OR PART, PROVIDED THE (DEEDS) NAME AND LOGO ARE VISIBLE IN ANY REPRODUCTION.
IFFCO
INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
NAME
DATE
PLANT : AMMONIA
EWR No.
DRN
B.V. PANCHAL
30.01.2008
CHD
B. K. MAHTO
30.01.2008
APD
SCALE N.T.S.
DEHYDROGENATION CURVE FOR 102–C GAS INLET (T1A & T1B) OUTLET (T2 & T3) NOZZLES
CODE AMM–000
DRAWING NO.
PLANT
FORM
NUMBER
SHEET
OF
REV.
P 1 D S D 4 – – – 1 1 0


DO NOT SCALE DRAWING
1676
1067
1254ø (ID)
LINER 1044.5ø (ID) x 6MM THK.
REFRACTORY POURING PORT
294
195
FIELD JOINT
T5
8mm. THK. CARDBOARD
FIELD REFRACTORY JOB
824
177.8
19mm. THK.
8mm. THK. CARBOARD
30mm. THK.
280
S2
LINER
222
228.6
GAS
749ø
873ø (ID)
419 (ID)x6MM THK.
444.5 (ID)x6MM THK.
T1A
16.4
425
16.4
10
445ø (ID) x 6MM THK.
609ø (OD)
873ø (ID)
18
19
76
50
140
1003
400
1403
℄ OF 101-CA/CB
101-CA/CB
℄ OF 102-C
102-C
LINER 1083ø (ID) x 6MM THK.
1219ø (ID)
DRAWING MAY BE USED IN WHOLE OR PART, PROVIDED THE (IFFCO) NAME AND LOGO ARE VISIBLE IN ANY REPRODUCTION.
NOTE :- ALL DIMENSIONS ARE IN MM. OTHERWISE SPECIDIED.
IFFCO
INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
NAME
DATE
PLANT : AMMONIA
EWR No.
DRN
N.V. PANCHAL
28.09.2007
CHD
APD
SCALE N. T. S.
FIELD WELD & REFRACTORY DETAIL OF JOINT NO. T1A & T1B BETWEEN 102-C & 101-CA/CB
CODE AMM-268
DRAWING NO.
PLANT P1
FORM DS
NUMBER 04114
SHEET OF 1 1
REV. 0



ERECTING THE NEW SECONDARY WASTE HEAT EXCHANGER 102-C USING KOBELCO CRAIN


BOOM LENGTH = 90' (FEET)
RADIUS = 10.8 mtrs.
BOOM ANGLE = 71.1° (DEGREE)
ACTUAL LOAD LIFTED = 27.6 TONS
LOAD CAPACITY OF CRANE = 50.8 TONS
PREREFORMING UNIT
AREA-10
AREA-11
℄ OF ROAD
S-507.923
135 T CAPACITY
KOBELCO CRANE
PRIMARY REFORMER
101-B
WALL No-2
WALL No-1
WALL No-3
RADIUS 10.8mtr.
102-C
101-CB
101-CA
103-D
104-D
101-F
101-U
104-M
104-J
123-J
104-C
103-C
INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL
EWR No.
PLANT : AMMONIA
ACTUAL RIGGING ARRANGEMENT FOR REMOVAL OF 102-C
SCALE N. T. S.
CODE AMM-DDD
DRAWING NO.
DO NOT SCALE DRAWING

PWHT OF THE NOZZLES S1 AND S2 OF NEW SECONDARY WASTE HEAT EXCHANGER 102-C

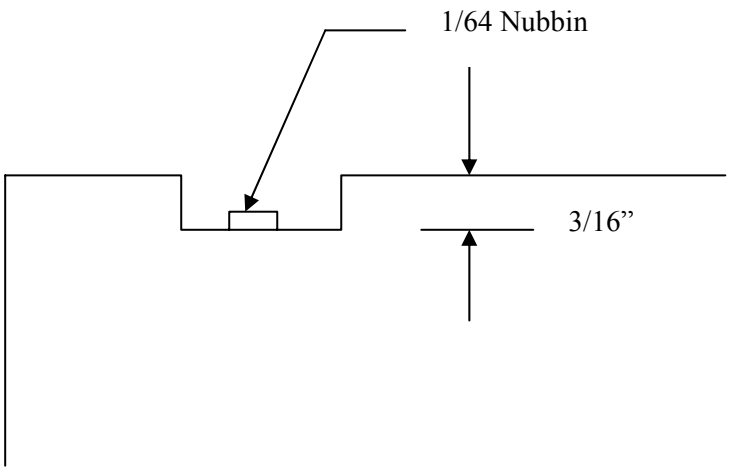
The bottom man-hole cover was opened and lowered before lifting. The nozzle cutting locations were marked after measurement with new 102-C and site conditions, keep safe allowance towards connecting nozzles. The nozzles were cut by gas torch. To cut Inconel liner of Nozzle no T1A & T1B, approx 30 mm wide strip of Inlet nozzles of old 102-C was gas cut and then the Inconel liner was gauged by Cutrod & E-6013. The bolts of Top Cover elbow of 101-CB was opened and the 7.0 Ton weight elbow was rigged out by RT-760 Crane with multi rope pulley on 27.03.2008. This is required to limit the raising of 102-C for jumping over the 101-CB. Metal sling of 40 mm dia x 12 mtrs long and 55 Ton capacity D –Shackle (Grade 80) having Pin dia of 69 mm x jaw width of 100 mm was used in removal of old 102-C. The actual effective length of sling was measured as 2.2 mtrs when used in three hands. On 28.03.08 morning the old exchanger was lifted with 135 T Kobelco Crane. The actual load as per Kobelco crane read out was 27.6 Ton @ 71.1 Degree Boom angle, radius 10.8 Mtrs and 90 feet boom length. The capacity of crane at these conditions was 50.8 Tons. During Lifting of old 102-C, the exchanger was clearly crossed steam lines of 101-CA & 101-CB. The three nozzles i.e T1A, T1B & T-3, being on same elevation, was fouling with Structure Support I-Beam. Then by-nozzle was gas cut and the exchanger was lifted. The bottom cover of old exchanger was removed and bottom cover of new exchanger was placed.

After removing the old 102-C exchanger, the foundation beam & bottle type spring jacks were inspected and found o.k. To install the new exchanger, the North side beam was removed by gouging the fillet weld and opening of bolts. On 30.03.2008, the new exchanger was lifted. The actual load from the read out of Kobelco crane is 28.9 Ton. The radius was 11.2 mtrs and boom angle was 70.3 degree. The slings were fixed on lifting trunions and the sling length was 2.9 mtrs. The nozzle fitment was carried out for T1A & T1B and Crane was released. After that by-pass nozzle fitment was carried out. Then electric coils were fixed for De-hydrogenation of Gas nozzles. The de-hydrogenation of connecting pipe of Gas outlet nozzle was carried out at ground level. The nozzles welding were carried out as per WPS. The root defects were found in T1A & T1B. Then Root run was carried out from outside by TIG and after dressing from inside weld was deposited by Arc Welding to avoid porosity. Again outside weld deposit was grind off at locations of DP indications. New inconel liners (M/s L & T supply) were welded and castable refractory was poured in annular space of gas inlet nozzles. The castable refractory of Bottom Channel, Gas inlet nozzles and gas by-pass nozzles and bottom channel cover was required to be dry out. As controlled heating & cooling temperature cycle for dry-out is not feasible through process gas , hence electric coils were installed for heating. After wards the Top cover and bottom cover was assembled back with new gaskets.

Primary Waste Heat Boiler (101-CA & 101-CB)

The flange joint of down comer Elbow & Top Flange of Inner tube bundle channel of both the primary waste heat exchanger was furmanited to arrest leakage during plant. The stud size is : 3” dia UN x 30” long qty : 28 nos , {993120137620}. The Bolts were opened to dismantle the top cover elbow. Approx. 18 nuts were removed by gas cutting as they were seized on the studs. Both the top cover elbow were removed and inner tube sheet was protected by asbestos cloth to prevent the falling of foreign material. Dents were observed on 1/64 inch thick Nubbin. The nubbin was machined out by placing MATRA machine on both exchangers and Top cover elbow was assembled with Kamprofile gaskets (SS 304, serrations on both side faces, ref PO No 20070358).

During internal hydrotest, the 101-CB i.e tube bundle no 1-72-04-3118472 was failed. This was replaced with spare available tube bundle no 13517 (1-71-04-31049-272). The Nubbin at Gasket groove of this bundle was found in good condition, hence top cover elbow was assembled with solid soft iron gasket.



Gasket Groove Details of Top flange face of Inner Tube bundle

Primary Reformer

The Ceramic fibre blanket insulation of following areas of Primary reformer convection zone was replaced.

Sr. No	Zone	Walls covered as mentioned in drawing no 01- DS - 03455 Sheet 1 of 1 Rev 0	Area M^2	Insulation Thk & Lining Material
1	HT Zone	D + East + West wall	81.84	5 ½” Ceramic Fibre blanket insulation with Incolloy 800 H lining
2	Distributor Duct	A+ B + C	114.20	4 ½” Ceramic Fibre blanket insulation with SS 310 lining
3	Hot Well	E + F + G + H + I	18.90	4 ½” Ceramic Fibre blanket insulation with Incolloy 800 H lining
4	Duct	J + K + L	15	4 ½” Ceramic Fibre blanket insulation with Incolloy 800 H lining

M/s Unifrax India Limited, Mumbai was engaged for supply and application of ceramic fibre blanket insulation. (ref WO no 20070178 dtd 22.02.08). The following grade of ceramic fibre insulation was used.

Grade : S (1260 degree C)

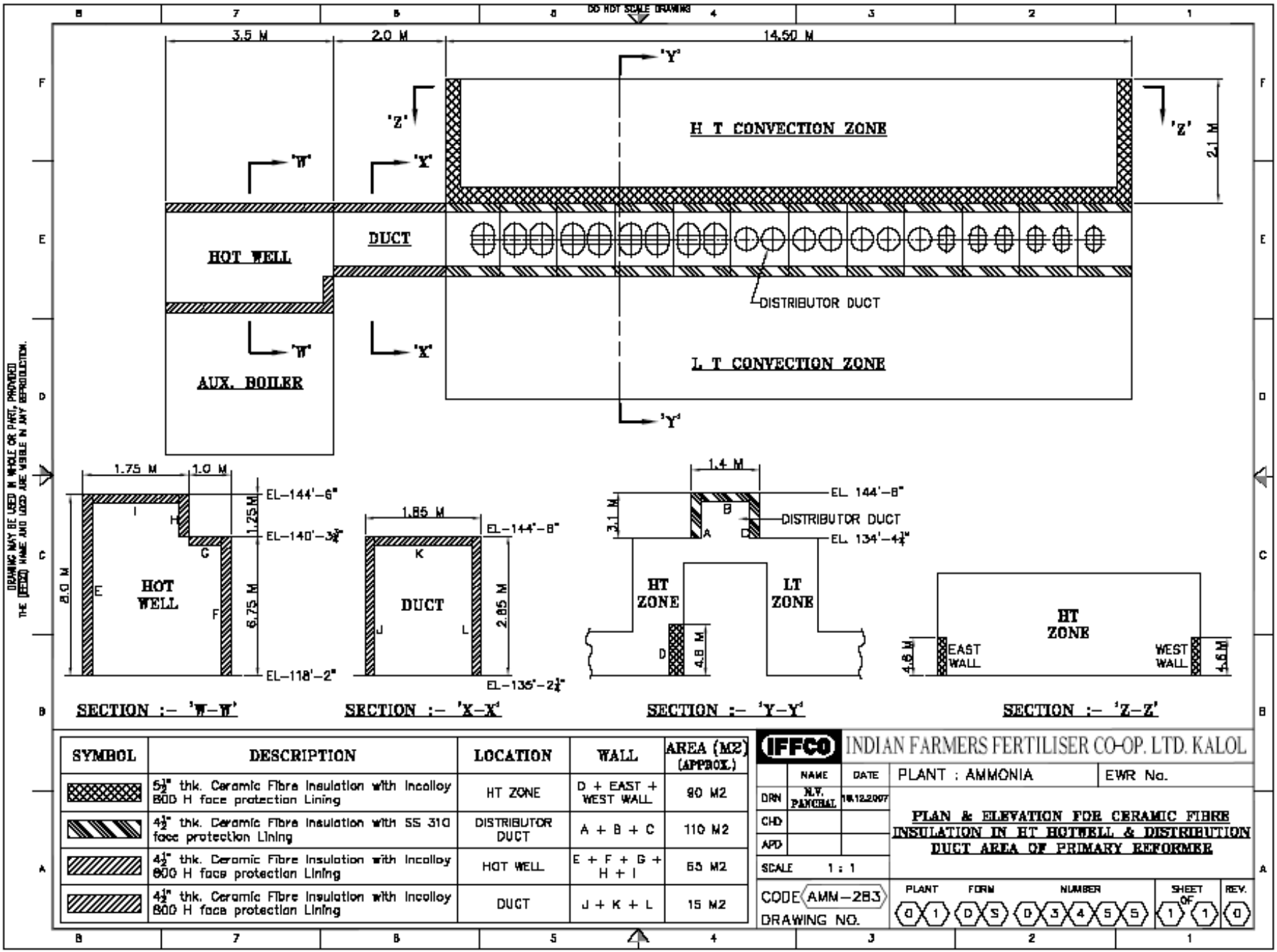
Density : 128 Kg / M3

Product : Fibrefrax ® Durablanket - S of M/s Unifrax

Thickness: Layers of 1 inch & ½ inch thk.

Blanket length x Width : 7620 mm x 610 mm

In HT convection zone& Hot well , 0.5 mm thk sheet of Inconel 800-H was provided as liner. Inconel 800-H grade fastners were used in this area. For Distributor duct area 0.5 mm thk SS310 sheet with SS310 grade fastners were used. Insulation upto 2.6 m height could be done on walls of HT section since complete 4.8 m was not accessible.



SYMBOL	DESCRIPTION	LOCATION	WALL	AREA (M2) (APPROX.)
	5½" thk. Ceramic Fibre Insulation with Incolloy 800 H face protection Lining	HT ZONE	D + EAST + WEST WALL	90 M2
	4½" thk. Ceramic Fibre Insulation with SS 310 face protection Lining	DISTRIBUTOR DUCT	A + B + C	110 M2
	4½" thk. Ceramic Fibre Insulation with Incolloy 800 H face protection Lining	HOT WELL	E + F + G + H + I	65 M2
	4½" thk. Ceramic Fibre Insulation with Incolloy 800 H face protection Lining	DUCT	J + K + L	15 M2

IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

	NAME	DATE
DRN	N.V. PANCHAL	18.12.2007
CHD		
APD		
SCALE	1 : 1	

PLANT : AMMONIA | EWR No.

PLAN & ELEVATION FOR CERAMIC FIBRE INSULATION IN HT HOTWELL & DISTRIBUTION DUCT AREA OF PRIMARY REFORMER

CODE AMM-283
DRAWING NO.

PLANT	FORM	NUMBER	SHEET OF	REV.
01	05	03455	1 OF 1	0

Primary Reformer wall Insulation:

Radiant Section of Primary Reformer at Kalol Unit is having 04 Nos Walls, which are lined by insulation Bricks right from inception stage and is in operation for the last 34 years. It was decided to upgrade this old brick lining insulation to Ceramic Fiber 'Z' Section Module to have more reliability, better insulation property and less maintenance.

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	
Size	228 mm x 114 mmx 63 mm
Max. Service Temperature	1260 deg C
Bulk Density g/cm3 (ASTM C 20)	0.55 max
Min cold Crushing Strength, Kg/CM2 (ASTM C 133)	15
Thermal Conductivity at 260 deg C Kcal/m/hr/deg C	0.14
Thermal Conductivity at 800 deg C Kcal/m/hr/deg C	0.18 max
Pyrometric Cone equivalent (ASTM C24)	23 / 1605 deg C Min
Chemical Composition	
Al2O3	40 min
SiO2	48.50 (typ)
Fe2O3	1.0 % Max

Details of Upgraded insulation on Wall No. 1 & 2:-

The following materials were used for the Up-gradation:-

Hot face Lining & Back –up insulation

Hot Face Lining : 225 mm thick Ceramic Fiber 'Z' Section Modules,1425 Degree C,160 Kg/ M3

Back-Up insulation :25 mm thick Ceramic Fiber Blanket Insulation, 1260 Degree C, 128 Kg / M3

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

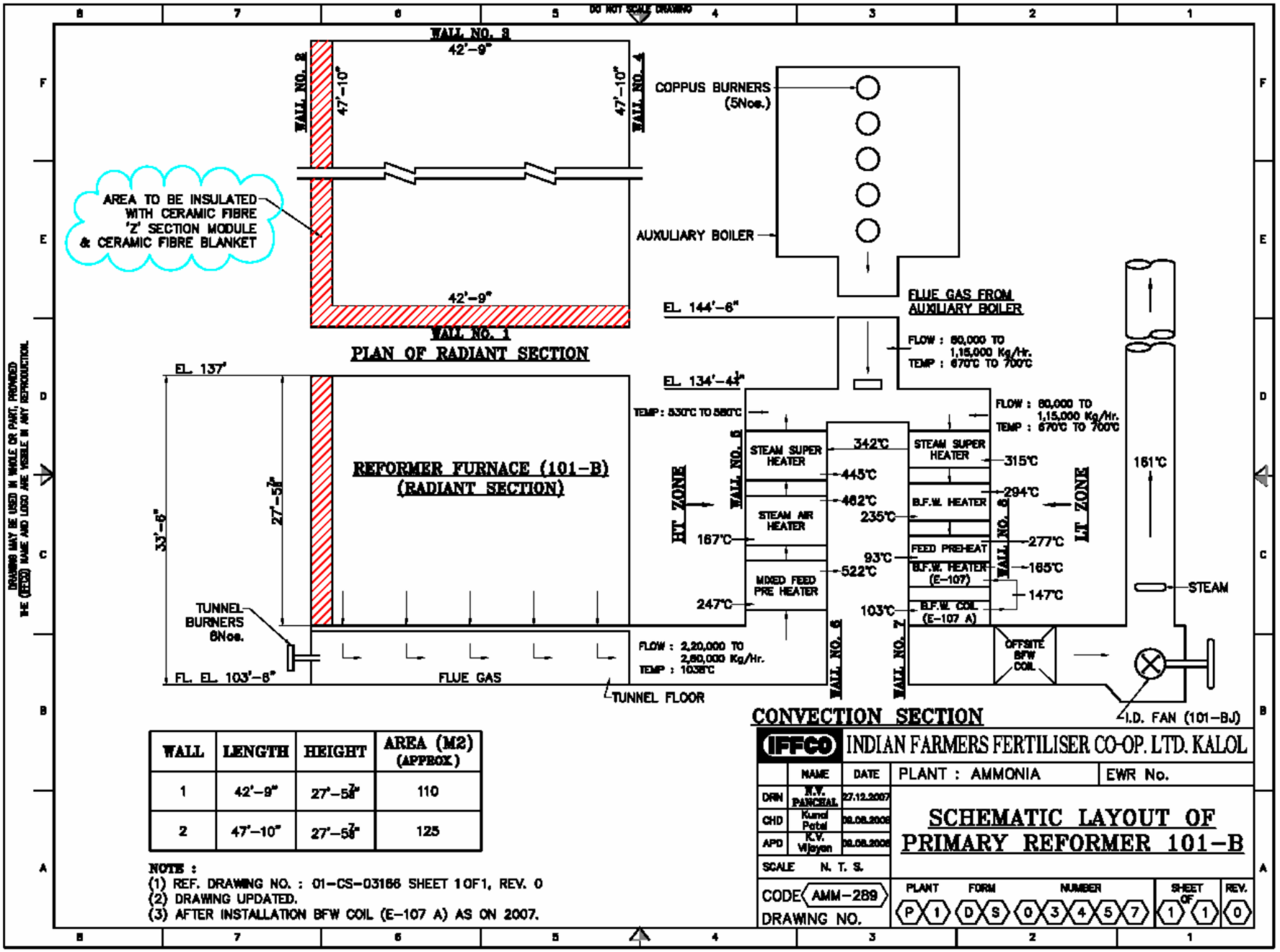
Vacuum Formed tailor made Ceramic fiber insulation with SS 304 anchors.

M/s Llyods Insulations (India) Ltd, Mumbai was engaged vide WO No 20070185 dtd 22.02.08 for supply and application of ceramic fibre Z section modules.

The Temperature survey was carried out on outside of wall of Primary Reformer before & after installation of CF 'Z' section Modules. The results are as under:

Temperature before Up-gradation: 105 deg C to 148 deg C

Temperature after Up-gradation: 85 deg C to 90 deg C



WALL	LENGTH	HEIGHT	AREA (M2) (APPROX)
1	42'-9"	27'-5⅞"	110
2	47'-10"	27'-5⅞"	125

NOTE :
(1) REF. DRAWING NO. : 01-CS-03166 SHEET 1 OF 1, REV. 0
(2) DRAWING UPDATED.
(3) AFTER INSTALLATION BFW COIL (E-107 A) AS ON 2007.

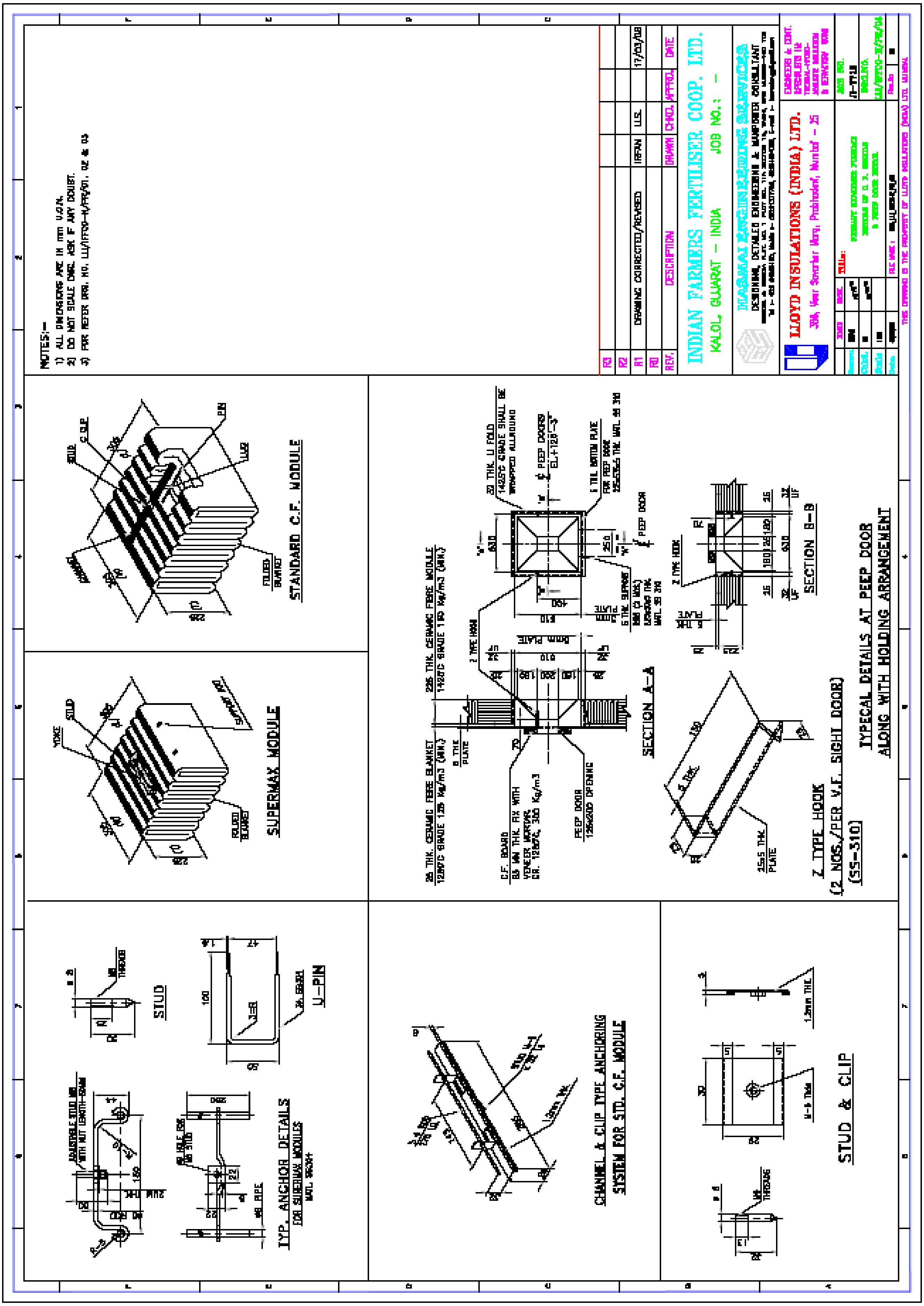
IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

	NAME	DATE
DRN	K.V. PANCHAL	27.12.2007
CHD	Kunal Patel	28.08.2008
APD	K.V. Vijayan	28.08.2008
SCALE	N. T. S.	

PLANT : AMMONIA | EWR No.

SCHEMATIC LAYOUT OF PRIMARY REFORMER 101-B

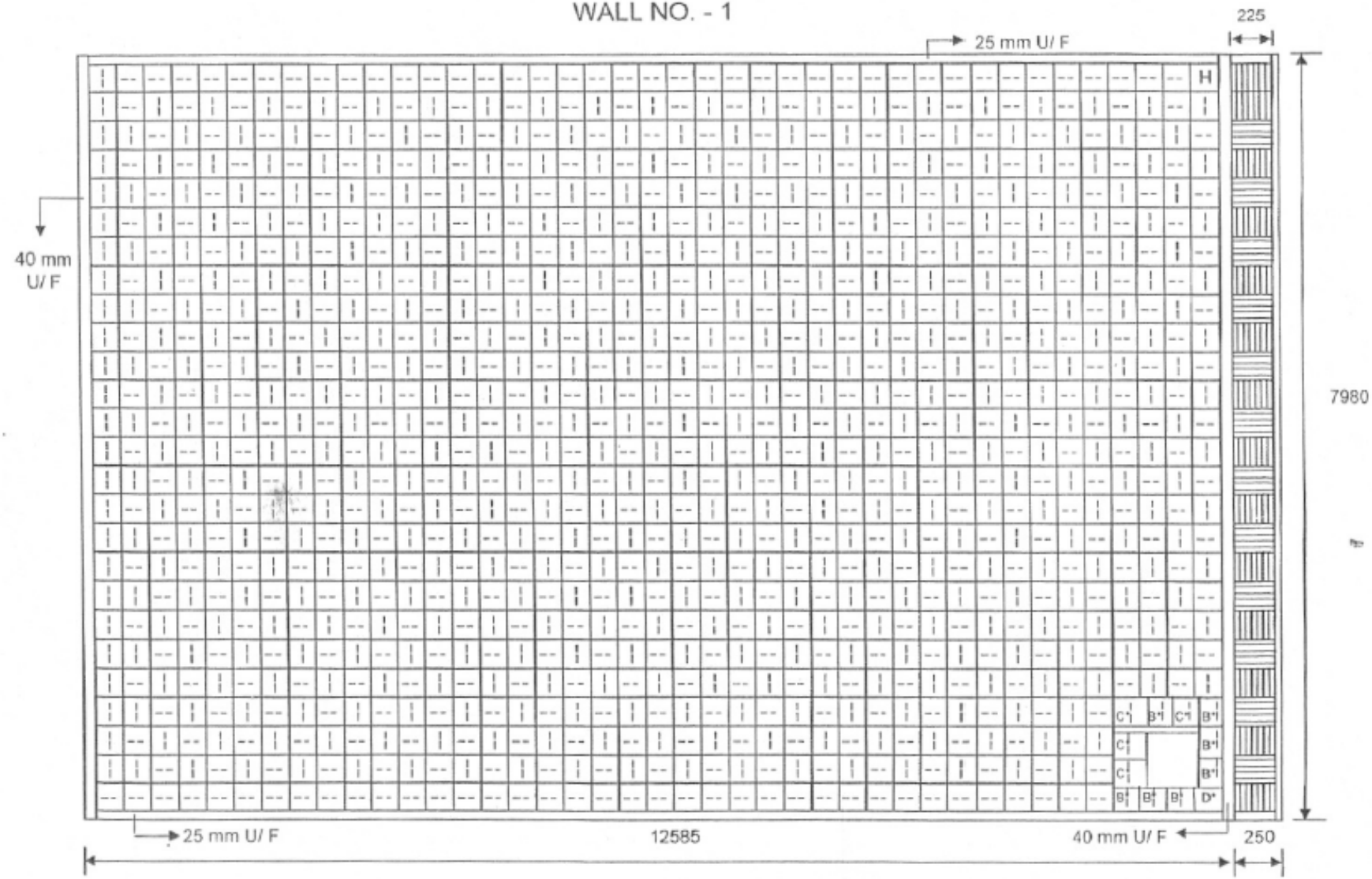
CODE AMM-289
DRAWING NO. PLANT P1 FORM DS NUMBER 03457 SHEET 1 OF 1 REV. 0


NOTES:-
1) ALL DIMENSIONS ARE IN mm U.O.N.
2) DO NOT SCALE DWG. ASK IF ANY DOUBT.
STANDARD C.F. MODULE
SUPERMAX MODULE
STUD
U-PIN
TYP. ANCHOR DETAILS
SECTION A-A
SECTION B-B
Z TYPE HOOK
(2 NOS./PER V.F. SIGHT DOOR)
(SS-310)
TYPECAL DETAILS AT PEEP DOOR ALONG WITH HOLDING ARRANGEMENT
CHANNEL & CLIP TYPE ANCHORING SYSTEM FOR STD. C.F. MODULE
STUD & CLIP
DRAWING CORRECTED/REVISED
DESCRIPTION
INDIAN FARMERS FERTILISER COOP. LTD.
KALOL, GUJARAT - INDIA
JOB NO.: -
LLOYD INSULATIONS (INDIA) LTD.

LLOYD INSULATIONS (INDIA) LIMITED

PRIMARY REFORMER - IFFCO, KALOL LAYOUT PLAN

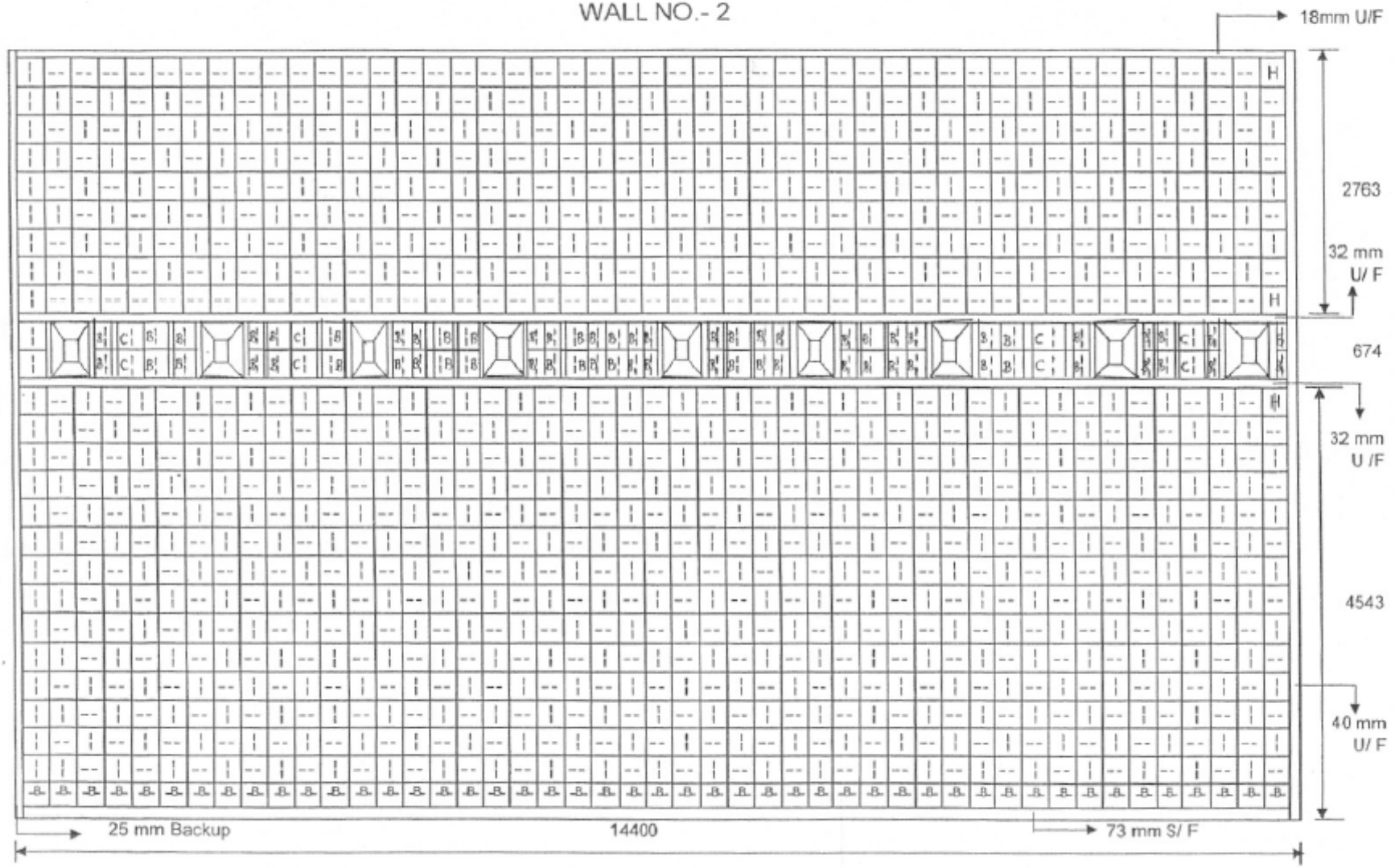
WALL NO. - 1

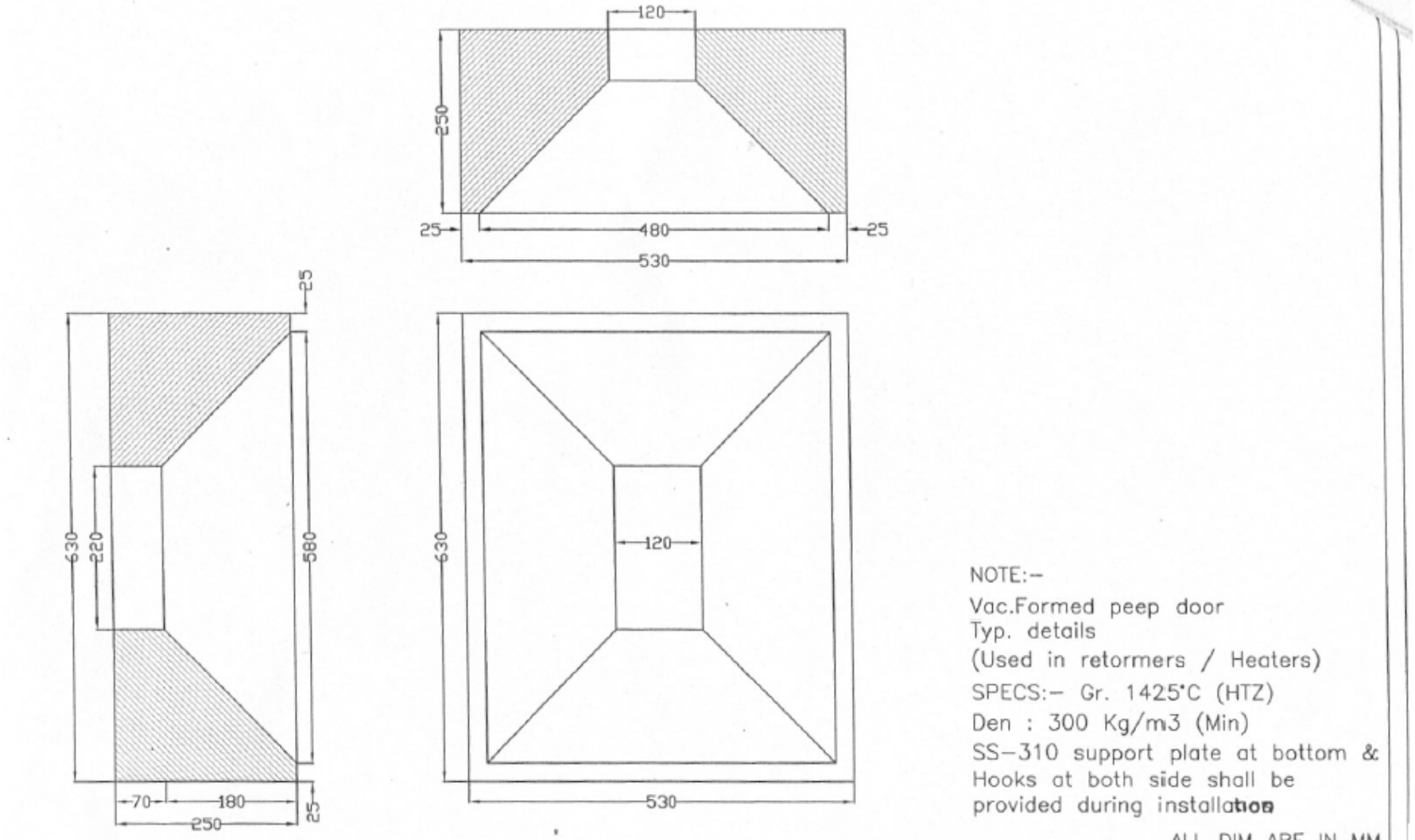


LLOYD INSULATIONS (INDIA) LIMITED

PRIMARY REFORMER - IFFCO, KALOL LAYOUT PLAN

WALL NO.- 2





NOTE:-

Vac.Formed peep door
Typ. details
(Used in retormers / Heaters)

SPECS:- Gr. 1425°C (HTZ)

Den : 300 Kg/m3 (Min)

SS-310 support plate at bottom & Hooks at both side shall be provided during installation

ALL DIM ARE IN MM

LLOYD INSULATIONS (INDIA) LTD. 386, VEER SAVARKAR MARG, PRABHADEVI, BOMBAY-400025. PH. 30480110/30480214	TITLE : VAC. FORMED PEEP DOOR FOR REFORMER	DRAWN.	CHECKED	DATE
		BHARAT	SATHE	13/02/08
	PROJECT : IFFCO KALOL	DRG.No:-- LIIL_IFFCO_01		

BRICK LINING OF RADIANT SECTION OF PRIMARY REFORMER

LINING OF RADIANT SECTION OF PRIMARY REFORMER

UREA PLANT

ROTATING EQUIPMENT

CO2 COMPRESSOR- HITACHI MAKE (K-1801)

PREVENTIVE MAINTENANCE OF CO_2 COMPRESSOR LP CASE (K-1801-1):

- Decoupled the LP case at both ends from Turbine & Gear box.
- Alignment readings were taken and recorded.
- Journal bearing pads on Turbine side were opened for inspection. Clearance values found within acceptable limit. (Clearance values measured are given in Table-1).
- Journal bearing pads on Gear Box side were opened for inspection. Clearance values found within acceptable limit. (Clearance values measured are given in Table-1).
- Thrust bearing was opened for inspection. Surface cracks were found on 7 nos of thrust pads of outboard side during DP test. All thrust pads of outboard side were replaced with new ones. Clearances value with new thrust pads was found within acceptable limits. (Clearance values measured are given in Table-1).
- Gauss measurement of pads, Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit.
- Final alignment readings were taken and recorded. Alignment between LP – Turbine & LP-Gearbox was checked and corrected as per OEM reference values.
- The Coupling spacer between LP casing & gearbox and LP casing & turbine was assembled.

Table 1: Bearing Clearance (Diametrical) Details for LP Case:

Description		Before PM (mm)	Design Value (mm)	After PM mm)
Journal bearing clearance on Turbine side		0.13	0.11 to 0.15	0.14
Journal bearing clearance on Gear Box side		0.15	0.11 to 0.15	0.14
Thrust bearing clearance		0.31	0.28 to 0.38	0.30
Observations	Oil/wax deposit was found on Bearing pads & thrust pads.			
Spares replaced	Set of thrust pads of outboard side.			
Inspection:				
DP Check	Crack was found on 7 nos of thrust pads of outboard side.			
Magnetism Check	Found acceptable			
Demagnetization	-----			

PREVENTIVE MAINTENANCE OF CO_2 COMPRESSOR HP CASE (K-1801-2):

- Decoupled the HP case from Gear box
- Alignment readings were taken and recorded.
- Journal bearing pads on Gear box side were opened for inspection. Clearance values found within acceptable limit. (Clearance values measured are given in Table-2).
- Journal bearing pads on Free end side were opened for inspection. Clearance values found within acceptable limit. (Clearance values measured are given in Table-2).
- 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-2).
- Gauss measurement of pads, Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit.
- DP testing of thrust pads, thrust collar and shaft journal was done and the same found acceptable.
- Final alignment readings were taken and recorded. Alignment between HP-Gearbox was checked and corrected as per OEM reference values.
- The Coupling spacer between HP casing & gearbox was assembled.

Table 2: Bearing Clearance (Diametrical Clearance) Details for HP case

Description	Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on Free end	0.12	0.11 to 0.14	0.13
Journal bearing clearance on Gear Box side	0.11	0.11 to 0.14	0.13
Thrust bearing clearance	0.30	0.25 to 0.35	0.28
Observations	Oil/wax deposit was found on Bearing pads & thrust pads		
Spares replaced	Nil		
Inspection:			
DP Test	Found acceptable		
Magnetism Check	Found acceptable		
Demagnetization	----		

PREVENTIVE MAINTENANCE OF CO_2 COMPRESSOR DRIVE TURBINE (Q-1801):

- Decoupled the Turbine at LP case end.
- Alignment readings were taken and recorded.
- Journal bearing pads on free end were opened for inspection. Found clearance values within acceptable limit. (Clearance values measured are given in Table-3).
- Journal bearing pads on LP case side were opened for inspection. Clearances values found within acceptable limit. (Clearance values measured are given in Table-3).
- Thrust bearing was opened for inspection. Thickness of the thrust pad was checked and clearances value found within acceptable limits. (Clearance values measured are given in Table-3)
- Gauss measurement of Thrust collar, journal shaft & bearing housing were carried out by Inspection section and found within acceptable limit. Max. Gauss value found on journal bearing pads of LP side. After demagnetization, gauss value came 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.

Table 3: Bearing clearance for Turbine

Description		Before PM (mm)	Design Value (mm)	After PM (mm)
Journal bearing clearance on free end		0.26	0.18 to 0.31	0.26
Journal bearing clearance on LP side		0.32	0.24 to 0.35	0.33
Thrust bearing clearance		0.28	0.25 to 0.35	0.28
Observations	Oil/wax deposit was found on Bearing pads & thrust pads.			
Spares replaced	Nil			
Inspection:				
DP Test	Found acceptable			
Magnetism Check	Max. Gauss value found on journal bearing pads of LP side. After demagnetization, gauss value came within acceptable limit.			
Demagnetization	Done			

PREVENTIVE MAINTENANCE OF GEAR BOX M-1801:

High-speed Pinion Shaft and Bearings:

- Decoupled the High-speed pinion shaft at HP case end.
- Alignment readings were taken and recorded.
- Both Pinion shaft bearings (Offset Halves Type) were opened for inspection. Clearance values found within limit. (Clearance values were measured as given in Table. 4)
- Gauss measurement of shaft journal & bearing housing was carried out by Inspection section and found within acceptable limit.
- DP testing of shaft journal & bearing housing was done and the same was found acceptable.

Low-speed Gear Shaft and Bearings:

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

Table 4: Bearing clearance for Gear Box

Description		Before PM (mm)	Design Value (mm)	After PM (mm)
Low speed shaft	Journal bearing clearance on LP side	0.17	0.125 to 0.185	0.17
	Journal bearing clearance on HP side	0.16	0.125 to 0.185	0.16
	Thrust bearing clearance	0.40	0.38 to 0.61	0.40
High speed shaft	Journal bearing clearance on LP side	0.20	0.15 to 0.21	0.20
	Journal bearing clearance on HP side	0.21	0.15 to 0.21	0.21

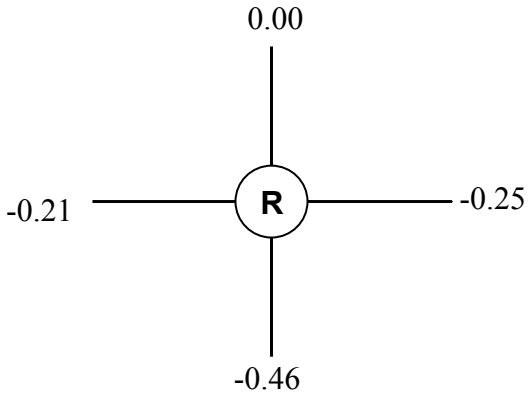
Gear backlash	0.55	0.383 to 0.608	0.55
Observations	Oil/wax deposit was found on Bearing pads & thrust pads.		
Spares replaced	Nil.		
Inspection :			
DP Check	Found acceptable		
Magnetism Check	Found acceptable.		
Demagnetization	----		

ALIGNMENT READINGS: GEAR BOX TO LP COMPRESSOR:

Dial on LP Compressor Coupling
All values are in mm

Before PM:

RADIAL



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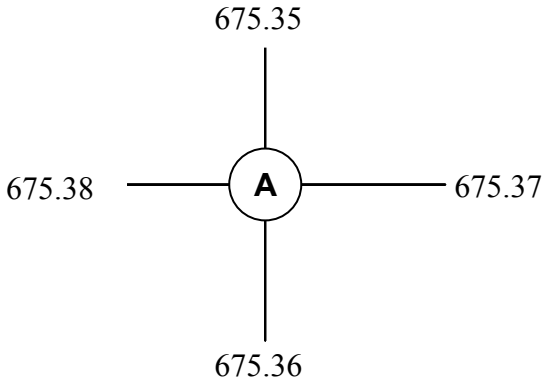

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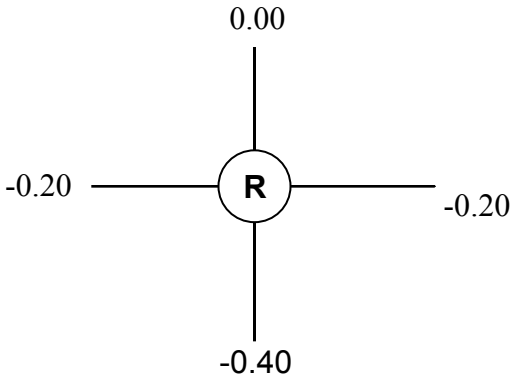

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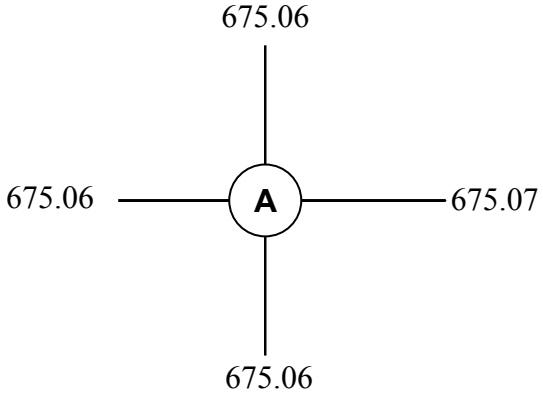
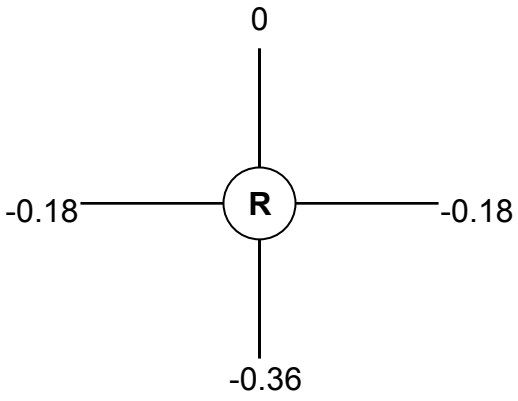


Protocol Values

RADIAL



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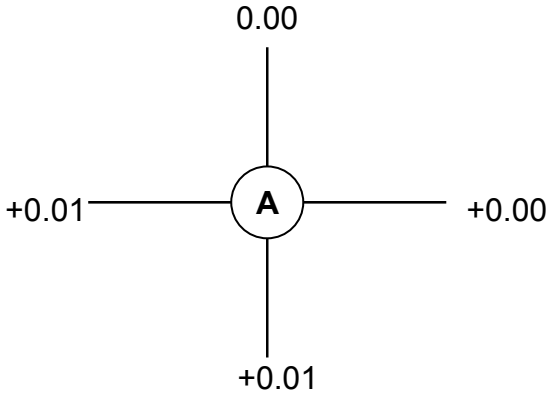
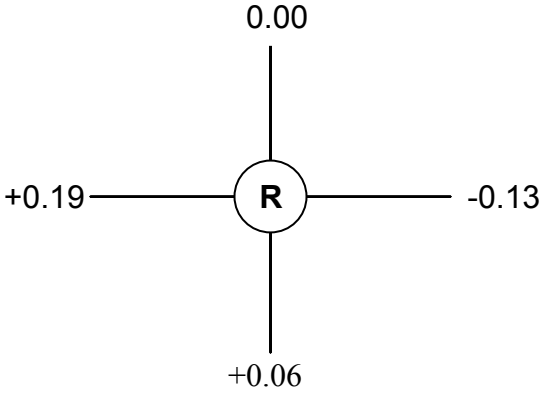


ALIGNMENT READINGS: GEAR BOX TO HP COMPRESSOR:

Dial on HP Compressor Coupling
All values are in mm

Before PM

RADIAL



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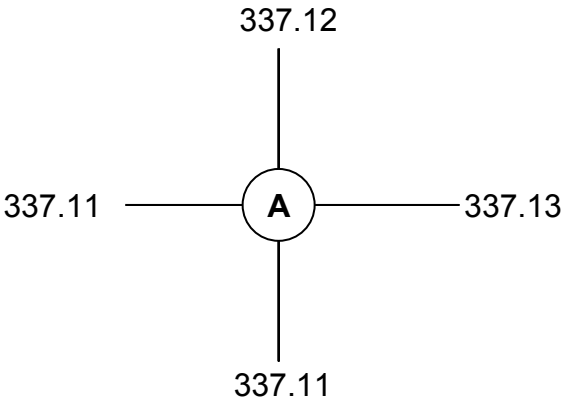

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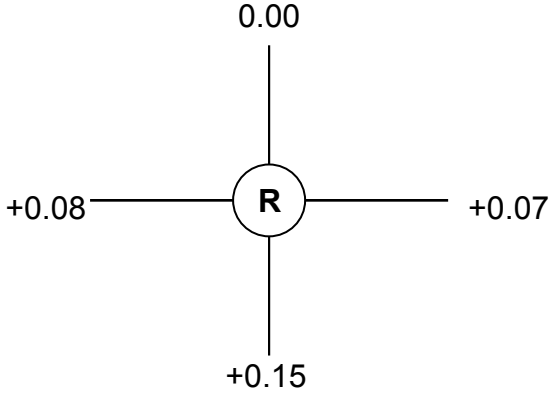

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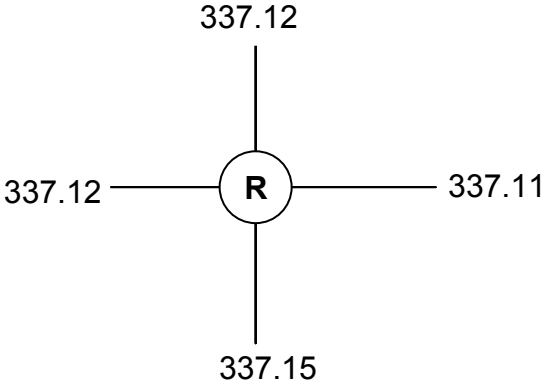

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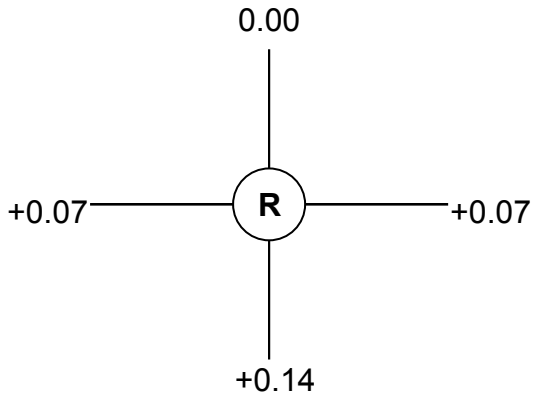

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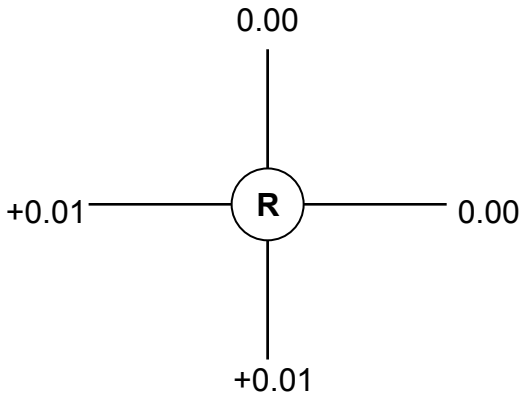
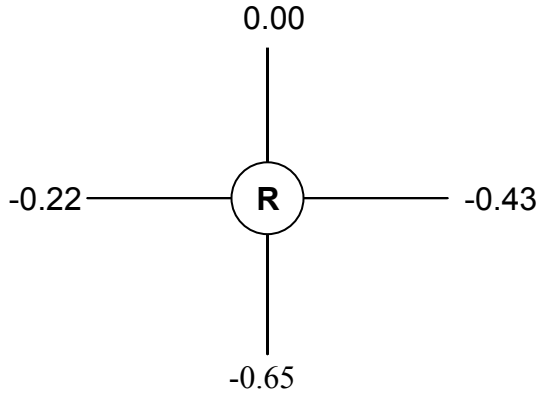


ALIGNMENT READINGS: TURBINE TO LP COMPRESSOR:

Dial on LP Compressor Coupling
All values are in mm

Before PM

RADIAL



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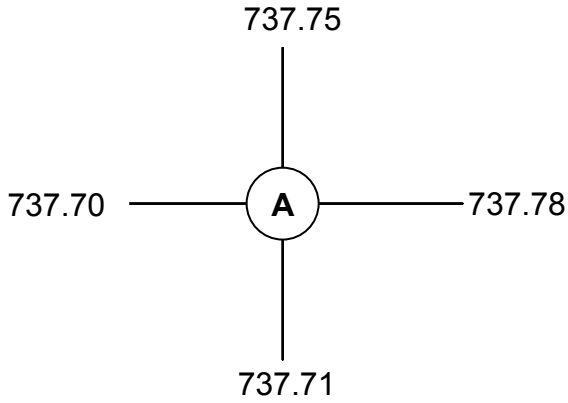

After PM

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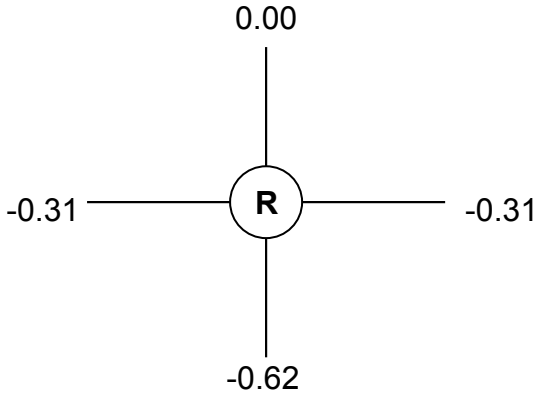

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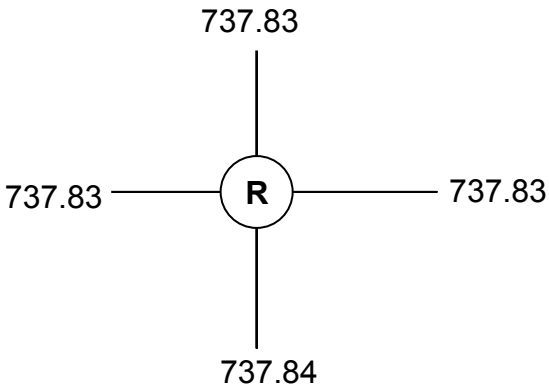

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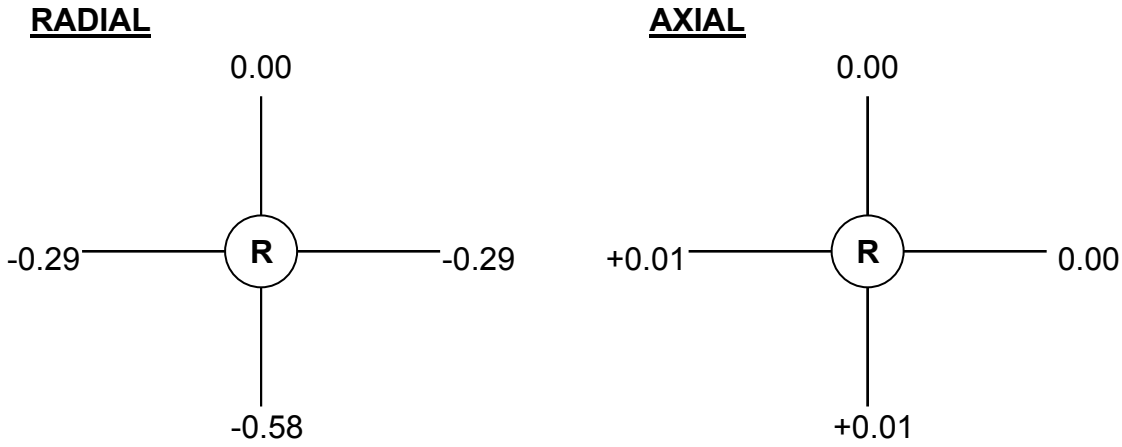


HP VESSELS

H-1201 (HP STRIPPER):

The top and bottom covers of the HP Stripper (H-1201) were opened using “Hydra Tight Sweeny” make bolt tensioner at hydraulic pressure of 900 kg /cm2. The top cover was shifted below the platform using monorail hoist and chain blocks. The bottom cover was lowered onto the wooden sleepers.

TOP DOME:

The top liquid barrier was opened and then all the ferrules were removed. The condition of sealing face was satisfactory. A thin blue oxide layer covered the overlay welding and liner in the gas phase completely, except between the strip beads. The liner and liquid inlet box in the phase were grey and slightly etched. No corrosion had been observed. Overlay welding on the tubesheet was grey and slightly etched. The tube welds were bright and smooth. Heavy oxides deposition was observed at many places between the tubes on tube sheet area. The same were carefully removed using SS chisel.

The old PTFE gaskets were removed. Then all the ferrules were thoroughly cleaned by Production department. Subsequently, pressure drop measurement was carried out and 2600 nos of New PTFE gaskets were provided in the ferrules, which were found acceptable in the DP measurement. HP Stripper vessel was thoroughly cleaned with compressed air and then with DM water. The ferrules were fixed in position and liquid barrier plates were boxed up.

BOTTOM DOME:

The condition of sealing face was satisfactory. The overlay welds in the manway were grey and slightly etched. The gaps of appx. 1-2 mm depth observed between the strip beads. The overlay welds in the hemi-head were grey and etched. The liner in the cylindrical section was grey and slightly etched. The tubesheet was covered with a thin blue grey oxide layer. The tubes inside were smooth. The liquid outlet pipe and the gas inlet pipe were bright shiny and showed no defects. Their nozzles and welds were in satisfactory condition.

After inspection, the bottom manhole was boxed up using new "Kempchen" gasket (860 mm OD x 800 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelope).

After the bottom manhole was boxed up, pressure drop measurement was carried out for each tube and the same was found acceptable. After clearance from Production, the top man way cover was boxed up using new "Kempchen" gasket. (860 mm OD x 800 mm ID x 4 mm thick) with 0.5 mm thick Teflon envelope).

Manhole tightening pressures for top and bottom covers

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

H-1202 (HP CONDENSER):

The top flange of H-1202 (off gas line) was opened. Then the top cover was opened with bolt tensioner at 700 kg/cm2 hydraulic pressure and shifted from position. The partition plates, basket, segments and rasching rings were removed.

Gasket sealing face was found satisfactory. The liner and welds in the man way were gray and smooth. The liner and weld in the channel were grey and slightly rough. Tube to tube sheet welds were found satisfactory.

At the bottom end, the Liquid outlet line (H-1202 to V-1201) was opened. Bottom cover was opened using bolt tensioner at 700 kg/cm2 hydraulic pressure. Gasket sealing face was found satisfactory. All liner welds and repairs were bright and smooth.

After getting clearance, the segments and basket was boxed up after loading rasching rings in the basket. The partition plates on basket were boxed up. After getting clearance from production department boxed up top cover H-1202 with new "Kempchen" gasket and tightened at following hydraulic pressures.

1st tightening round..... 300 kg/cm^2
2nd tightening round..... 500 kg/cm^2
3rd tightening round..... 700 kg/cm^2
4th/final checking round… 700 kg/cm^2

Finally the offgas line was boxed up using new ring gasket.

After inspection & clearance from production the bottom cover was taken for box up. Both gasket seats of the vessel were thoroughly cleaned. The bottom cover was lifted and put into position, provided new "Kempchen" gasket and hand tightened the nuts. The gap between two flanges of the vessel was checked and tightening was done at following hydraulic pressures.

1st tightening round..... 300 kg/cm^2
2nd tightening round..... 500 kg/cm^2

3rd tightening round..... 700 kg/cm^2
4th/final checking round… 700 kg/cm^2

Connected liquid outlet line and tightened it.

HP Scrubber (H-1203)

The top Dome of HP Scrubber (H-1203) was opened using "Hydra Tight Sweeny" make bolt tensioner at hydraulic pressure of 700 kg /cm2. The top dome was shifted at the platform using monorail hoist and 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 found corroded along with its fillet weld. Two nos. of deep pin holes were observed in the seal weld of CO2 inlet pipe (3/4") with diaphragm ring. All these pinholes were repaired using TIG welding method and 25-22-2 L Mn filler wires. The weld repaired areas were DP tested, passivated and washed with DM water. Condition of liquid inlet and gas outlet pipe was found satisfactory.

Bottom Shell :

Visual condition of the tube bundle was found to be satisfactory.

After inspection by production department and getting clearance, the top dome was boxed up using new "Kempchen" gasket (952 mm OD x 904 mm ID x 5 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)

Off gas line at the top was opened including all the steam tracing lines. The top man way cover was opened using hydraulic bolt tensioner at 700 kg/cm2 pressure. The cover was shifted by mono-rail and chain block towards cooling tower side grating area and was put on wooden sleepers. Clearance was taken from Production that the temperature inside is suitable for vessel entry. Compressed air was provided from the bottom end and vacuum blower hose was arranged in the top compartment. Aluminium ladders & hand lamps were provided in each compartment and both the domes. Telephones were provided at the bottom end, top end and 5th compartment.

Inspection section carried out visual and NDT examination of liners and shell areas. The bulged liners were inspected for any abnormal increase. Based on the NDT examination, cracks, pin holes & weld under cuts were repaired using TIG welding method and 25-22-2 L Mn filler wires. The weld repaired areas were passivated and washed with DM water. The compartment wise repair work are mentioned below:

Compartment No.1 (Top Compartment):

Crevice cavity of approx 7" long and 4" long was observed on the south west side L-seam. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. Some of the trays holding nuts were found loose, which were tightened.

Compartment No.2:

4 nos. of J-bolts were found loose, which were tightened. 3 nos. of corrosion cavity were observed in south west side longitudinal seam, 2 nos. of crevice cavity was observed in C-seam, 1 no. spot welding and 2 nos. old clit marks observed to have corroded. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. Some of the trays holding nuts were found loose, which were tightened

Compartment No.3:

1 no. of undercuts/corrosion cavity was observed in north east side long seam and also 1 no. of undercuts/corrosion cavities was observed in south west side long seam. 2 nos. of old clit marks and 2 nos. of spot weld were also observed to have corroded.. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. 2 nos. of 'J' bolts were found loose which were tightened.

Compartment No.4:

9 nos. of corrosion cavities and 1 no. of old clit mark were observed to have corroded. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. 6 nos. of 'J' bolts and some tray holding nuts and bolts were also found loose which were tightened

Compartment No.5:

3 nos. of 'J' bolts and some tray holding nuts and bolts were also found loose, which were tightened.

Compartment No.6:

5 nos. of 'J' bolts and some tray holding nuts and bolts were also found loose, which were tightened. 3 nos. of corrosion cavities and 6 nos. of spot welds were also observed to have corroded. Which were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water.

Compartment No.7:

3 nos. of corrosion cavities, 2 nos. of spot welds and 2 nos. of old clit marks were observed to have corroded. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. 9 nos. of 'J' bolts was found loose, which were tightened.

Compartment No.8:

3 nos. of spot welds observed to have corroded which were marked. 3 nos. of old clit marks were observed to have corroded which were marked. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. Some of the trays holding nuts and bolts were found loose, which were tightened

Compartment No.9:

1 no. of corrosion cavity and 6 nos. of old clit marks were observed. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water. Some tray holding nuts and bolts were also found loose, which were tightened.

Compartment No.10:

No repairing work was done in this compartment.

Compartment No.11:

Some of the trays holding nuts were found loose. , which were tightened

Compartment No.12 (Bottom Compartment.):

Weld joints of all nozzles, petal plates, crown plates and the circumferential weld of the bottom dished end liner were DP tested. 15 nos. of defect indications were marked for repair. These spots were repaired using TIG welding method and 25-22-2 L Mn filler wires. Repaired areas were passivated and washed with DM water.

Ferrite was also measured on liner, welds and at repaired locations and observed nil.

After completion of repairs, clearance was taken from production (Urea) for the removal of ladders, hand lamps, telephones and air hoses and then top man way cover was boxed up with new "Kempchen" gasket using hydraulic bolt tensioner at following pressures.

1^{st} tightening round..... 300 kg/cm^2
2^{nd} tightening round..... 500 kg/cm^2
3^{rd} tightening round..... 700 kg/cm^2
4^{th}/final checking round… 700 kg/cm^2

All the nozzles at the bottom end and the off gas pipe line including the steam tracing lines were boxed after taking clearance from Production. RTJ ring gasket of non standard height was used for box up of flanges in the pipe line leading to H-1202 (6" x 1500#).

LP Vessels:

V-1101 (CO_2 Knock Out Drum):

Manhole was opened for internal inspection. Demister pads in west half were found lifted upwards. Leveling of demister pads was done manually. After getting clearance from production department the vessel manhole was boxed up using new gaskets.

V-1102 (NH_3 Suction Filter):

Top cover was opened for internal inspection. Weld joint of upper support ring of filter basket with shell was peeled off, filled with weld material. Filter cloth was replaced with new one. After getting clearance from production department the vessel top cover were boxed up using new gaskets.

V-1103 (NH_3 Suction Vessel):

Manhole was opened for internal inspection. The condition of longitudinal and circumferential weld joints was found satisfactory. After getting clearance from production department the vessel manhole and top cover were boxed up using new gaskets

V-1202 (Rectifying Column):

Top cover and Manhole were opened for internal inspection. Appx. 1'' sq. area & 4 mm deep groove was observed on shell in south direction. This groove was repaired using TIG welding method and 25-22-2 L Mn filler wire. 3 nos of nuts were provided in grating support ring. After getting clearance from production department the vessel manhole and all connected pipe lines were boxed up using new gaskets.

V-1203 (L. P. Absorber):

Perforated support grid just below top hand hole was found intact in position. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1206 (Atmospheric Vent Scrubber) :

Condition of internals was found satisfactory. Tighten the one no. of loose bolt of inlet flange. After getting clearance from production department the vessel manhole and all connected pipe lines were boxed up using new gaskets.

V-1207 (L. P. Scrubber):

Grating condition on top was satisfactory. Coloration of shell portion was observed grayish black. After getting clearance from production department the vessel manhole and all connected pipe line were boxed up using new gaskets.

V-1301 (2ND Disrober):

Nozzle condition was found satisfactory. One loose clamp of the tray was tightened. After getting clearance from production department the vessel manhole was boxed up using new gaskets.

V-1351 (Hydrolyser):

3 nos of bolts were provided in 2nd tray from south. Tighten the 1 no of loss bolt of steam inlet flange. After getting clearance from production department the vessel manhole was boxed up using new gaskets.

V-1352 (First Disrober):

Weld joint condition was found satisfactory. All internals were found intact in position. Gasket of inlet flange of reflux line was replaced. After getting clearance from production department the vessel manhole was boxed up using new gaskets.

V-1418 (Pre Evaporator Separator):

Condition of cone and weld joints were found satisfactory. Tube to tube sheet weld was found in good condition. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1423 (1 ST Stage Evaporator Scrubber):

Outer ring of demister pads were found lifted at few locations. Leveling of same was done manually. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1501 (4 ATA STEAM DRUM):

All the internals were found intact in position. Demister pads were found intact in position. Condition of all weld joints was found satisfactory. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1502 (23 ATA Steam Drum):

All the internal fittings were found in good condition. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1503 (9 ATA Steam Drum):

Welded the support of 1-1/2" condensate inlet from 4 ata drum with shell, which was found cracked. Approximate 3 mm deep pit was observed at the bottom of shell at the centre, filled it with weld material. One missing nut was provided in u clamp of inlet header. All other internal fittings were found in good condition. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1811 (Ist Stage Separator):

Demister pads were found intact in position. Vortex breaker was found intact in position. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1812 (IInd STAGE SEPARATOR):

Demister pads found intact in position. Vortex breaker found intact in position. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

V-1813 (IIIrd STAGE SEPARATOR);

Demister pads found intact in position. Cavity of appx. 2 mm depth and 3 mm dia was observed inside 6" nozzle at south end of vessels, Weld material was filled into the cavity. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

TANKS:

T-1301 (Ammonia Water Tank):

Weld joints and nozzle condition was found to be satisfactory. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

T-1301-A (New Ammonia Water Tank):

All weld joints and nozzle condition was found satisfactory. After getting clearance from production department, the vessel manhole was boxed up using new gaskets.

T-1401 (Urea Solution Tank):

Weld joints condition was found satisfactory. Stiffener provided on top roof plate was found intact in position. After getting clearance from production department, the tank manhole was boxed up using new gaskets.

T-1401-A (New Urea Solution Tank):

Nozzles and weld joint condition was satisfactory. After getting clearance from production department, manhole was boxed up using new gaskets.

T-1501 (Condensate Tank):

One no. support out of two of 6" west most condensate inlet line was welded, which was found broken. Condition of all other weld joints was found satisfactory. After getting clearance from production department, manhole was boxed up using new gaskets.

CLEANING AND HYDROJETTING OF HEAT EXCHANGERS:

The Hydrojetting job was awarded to M/s Delux Hydroblasting services, Mumbai vide W.O. No. 9921620. 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.

- 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)
- Circulation cooler for V-1423 (H-1427)
- Ammonia water cooler (H-1208)
- 1st inter stage cooler of Hitachi Train (H-1813) : Tube bundle was pulled out.

PRILL TOWER ID FAN K-1401-1/2/3/4

Preventive maintenance of all these fans was carried out. The scaffolding was provided in the fan cell. The blades were checked for tightness. All blade locking bolts of K-1401/1, 2, 3, 4 were loosened and blade angle was set at 10^0. The blades were tightened. Bearings were inspected, found ok. Thrust ring of K-1401-4 were replaced with new one. Belts of K-1401-2/4 were replaced with new ones. Alignment of fan motor w. r. t. fan was carried out and the all V belts were fully tensioned. Scaffolding was removed after completion of job. 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) & EXHAUST AIR FAN (K-1702):

Bearings of K-1701 were opened and inspected. Bearing condition was found satisfactory and hence boxed up. Bearings of K-1702 were replaced with new ones. Condensate flushing arrangement was provided in K-1702. Condition of Damper mechanism and V-belts (SPC-6300) of both fans was found satisfactory. Fresh lube charged. Alignment of fan pulleys of K-1701 & K-1702 was checked and corrected. Painting of internal surfaces of casing carried out. Balancing of fan blades of K-1701 was done due to high vibration during startup. 705 gm weight was welded in 5th no. blade to correct the balancing.

FLUIDIZED BED COOLER (H-1701):

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 tighten the loose locking nuts. After inspection and cleaning of fluidized bed cooler, dust silos and cyclone separators the same were boxed up.

CONVEYOR SYSTEM:

LINK CONVEYOR (M-1419) :

Gear box was replaced with reconditioned one. Head end pulley with pillow block bearings (NTN make) were replaced with new one. Belt condition was found satisfactory. Condition of carrying rollers and return rollers was found satisfactory. Alignment was checked and corrected.

PRILL COOLING SYSTEM LINK CONVEYOR (M-1421):

Gear box was replaced with reconditioned one. Head end pulley with Pillow block bearings was replaced with new one. Belt was replaced due to poor condition. Condition of carrying rollers and return rollers was found satisfactory. Alignment was checked and corrected.

DUST CONVEYOR SYSTEM (M-1702):

A cleaning brush was provided in head end pulley side. Head end pulley with pillow block bearings were replaced with new ones. Belt was replaced due to heavy wear & tear of exiting belt.

BUCKET CHANGE OVER MECHANISM (M-1401 A/B):

Shaft of M-1401 A was removed for drawing development. Shaft drawing was required for commissioning of modify Prill bucket. Both bearings (6314 & 6020) of same shaft were replaced with new one. Condition of both timing pulley was found satisfactory. Toothed belt of M-1401 B was replaced with new one.

SCRAPPER (M-1402 -1/2):

Both fluid couplings were replaced with reconditioned ones. V belts (B 69, 1set = 4nos.) were replaced with new ones. Oil seal of scrapper gear box (M-1402-2) was replaced with new one. Removed oil from scrapper main gear box, flushed the oil and opened the inspection window of both the gear boxes and maintained the oil level. No abnormality was observed during inspection of the gear box.

Replacement of Existing Prill Tower Conveyor (M-1403) With Modified Three Part Conveyor Design

In the Urea plant we are operating a Prill Tower Belt conveyor (M-1403) which is situated below the scrapper floor of Prill tower. This conveyor was operated in both the directions depending on requirement for shifting product Urea to Prill cooling system (PCS) or directly to Bagging Transfer conveyor M-2110 bypassing PCS.

Generally this Conveyor was run towards PCS system. Whenever the PCS system was taken for maintenance for extended hours (e.g. Fan washing etc.), direction was required to be reversed. Under emergency, plant load was required to be reduced as direction change involved decoupling at one end & chain assembly at other end of conveyor drive.

Conveyor was flat in middle and raised at both ends. Conveyor belt didn't remain in contact with the rollers at ends. The conveyor belt had frequent swaying tendency and wear and tear of belt was very fast. Due to high swaying tendency the skirt spillages was frequent. In every 2 years it was needed to replace the belt. Gravity arrangement for take-up was also not effective due the saucer shape of belt conveyor. Under no-load condition during start-up heavy friction between skirt rubber & belt lead to overloading on motor & gear box. This sometimes resulted in failure of gear box also.

To overcome the above problems, this single part conveyor system was modified into the three part conveyor system.

Conveyor No.1: Middle Section Conveyor with “FLAT RUN” with reversible motion to shift urea to either Fluidized bed cooler of Prill Cooling System through Conveyor no.2 or to the Plant Transfer Link Conveyor (M-1419) through Conveyor No.3.

Conveyor No. 2: PCS side Conveyor to shift Urea from Conveyor No. 1 to Prill Cooling System.

Conveyor No. 3: Plant side Conveyor to shift Urea from Conveyor No. 1 to the Plant Transfer Link Conveyor M-1419.

Design, Engineering, Supply of three Part Conveyor belt assemblies was awarded to M/s. Elecon Engineering Co. Ltd; V.V.Nagar vide PO No. 9920376 dated 30.03.2007 and replacement of exiting conveyor with modified three part belt conveyor system was awarded to M/s EMTICI Engineering Limited, V.V. Nagar vide PO No. 9920377 dated 30.03.2007

Following activities were carried out for the modification. .

1. As a prefabrication activity, height of supplied SS feed hopper was increased by 200 mm. 5 mm thick SS plate was welded with all three segments of SS feed hopper.
2. Dismantled existing Conveyor Structure, Feed Chute plates of middle conveyor, Carrying & Return Idlers, Chutes, Drive Unit, Pulleys, Hopper & Skirts etc.
3. All three SS feed hoppers were erected first.
4. All the structural works were done including erection of frame structures, stands and stringers as per drawing.
5. Installed carrying and impact rollers, head and tail end pulleys, return rollers.
6. Receiving skirts and discharge chute of all conveyors was fabricated.
7. Vulcanizing of all three conveyor belt joints was done.
8. Installed all electrical accessories (rope switch and swaying switch).
9. Installed the gear box and motor for all three conveyors.
10. Alignment of motor with gear box for all three conveyors was checked and corrected.
11. Installed the sprockets on the shaft of head end pulleys and gear boxes and assembled with chain for conveyors no. 1 & 2. Conveyor no. 3 directly coupled with gear box.

The entire job was completed within stipulated time of 21 days. Trial run of all 3 conveyors was done for 10 hrs to ensure that all components are operating normally & there is no swaying tendency. Necessary adjustments to avoid belt sway, corrections on grease labyrinths of bearings etc. were done.

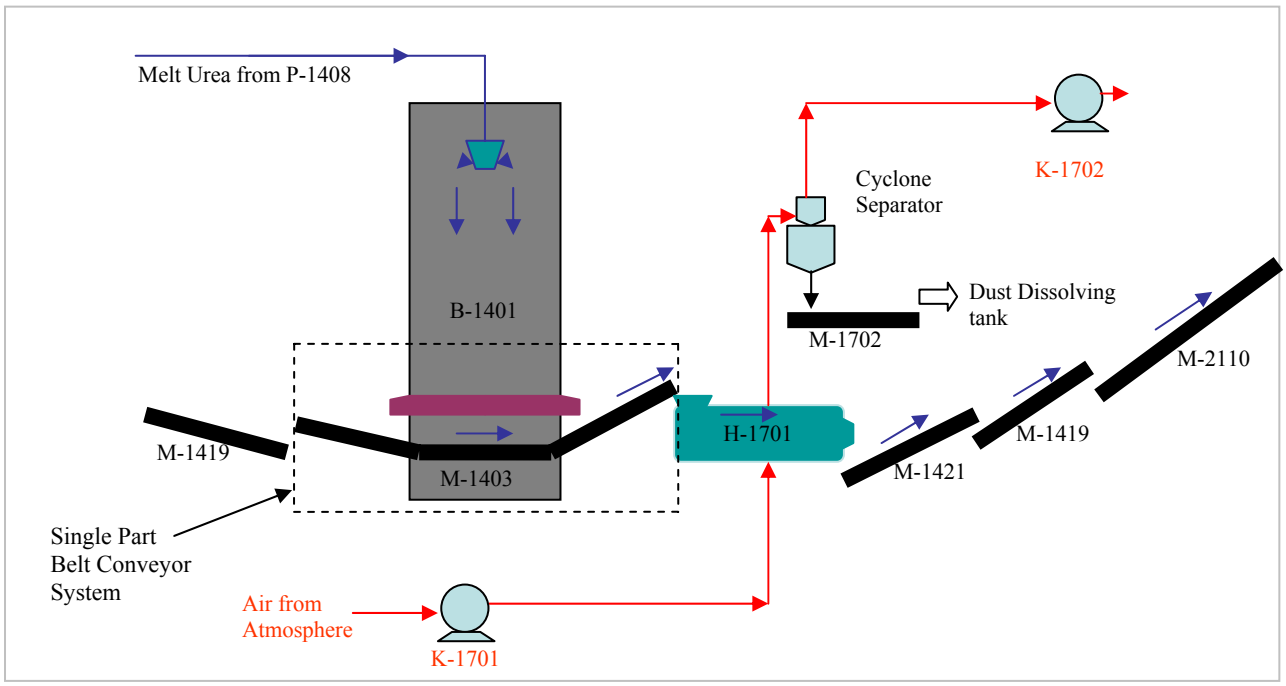
On-load test couldn’t be done due to non-availability of urea prills. It was planned to organize correction during on load test after plant start-up.
Following problems were observed during the running condition on load

1. The High Coupling Bush wear on conveyor no. 2
2. Spillage of urea Prills from rubber skirts in M-1403-1 and from receiving skirts of M-1403-2
3. Vibration on Motor of conveyor no. 2
4. After 10 days of normal operation urea prills started rolling back in M-1403-2 at prilling load beyond 100%.

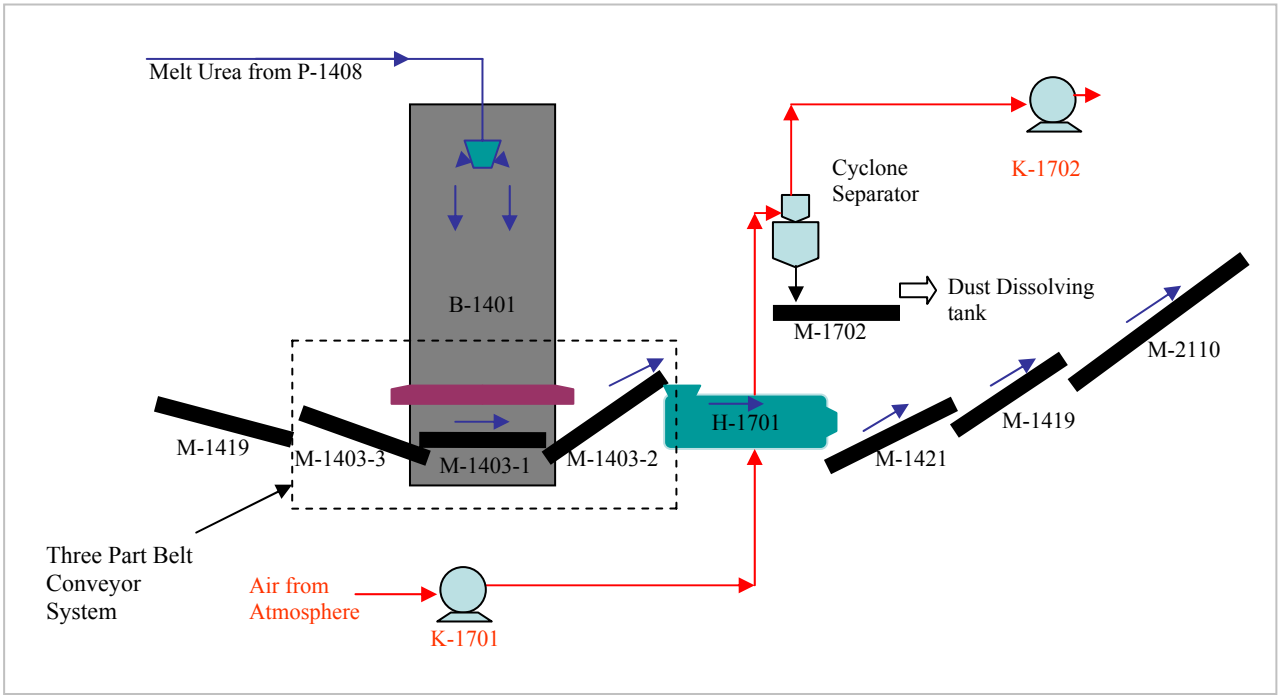
To overcome the above problems following activities were carried out.

1. Replaced the couplings of M-1403-1 and M-1403-2 with next higher size EFC-2 in place of EFC-1.
2. To increase the speed of conveyor M-1403-2 changed the sprocket of 26 teeth in place of 18 teeth on Gearbox shaft.
3. Inclination of M-1403-2 was reduced from 16 deg. to 13.3 deg.

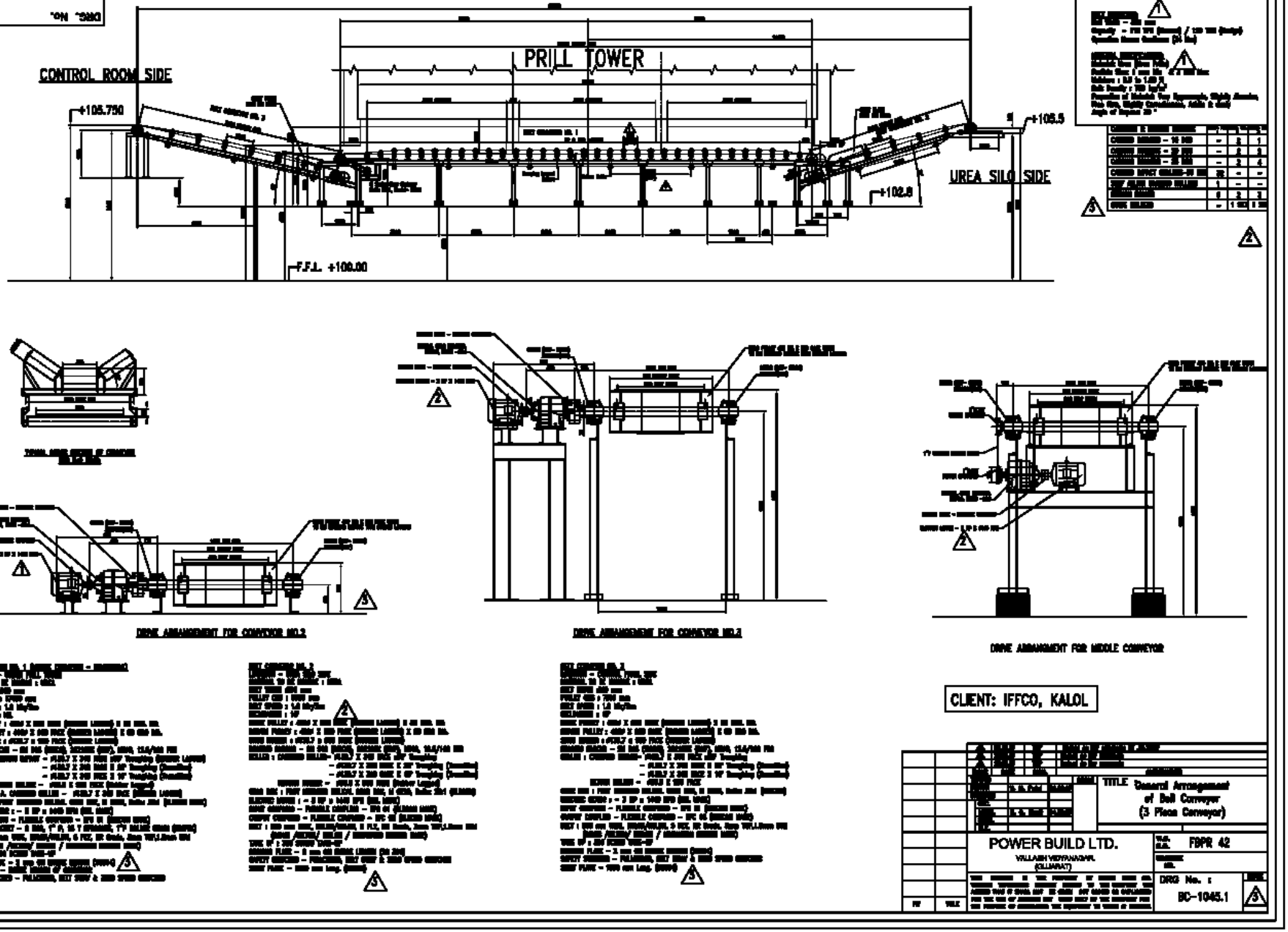
The conveyors are operating satisfactory, after rectifications.



Old Belt Conveyor System: Single Part Belt Conveyor System



Modified Belt Conveyor System : Three Part Belt Conveyor System


PRILL TOWER
CONTROL ROOM SIDE
UREA SILO SIDE
+105.750
+105.5
+102.8
F.F.L. +100.00
DRIVE ARRANGEMENT FOR CONVEYOR NO.3
DRIVE ARRANGEMENT FOR CONVEYOR NO.2
DRIVE ARRANGEMENT FOR MIDDLE CONVEYOR
CLIENT: IFFCO, KALOL
TITLE General Arrangement of Belt Conveyor (3 Place Conveyor)
POWER BUILD LTD.
VALLABH VIDYANAGAR (GUJARAT)
FBPR 42
DRG No. : BC-1045.1

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 vide W. O. No. 20070163.

Sr. No.	RV No.	Description	Set Pressure Kg/cm2 g	Reset Pressure Kg/cm2 g
1	RV-1201 A	V-1201 off gas line	165	150
2	RV-1201 B	V-1201 off gas line	165	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-1206	P-1201 C discharge	165	148
7	RV-1103 A	P-1102 A discharge	150	135
8	RV-1103 B	P-1102 B discharge	150	135
9	RV-1103	P-1102 C discharge	150	135
10	RV-1181	K-1801 final discharge	177	159
11	RV-1903	K-1801 IIIrd stage discharge	111	100
12	RV-1202A	V-1202 off gas line LP System	6	5.5
13	RV-1202B	V-1202 off gas line LP System	5.7	5.2
14	RV-1202C	V-1202 off gas line LP System	6	5.5
15	RV-1203	P-1201 A Suction line	8.5	7.5
16	PSV-1201A	P-1201 A Suction line	8.5	7.5
17	PSV-1201B	P-1201 B Suction line	8.5	7.5
18	PSV-1201C	P-1201 C Suction line	8.5	7.5
19	RV-1101A	Liquid ammonia line from H-1102 to V-1102	31	29
20	RV-1101B	Liquid ammonia line from H-1102 to V-1102	31	29
21	RV-1102 A	Ammonia suc. Vessel (V-1103)	31	29
22	RV-1102 B	Ammonia suc. Vessel (V-1103)	31	29
23	RV-1108 A	Cold ammonia line from Amm storage tank to H1102	31	29
24	RV-1108 B	Cold ammonia line from Amm storage tank to H1102	31	29
25	RV-1106 A	Liquid amm, line from amm. Plant to amm. filter.	31	29
26	RV-1106 B	Liquid amm, line from amm. Plant to amm. filter.	31	29
27	RV-1107 A	Liquid anmmonia line(hot) before ammonia filter	31	29
28	RV-1107 B	Liquid anmmonia line(hot) before ammonia filter	31	29
29	RV-1110 A	Liquid ammonia line from atm. Amm.storage tank to H-1102	31	28
30	RV-1110 B	Liquid ammonia line from atm. Amm. storage tank to H-1102	31	28
31	RV-1901	Ist stage discharge of K-1801.	7	6.7
32	RV-1902	IInd stage discharge of K-1801	27	25.1
33	RV-1503	23 ata Steam	25	23.8
34	RV-1504	9 ata Steam Drum	12	11
35	RV-1129 A	4 ata Steam Header	6	5.4
36	RV-1129 B	4 ata Steam Header	6	5.4
37	RV-1501 A	4 ata Steam Drum	7.5	6.8
38	RV-1501B	4 ata Steam Drum	7.5	6.6
39	RV-1506	4 ata Steam Main	6	5.4
40	RV-1209	V-1203 Vessel	10	9
41	RV-1351	RV of V-1351	24	23

42	RV-1352	RV of V-1352	6	5.4
43	RV-1301	RV of V-1301	6	5.9
44	RV-1184 (CCS-I)	H-1102 outlet NH3 outlet	6	5.5
45	RV-1221 (CCS-II)	P-1204 disch. To H-1203	16.5	15
46	RV-1913	Ejector system of Q-1801	0.20	0.20
47	RV-1914	Ejector system of Q-1801	0.20	0.20
48	RV-1916	23 ata Steam extraction	28	26
49	RV-1917	4 ata Steam exhaust	4	3.6
50	RV-1351 A	RV of P-1351 A	10	9
51	RV-1351 B	RV of P-1351 B	10	9
52	RV-1130	24 ata steam header	26	22.5
53	RV-1904	H-1811 First stage gas cooler	7	6
54	RV-1905	H-1812 Second stage gas cooler	7	6
55	RV-1906	H-1813 Third stage gas cooler	7	6
56	RV-1224	C.W from utilities	6	5.4
57	RV-NH3	RV To NH3 Ammonia Plant	85	77

NRV Inspection:

Sr. No.	Description
1	CO_2 to H-1201
2	NH_3 to H-1202
3	NH_3 to V-1201
4	Carbamate to H-1202
5	Carbamate to H-1203
6	CO_2 to H-1203
7	4 ata steam to V-1352
8	23 ata steam to V-1351
9	4 ata steam to V-1301
10	Condensate to melt return line
11	P-1201 A/B steam injection to discharge RV
12	9 ata steam injection to offgas line of V-1203/V-1207
13	9 ata steam injection to off gas line of V-1205
14	NH_3 water to V-1352
15	CO_2 to 1st Desorber V-1352
16	P-1351 A/B discharge
17	Final discharge of K-1801 to H-1201
18	NH3 water to V-1203 top
19	NH3 water to V-1207

Process Jobs:

Following process jobs were carried out.

SR. NO.	DESCRIPTION
Compressor	
1	Bonnet Leakage was found in 2nd i/v of V-1813 LAHH-1808 LT. Valve was replaced with new one (Gate valve, 1" X 1500#, SS, SW). Radiography was done for final welding, found ok.
2	New hand wheel was provided in I/V of LC-1101
3	New hand wheel was provided in drain i/v of LT-1101.
4	PICV-1810 U/S I/V was hard to Operate. Replaced it with new one
Synthesis	
1	Gland leakage was found in 1st I/V of CO2 to H-1203 at PT top, replaced the valve with new one (Gate valve, 1" x 1500#).
2	P-1102C 1st Suction I/V was is passing, replaced it with new one. (Gate Valve , 6" x 300# , CS) .
3	P-1102C drain I/V between both suction I/V was passing. Replaced it with new one.
4	Reconditioning of all suction i/v of P-1201 A/B/C was done.
5	Welded the broken Hand wheel of 1st I/V of NH3 to H-1202.
6	Flange leakage was found in V-1202 Offgas line, gasket was replaced with new one.
7	Replaced the gland packing of 2nd discharge I/V (Gate valve , 4" x 900#) of P-1102 B
8	Reconditioning of both passing i/v (Bel Valve, 1" x 1500#, ½" x 1500#) of H-1201 was done.
9	Reconditioning of 2nd I/V in discharge line of P-1201 C was done to make easy to operate.
10	Replaced the outlet I/V of condensate line with new one (Gate Valve, CS, ¾" x 800#).
11	Reconditioned the both drain i/v (Bel Valve, 1" x 1500#) of (FICV-1202) in line CO2 to H-1203 at PT top to make easy to operate.
12	Reconditioning of drain bleeder I/V (Bel valve,1"x1500#) at H-1203 bottom was done to make easy to operate.
13	Reconditioned the inlet I/V of CW to H-1207 to make easy to operate
14	Replaced the inlet and outlet i/v of C.W. of Lube oil cooler for P-1102 B with new one (Gate Valve, CS, 2" X 800#)
15	Replaced the vent i/v of CCS-1 Inlet to H-1102 line above pre-heater. Valve was not operatable.
16	PICV-1105 u/s I/V was not operatable, replaced it with new one.
17	Replaced the gland packing of bypass I/V of H-1210.
18	Replaced the gland of i/v of NH3 water outlet of H-1210
19	1st I/V in drain of V-1102 was not operatable, replaced it with new one.(Gate valve, ¾" x 800#, CS)
20	There was flange leak in V-1202 off gases line to H-1205A u/s, replaced the gasket with new.
21	Bonnet leak was found in 3rd I/V (9 ata steam to V-1201). (Bel valve), reconditioned it and replaced the bonnet with new one. (Bel valve, 2" x 1500#)
22	P-1201A/B L.O. Cooler CW IN/OUT I/V was hard to operate, and replaced it with new one. (Gate valve, CS, 1-1/2" X 800#)
23	Crack was found on the elbow of final discharge line for P-1210 A/B, replaced it with new One (Elbow, 3" x 40 Sch, SS 304)
24	Drain valve was provided in ammonia suction filter.
25	Valve body of Autoclave drain valve was replaced with new one. (Bel valve , 2" x 1500#)
26	Reconditioning of both sealing valve of autoclave was done.
27	Fermaniting of 9 ata steam injection I/V to autoclave was done.
29	Gland packings of suction and discharge i/v of P-1426 A/B and P-1305 A/B were replaced
	Evaporation Prilling
1	Flange leak was found at V-1423 liquid outlet, replaced the gasket (4" x 150#).
2	H-1419 CW IN/OUT both I/V was hard to operate. Reconditioning was done to make easy to operate.
3	Drain valve was provided in melt line to T-1401 A
	Hydrolyser
1	CO2 to Hydrolyser vent I/V was passing, replaced it with new one (Ball Valve SS, hreaded , 1"x 00#).
2	Replaced the gland packing of PICV-1351 bypass i/v
3	Replaced the gland packing of PICV upstream i/v

Steam/Condensate Job:

Following steam/condensate jobs were carried out.

SR. No.	Description
	Compressor
1	60 Ata to K-1801 (battery limit) I/V U/S line drain i/v (fermainited) was replaced with new one. (Gate valve, CS, ½" x 1500#)
2	Stem leak found on i/v of PI Tapping 23 ata line, replaced the gate valve with new one (Gate valve, ½" x 800#)
3	Rerouted the 4 ata header strainer discharge line with I/V.
4	Upstream valve of PICV-1128 tapping found leaked, replaced with new one (Gate Valve, CS, ¾" x 800#).
5	PICV-1181 D/S line to Silencer drain line was extenended to open channel.
6	PICV-1129 D/S line Trap was not working. Replaced the trap with new one (TD-55).
7	PICV-1129 Bypass I/V D/S line Trap was not working. Replaced the trap with new one (TD-55)
	Ground Floor
1	H-1201 condensate outlet flange to V-1502 was found leak. Gasket was replaced.
2	P-1201B Near Discharge Dampener condensate service point to be provided. 1 no. of new I/V was provided. (Gate valve, SS, SW, ¾" x 800#)
3	Condensate service station point to be provided near P-1102C pkg. filter service station. 1 no. of new valve (Gate valve , CS , ¾" x 800#) was provided
4	Near P-1408 steam condensate line was found leak. Replaced the line (¾" x 40 Sch, CS)
5	Replaced the gland packing of Condensate to LRCV-1201 D/S line flushing I/V and its drain I/V
6	Condensate to H-1201 sample point I/V Wheel was found broken. New wheel was provided.
7	P-1401A Discharge line condensate flushing I/V was replaced with Ball valve (¾" X 800#, SS,SW)
8	Replaced the gland packing of i/v for BFW to P-1204B
9	Replaced the gland packing of steam tracing I/V Near P-1401B
10	P-1401B suction line condensate flushing I/V and its line was rerouted.
11	T-1401 common suction line to P-1401A/B condensate flushing line and I/V was rerouted.
12	Steam trap line was extended to open channel Near T-1301A .
13	Replaced the gland packing of LT-1502
14	Rerouted the steam tracing line of P-1201 C
	First Floor
1	Replaced the gland packing of condensate Inlet I/V of H-1207 A
2	BFW to CCS-2 vent I/V was passing, replaced it with new one. (Gate valve, flange end, SS, ¾" x 150#).
3	4 ata steam vent silencer drain line was replaced with new one.
4	Near V-1409A Steam tracing condensate outlet trap was replaced.
5	Above H-1204 top side condensate flushing I/V (Fermanited) was replaced with new one. (Gate valve, 1" x 800#).

6	Hand wheel of PICV-1130 D/S line drain I/V was welded.
7	Steam tracing of V-1406 Outlet to V-1418 was replaced with new one.
8	V-1409B inlet line drain valve was passing. Replaced it with new one. (Gate valve ¾" x 800# SS, SW)
9	V-1409B O/L line condensate flushing ball valve and drain I/V was passing. Replaced it with new one. (Gate valve, ¾" x 800#, SW, SS & Ball valve ¾" X 800# SS, SW)
	Second Floor
1	Pinhole was found on H-1422 condensate outlet line to V-1420. Replaced the line with new one. (3" x 40 Sch, CS)
2	FR-1503 FT I/V was replaced with new one. (Gate valve , ½" x 800#)
3	Main I/V of V-1301 Top side 4 ata steam tracing I/V was found leaked from flange, replaced the gasket with new one.
	Third Floor
1	Replaced the H-1424 bottom side steam tracing line .
2	CCS-1 Over head Tank outlet drain I/V was not operatable . Replaced it with new. (Gate valve, 1" x 800#).
3	Pinhole leak was found in steam tracing condensate outlet line near V-1202 bottom side towards H-1205A side, replaced line with new I/V (Gate Valve, CS, ½" x 800#)
4	Condensate flushing to H-1425 main I/V was relocated.
5	H-1425 and H-1423 Condensate flushing I/V to be replaced with Ball valve.
6	V-1201 bottom steam trap was replaced with new one.
7	pinhole leak was found on steam tracing line to H-1424 , line was replaced with i/v (gate Valve , ½" x 800#).
	3.5 Floor
2	Raw water service station I/V was passing. Replaced it with new. (Gate valve , SW, ¾" x 800#)
3	Reconditioned the HPF to Carbamate to H-1202 1st I/V (Bel Valve, 1" x 1500#)
	P.T. Top
1	Pinhole leak was found steam tracing line near V-1207 bottom, replaced the line with new one.
2	Flange leak in V-1203 9ata injection I/V d/s was found at V-1203 top. Gasket was replaced with new one.
3	Pinhole leak was found in 4 ata steam tracing line near PT top, line was replaced with new one.
	PCS Section
1	Replaced the steam tracing line of P-1701A/B recycles line to tanks due the pinhole leak.
	Hydrolyser
2	Replaced the gland packing of 4 ata steam tracing Main I/V on Hydrolyser walkway to 1st floor.
3	Reconditioned the H-1352 CW IN/OUT I/V , valve was hard to operate.

Miscellaneous Jobs:

1. Erection of Overflow line of Autocalve (V-1201 to H-1201)

Thickness measurement of overflow pipe line (8" x 120#, SS 316 L Urea Grade) of Autoclave was done by Inspection department. Min. thickness was observed to be 12.8 mm in this pipe line as against design thickness of 19.58 mm. No reduction was observed in the elbows. 14.45 meter of pipe line was to be replaced during shutdown-2008 except existing elbow. Since elbows were found to have no reduction in thickness, existing elbows were used while fabricating the new loop.

Prefabrication of line was done at site in three segments of 6 mtr, 4.45 mtr, and 4 mtr.

New sample point isolation valve (Bel Valve, 1" x 1500#) was welded in 800 mm distance from one end of 6 mtr of segment. Root and final welding was done by TIG using 25-22-2 L Mn filler wires. DP checking of root and final welding was done and found acceptable. Radiography of 1 no. of butt weld was also done and found satisfactory.

Existing elbow was cut to weld with 4 mtr of pipe segment. Root welding was done with TIG method using 25-22-2 L Mn filler wires and final welding was done with Arc method using ESAB electrode 316 KCR. 100 % radiography test of root and final welding was done after DP checking found acceptable.

Erection of 1st segment of 6 mtr pipe was done vertically. This pipe segment was welded with existing pipe line at 1st floor. Root welding was done with TIG method using 25-22-2 L Mn filler wires. 100% radiography test of root welding was done after DP checking. Repairing was carried out based on RT result. Final welding was done with Arc method using ESAB electrode 316 KCR. 100 % RT was done after DP checking, found acceptable.

Erection of 2nd segment of 4.45 mtr pipe was done vertically. This pipe segment was welded with newly welded 6 mtr segment of pipe line at 2nd floor. Root welding was done with TIG method using 25-22-2 L Mn filler wires and final welding was done with Arc method using ESAB electrode 316 KCR. 100% radiography test was done after DP checking, found acceptable.

Erection of 4 mtr pipe segment with newly welded elbow was done horizontally. One end of pipe segment was welded with existing elbow of pipe line and other end (elbow side) of pipe was welded with newly welded 4.45 mtr segment of pipe at 3rd floor. Root welding was done with TIG method using 25-22-2 L Mn filler wires. 100% radiography test of root welding was done after DP checking. Repairing was carried out based on RT result. Final welding was done with Arc method using ESAB electrode 316 KCR. 100 % RT was done after DP checking, found acceptable.

Finally steam tracing lines of pipe line were erected.

2. Replacement of Discharge Line of Urea Melt Pump P-1408

Cracks were observed on the of 6" jacket line for 3" discharge line of P-1408. 9 mtr of discharge line with jacket line was to be replaced with both end flanges. Prefabrication job was done in workshop. Reducer flanges (6" x 3", 150#) was fabricated on both ends of discharge line and jacket line. Two nos of nozzle (¾" x 150#) were fabricated on jacket line for suction and discharge line of condensate. Each nozzle was fabricated at 95 mm distance from flange end. Erection of pipes lines was done vertically with help of chain pulley.

3. **Installation of New NH3 Flow Meter**:

In NH3 suction line existing NH3 flow meter was replaced with new one. Flange distance of new flow meter was more than existing one. So fabrication job was required for installation of new flow meter. Both side, flanges were fabricated, and radiography test of final welding of flanges was done, found acceptable. Finally new flow meter was installed by Instrument section.

4. Replacement of suction line) for sample point to N/C ratio meter.

Pinhole leak was found in suction line (½" x 80 Sch, SS 316 L) for sample point to N/C ratio meter. Line was cut and welded with new line. Radiography test of final welding of line was done, found acceptable. Steam tracing line of this line was also replaced with new one.

5. **Interchanging of P-1305 A and P-1352 A**.

As per energy saving scheme, P-1305 A was interchanged with P-1352 A. Suction and discharge line of both pumps were fabricated. In P-1305 A, condensate flushing arrangement in mechanical seal was provided. Steam tracing line of P-1352 A was modified. Grouting of base plate of both pumps were done by civil department. Finally alignment of both pumps was checked and corrected.

6. Hydrotest of H-1205

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

(i) Carbamate solution outlet nozzle (8" x 150#)
(ii) Carbamate solution inlet nozzle (8" x 150#)
(iii) NH3/CO2/H2O inlet nozzle (18" x 150)
(iv) Liquid NH3 inlet nozzle (1" x 300#)
(v) Carbamate inlet nozzle (2" x 1500#)

Vent valve was used to remove the air. NH3 solution inlet nozzle (1-1/2" x 150#) was used *to* pressurize the liquid.

Hydrotest test pressure: 11.0 kg /cm2
1 no of tube was found leaking. Plugged both the holes of leaky U-tube.

7. Hydrotest of H-1205 A :

Hydrotest of H-1205 A was done to detect the tube leakage. It is a fixed tube sheet and straight tube type heat exchange. 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 removed the air.

Hydrotest Pressure: 10.5 kg/cm2 g.
No tube leakage was found.

8. Replacement of Reinforcement pad of nozzle in H-1421

There was leakage from weep hole in reinforcement pad of inlet nozzle (14" x 150#) of H-1421. Reinforcement pad was cut and DP check was done on the surface of shell after removal of reinforcement pad. Cracks were observed on the H-A2 of 14" Nozzle and also on weld in approx. 50% circumference. Repair was done on shell surface and new reinforcement pad was welded.

9. Erection of HICV-1204 in 10" Cooling Water line:

A bypass isolation valve of 10" cooling water line (CW-1204-10"-B13) was replaced with control valve HICV-1204.

10. Repair work in Recirculation Heater (H-1204):

Cavity was found in 1 no. of weld joint of tube to tube sheet (Top side). Repairing was done by TIG welding using 25-22-2 L Mn filler wire.
DP checking was done found acceptable.

OFFSITES & UTILITY PLANTS

COOLING WATER PUMP (P-4401/A)

- Both the journal Bearings were checked and found okay.
- The clearances were checked & following are the readings:

Sr. No.	Description	Design Value	Actual Value (MM)
1	Total Float of the pump	10.0 mm	8.0 mm
2	Radial bearing Clearance coupling end	0.20 mm	0.20 - 0.22 mm
3	Radial bearing Clearance free end	0.20 mm	0.25 - 0.27mm

- Total Axial Float of the pump is 8.0 mm.
- Both side glands of pump was repacked with 25 mm PTFE packing (454801214).
- Coupling of pump with gear box was cleaned, checked and found O.K.
- Alignment between pump and gear-box were checked, greasing is done & box-up the coupling.

LUFKIN Gear-Box Maintenance:

- Opened the GB Top cover by using RT-760 crane (from Admn. Side).
- Checked the gearwheel and pinion found O.K.
- Removed the journal bearings and DP checked, found O.k.
- The bearing clearances were checked & following are the readings:

Sr. No.	Description	Actual Value (MM)
1	Gear wheel front brg. Clearance	0.26mm
2	Gear wheel rear brg. clearance	0.28mm
3	Pinion front brg. clearance	0.18 mm
4	Pinion rear brg. clearance	0.18 mm

Elliott TURBINE Q-4411:

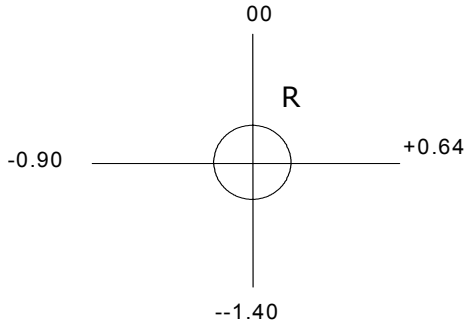
- Complete overhauling of the turbine carried out for attending oil leakage at Governor end bearing.
- Both the journal Bearings and thrust bearing were DP checked and found okay.
- Oil Cooler tubes were cleaned by Hydro jetting. Oil Cooler shell side was cleaned by diesel.

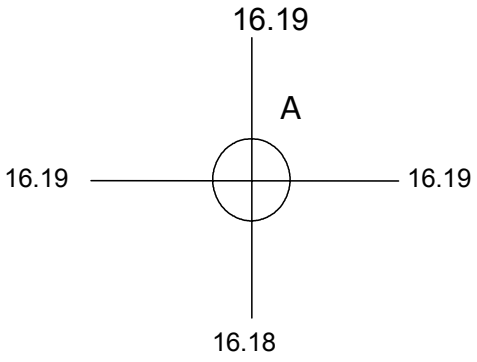
- Fresh oil was charged in Governor (SERVO-PRIME 32).
- Oil console was drained; cleaned and fresh oil charged (SERVO-PRIME 32) Approximately 620 ltrs of Oil was used.
- Main oil pump suction strainer was cleaned & boxed up.
- Auxiliary oil pump two nos suction strainers (336002060) were replaced & boxed up.
- The surface condenser was opened. Hydro jetting was carried out and boxed –up.

The clearances were checked & following are the readings:

Sr. No.	Description	Actual Value (MM)
1	Axial Float of the turbine	0.33 mm
2	Radial bearing Clearance coupling end	0.30 mm
3	Radial bearing Clearance Governor end	0.25 mm

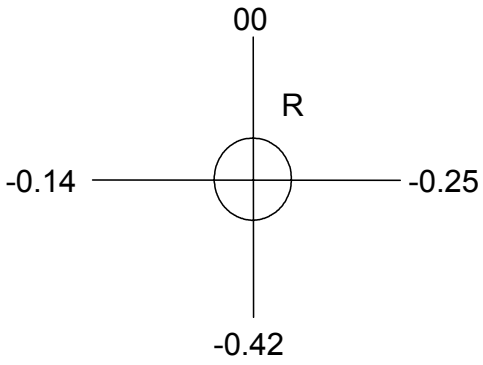
Alignment readings between Gear Box & Cooling Water Pump- Dial

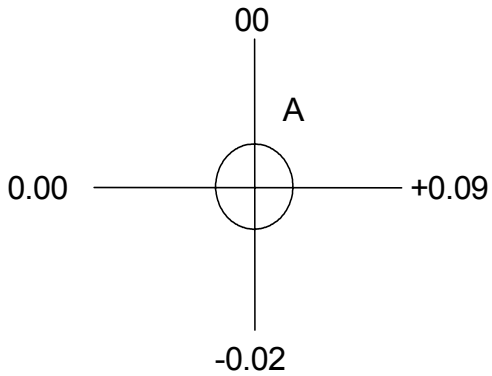




By Slip Gauge

Turbine to Gear Box Alignment readings:





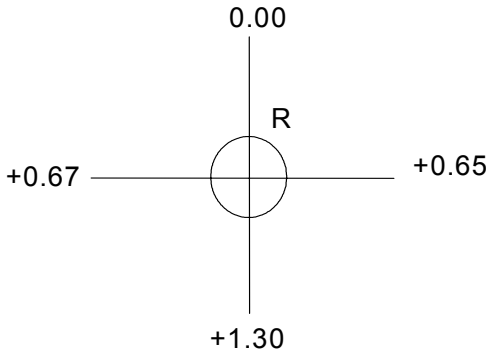
By Slip Gauge

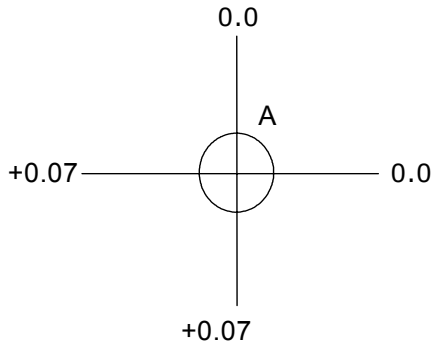
PREVENTIVE MAINTENANCE OF COOLING WATER PUMP (P-4402):

- Coupling between the pump and motor was decoupled.
- Both the journal bearings were checked & found okay.
- The clearances were checked & following are the readings. Free end side : 0.17 to 0.21 mm , Coupling side : 0.18 to 0.24 mm
- Both the bearing housing was flushed with oil & fresh oil (SERVO-PRIME 68) charged.
- Radiator cooling water line opened and box-up after cleaning of radiator.(Only Motor driven)
- Coupling oil paper replaced and new grease filled.
- The clearances were checked & following are the readings:

Sr. No.	Description	Actual Value (MM)
1	Front bearing clearance	0.22 to 0.23 mm
2	Rear end bearing Clearance	0.23 to 0.24 mm

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





By Filler gauge

PREVENTIVE MAINTENANCE OF COOLING WATER PUMP (P-4403), GEAR BOX & DRIVE TURBINE Q-4403 (TRIVENI)

Preventive Maintenance of Drive Turbine Q-4403 (Triveni):

The following Preventive Maintenance activities were performed in Triveni Turbine.

- Speed governor, main steam valve, relay, over speed trip bolt, Main Oil Pump, governor were overhauled and assembled back.
- Journal bearings were checked, polished and assembled.
- Journal Bearing clearance were checked & following are the readings.

Sr. No	Description	Actual Value (MM)
1.	Front bearing Clearance	0.20 - 0.21 mm
2.	Rear bearing Clearance	0.22 - 0.23 mm

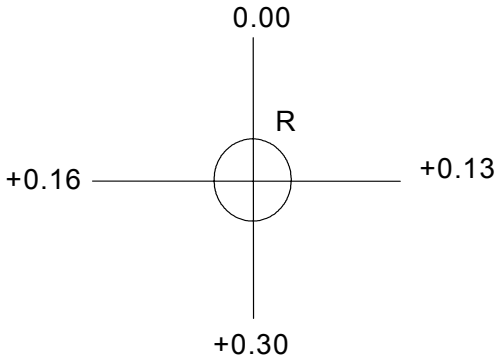
- Rotor thrust float : 0.30 mm

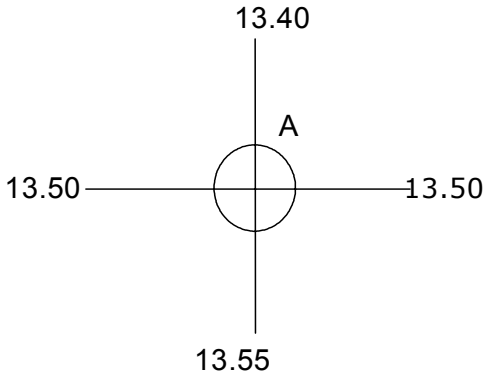
Cooling Water Pump (P- 4403):

- The journal bearings were opened, cleaned and checked for clearances.
- The coupling side journal & rear bearing were found ok.
- The rotor float was measured as 0.24 mm.
- Both side glands were repacked.

Sr. No	Description	Actual Value (MM)
1.	Front end bearing Clearance	0.20 - 0.21 mm
2.	Rear end bearing Clearance	0.22 - 0.23 mm

- The alignment readings are as under ;-



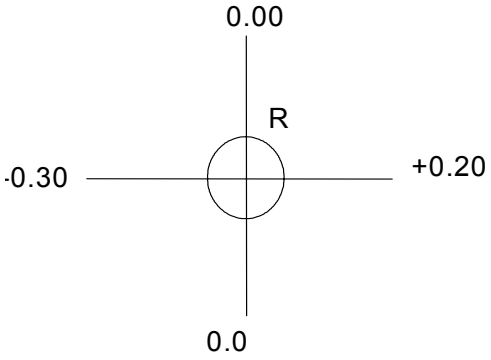


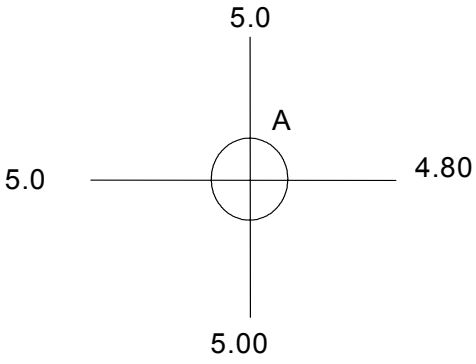
COOLING WATER PUMP (P-4401 / C):

- Checked the journal bearing Clearance at both ends.
- Coupling end 0.21 to 0.23 mm.
- The rotor float was measured as 0.35 mm.
- Cleaned & greasing done after coupling.
- Checked the alignment.

Sr. No	Description	Actual Value (MM)
1.	Front end bearing Clearance	0.21 - 0.23 mm
2.	Rear end bearing Clearance	0.21 - 0.23 mm

- The alignment readings are as under ;-

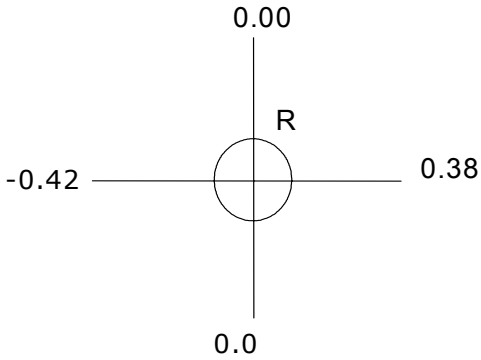


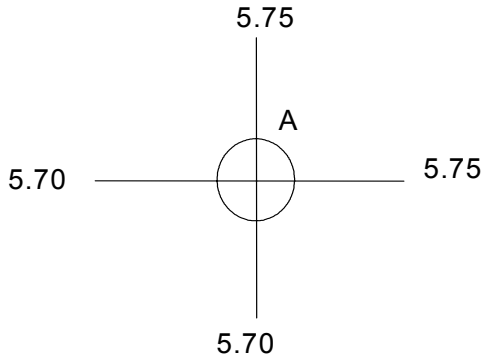


COOLING WATER PUMP (P-4401 / D):

- Checked the bearing Clearance at both end
- Coupling end 0.18 to 0.20 mm
- Free end 0.17 to 0.20 mm
- The rotor float was measured as 0.60 mm.
- Cleaned & greasing done after coupling.
- Checked the alignment & readings are as under ;-

Sr. No	Description	Actual Value (MM)
1.	Front end bearing Clearance	0.18 - 0.20 mm
2.	Rear end bearing Clearance	0.17 - 0.20 mm

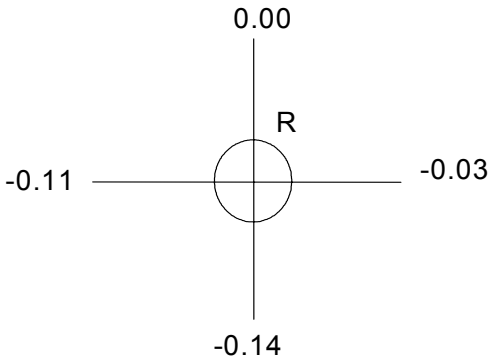


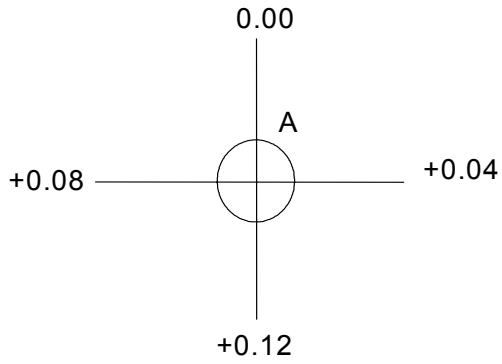


COOLING WATER PUMP (P-4404-E):

- Coupling float was checked after de-coupling and observed as 0.14 mm
- The pump to motor alignment was checked and corrected.
- Both bearing top half opened. Both side bearing checked, found in healthy condition.
- Bearing housing cleaned and fresh oil (SERVO PRIME 68) charged.

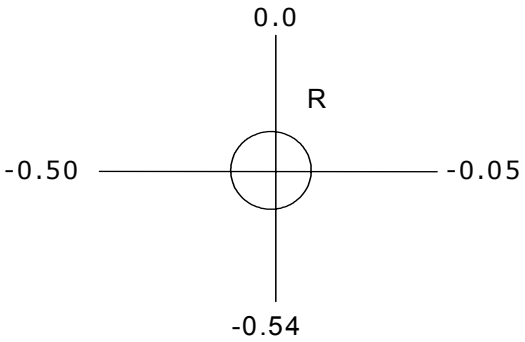
- The following are the alignment readings:

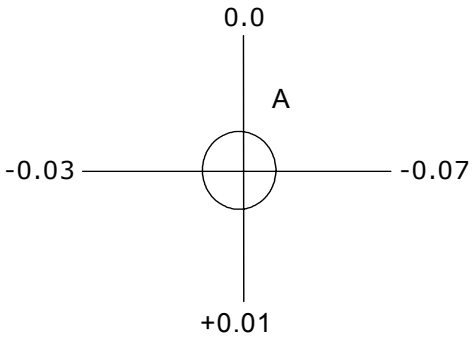




PREVENTIVE MAINTENANCE OF B. F. W TURBINE Q - 5111 :

- Cleaned the Radial & Thrust bearings.
- Checked the radial clearances of bearings using lead wire.
- Alignment readings were checked.
- The oil cooler covers were opened and hydro- jetting was carried out.
- Cleaning / replacing oil filters and oil in the oil console.
- Checked the oil lines, water line for leaks.
- Suction filter of the MOP was cleaned.
- The oil console was cleaned and fresh oil (servo-68) was charged.
- Alignment Readings: Pump to Turbine





- Readings were taken with inside micrometer
- The clearances were checked & following are the readings.

Sr. No.	Description	Actual Value(MM)
1	Axial Thrust	0.25 mm
2	Front bearing clearance	0.25 mm
3	Rear end bearing Clearance	0.17 to 0.18 mm

B F W PUMP P- 5111:

- Preventive maintenance was carried out on Pump.
- Bearing top halves were removed.
- Babbit metal lining of both the bearings were found debonded hence replaced with new one.
- 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.
- Very little chocking was observed in the BFW suction strainer with compared to previous shut-downs. It was cleaned and assembled.
- The clearances were checked & following are the readings.

Sr. No.	Description	Actual Value(MM)
1	Axial Thrust	0.30 mm
2	Coupling end Bearing Clearance	0.14 to 0.15 mm
3	FE Bearing Clearance	0.13 to 0.14 mm

B F W PUMP (MOTOR DRIVEN) P-5112:

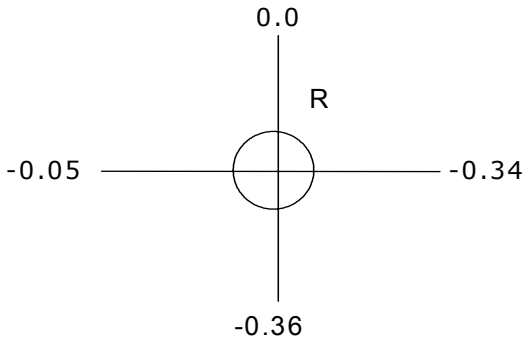
PREVENTIVE MAINTENANCE:

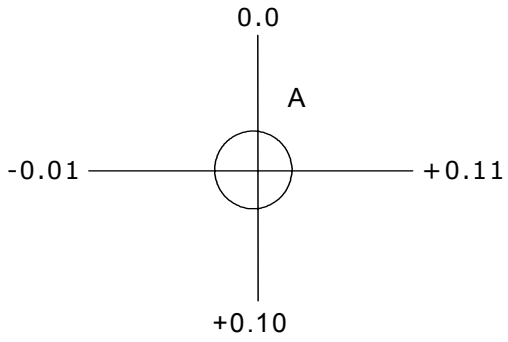
- Couplings between the Pump and Gear Box were decoupled after recording the necessary match marks.
- Initial alignment readings and axial float were measured and recorded.
- Bearing top halves were removed.
- Babbit metal lining of both the bearings were found debonded hence replaced with new one.
- Thrust collar and the bearings assembled, clearance checked and recorded.
- Oil tank & filter was cleaned.
- Oil cooler was opened and cleaned.
- Suction filter of the pump was cleaned.
- Gear Box oil was replaced with new oil. (Servo -68)
- Gearbox cooler cleaned.

PREVENTIVE MAINTENANCE OF GEAR BOX:

- Coupling between the Gear Box and Motor was decoupled after recording the necessary match marks.
- Initial alignment readings and axial float were measured and recorded.
- Bearing top halves were removed.

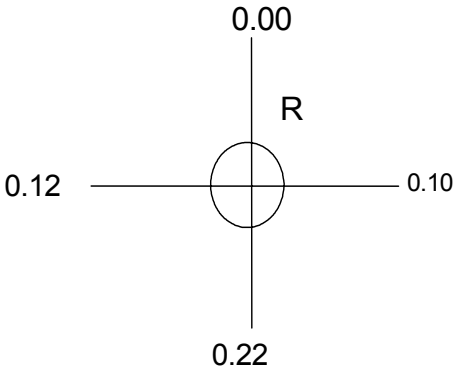
- The clearances were checked & following are the readings
- Bearing halves were cleaned and polished using green rouge.
- Gears were taken out, cleaned and inspected.
- Gears were re installed. Backlash was checked and noted.
- Bearings were assembled, clearance checked and recorded and boxed up.
- Gear Box cover O rings were replaced.
- Coupling is aligned with reference to match mark.
- Alignment reading between Gear Box to Pump.

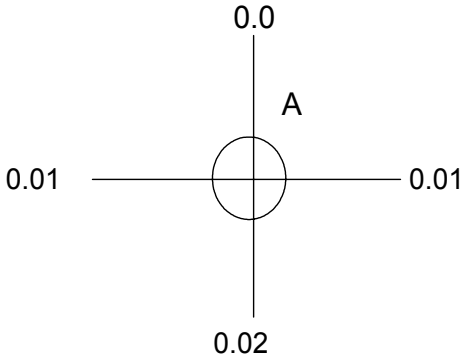




Measured by inside Micrometer

- Alignment reading between Gear Box to Motor





By slip gauge

Sr. No.	Description	Actual value (MM)
1	Radial bearing clearance coupling end	0.12 – 0.13
2	Radial bearing clearance free end	0.13 – 0.14
3	Gear wheel front bearing clearance	0.18 – 0.19
4	Gear wheel rear bearing clearance	0.18 – 0.19
5	Pinion gear front bearing clearance	0.17 – 0.18
6	Pinion gear rear bearing clearance	0.15 – 0.16
7	Pinion Gear thrust float	0.30
8	Gear backlash	0.45
9	Axial thrust of pump (after adjustment)	0.35

F. D. FAN TURBINE Q-5113 & F.D. FAN:

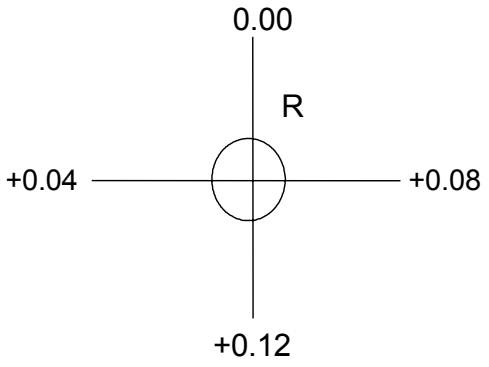
- Between turbine and fan coupling rubber pads were replaced.
- Gearbox cover is opened and checked the gears and brings. The same was cleaned, D.P. test was carried out and assembled back.
- Light dust was observed at main oil console. The same was cleaned and refilled with new oil (SERVO PRIME 68).
- The sentinel warning valve was checked and found OK.
- The air dampeners were attended for proper working. The Fan inlet air mesh screen was changed.
- The clutch oil (Servo Tran fluid-A) was replaced.
- The clearances were checked & following are the readings

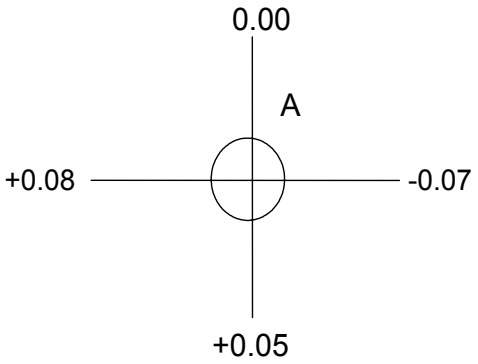
Sr. No.	Description	Actual Value(MM)	REMARKS
1.	Pinion bearing clearance front end	0.14	Same bearing Re- used.
2.	Pinion bearing clearance rear end	0.16	Same bearing Re-used.
3.	Gear wheel bearing clearance front end	0.12	Same bearing Re- used.
4.	Gear wheel bearing clearance rear end	0.14	Same bearing Re- used.
5.	Fan roller bearing clearance front end	0.10	Same bearing Re- used.
6.	Fan roller bearing clearance rear end	0.13	Same bearing Re- used.

- Pinion thrust float: 0.23.
- Gear wheel thrust float: 0.22.
- Backlash: 0.22

- **ALIGNMMENT BETWEEN GEARBOX AND FAN:**

FD Fan to Gear box: Clamp on fan & Dial on Gear Box:





STEAM LEAK & FABRICATION JOBS:

- All Steam leak jobs attended as per the Shutdown job list. Seven nos ½" x 800 # & two nos ¾" x 800# passing valves were replaced on Steam Traps lines on stem header.
- Fabrication jobs in Compressor house area was carried out as per job list.
- SS 304 patch plates were welded in cooling water lines in front of R.O. plant to avoid external corrosion.

BHEL BOILER JOBS (F-5111):

BHEL BOILER INSPECTION:

- Boiler was inspected by Boiler Inspector in open condition on 03.04.2008 & Hydrotest was carried out at 89.6 kg/cm2 pressure on 08.04.2008 and witnessed by Boiler Inspector.
- The nozzle seats of all three safety relief valves were in-situ machined by hand lapping, overhauled & assembled. The RVs were floated on 10.04.2008 and their readings were as follows.

Description	Popping Pressure Kg/cm2g	Reset Pressure Kg/cm2g
Drum Rear R.V.	71.9	69.2
Drum Front R.V.	69.3	66.3
Super Heater R.V.	64.54	62.82

- The following safety valves were overhauled, tested with nitrogen medium at test bench. The services of M/s Flotec Engg. Services, Surat were taken for overhauling of Relief valves. (Ref W.O. 20070196 dtd 15.03.2008)
- F.D.Fan turbine Exhaust line 4 ata Header R.V.

- 14 ata Automisation line R.V. This RV setting has been increased to 16.5 ata as per modified burner requirements.
- 40 ata Soot Blower Header R.V.
- 40 ata steam line RV of Q-5114.
- BFW turbine exhausts 4 ata R.V.
- LSHS supply pump turbine exhaust R.V.
- Steam drum connected all first and second isolation valves gland packing were repacked. The services of Efco Maschinenbau, India P. Ltd. were taken for valve gland repacking job. (Ref: WO No 9921481 dtd 22.01.2008).
- **13 Th Number** from top primary super heater coil was leaked & the same was plugged.
- All inspection window glasses were cleaned and replaced where ever found broken.
- All dampers of air duct were checked and made free by greasing for smooth operation.
- LRB-1 was taken for complete overhauling. The nozzle of lance tube of LRB was found burn out. The feed pipe & lance tube (146012459210) were replaced and assembled.
- The seal air line NRVs were checked and found working normal.

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 found healthy.
- Both End Rotor Bearings (Spherical self aligning, withdrawal sleeve 22330 CCK /C3 / W 33) housing were open for inspection. The condition of bearings were found o.k. Boxed-up and fresh oil (C: 100, 5 liters) charged.
- RAH Gear Box with sprocket with electric motor was replaced. Re conditioned gearbox lying in stores was used. (Code : 335702001)
- Bearings Clearances were checked by filler 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. The coupling bolts of motor of this unit were replaced. Coupling pad (L-95) was also replaced.

Cooling Tower Jobs:

- The wooden structure of all Cooling tower cells was inspected by M/s Paharpur Cooling Tower Pvt Ltd, Vadodara and a committee of IFFCO Officials duly nominated by GM. Scheduled preventive maintenance is planned over a period of three years for revamping of cells as recommended by M/s PCTL.
- 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 and 3 nos. of partition walls were made to facilitate the complete revamping of ammonia cooling tower cells (A1 to A3) in future.

DM PLANT JOB:

- S-1 & S-2 tank outlet & Drain valve diaphragm were replaced.
- The diaphragms of all five SMB units inlet lines were replaced.
- The Degasser tower sump was opened and all first valves were attended.

PAINTING JOBS CARRIED OUT:

- Cooling water return header on the top of new cooling tower. their readings were as follows.

B & MH PLANT

RECLAIM MACHINE M - 2116 :

Reclaim machine was taken for overhauling. Overhauling was carried out under the supervision of M/s EMTICI, V.V. Nagar against IFFCO W.O. No.:15/00611/9921483 dt.12/01/2008. The following major jobs were carried out:

Main Drive gear box:

- Checked the Bearings of chain sprocket shaft & chain, found in good condition.
- Aligned the gear box with motor & coupled with new Coupling bushes.
- Fluid coupling checked, found in good condition. Replaced the oil.

Overhauling of Bucket Elevator Assembly

The following activities were carried out after thorough inspection of complete bucket elevator assembly:

- Replacement of complete Bucket elevator chain including Buckets with complete new assembly.
- Take-up unit was overhauled - cone washer set replaced. Checking & lubrication of bearings, shaft & sprockets was carried out.

Overhauling of scraper chain Assembly

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

- New scrapper shaft was assembled with new bearings, new sleeves & repaired Big & Small housings.
- Sprocket was found damaged during checking & replaced with repaired sprockets.
- Replacement of the scrapper chain with new scrapper chain.
- Scrapper chain End bearing block replaced with new one.
- Cone washer replaced with modified Belleville spring washer (complete set of 14 Nos.).procured from M/s International Industrial Springs, Mumbai against P.O. No. 20070326 Dated 14/03/2008
- Assembly of the scrapers & proper tightening and tack welding of nuts to avoid looseness during running.
- Chain was tightened and required tension was given by adjusting tie rod.
- Idler pins were found in good condition. Gear trains wheels were assembled & End cover boxed up.

Traveling Gear box

- Gear box checked found good condition& coupled with new bushes after checking alignment.
- Chain & chain sprocket cleaned and checked, found in good condition.

Slewing Gear box

- Existing gear box top cover found damaged .Replaced the gear box with repaired gear box. Coupled the gear box with new bushes after proper alignment with motor.
- Replaced output shaft pedestal block with bearing, sleeve, washer and nut & assembled with hub & pinion after proper alignment.
- Dismantled complete assembly of Slewing rack, found the slewing rack pins surface are damaged. Assembled with new hardened pins (Nitriding process done).Plasma Nitriding was done for all the new pins through M/s Metal Treat, Ahmedabad against W.O. No. 9921277 Dated 01/11/2007.Surface hardness of the pins was 45 HRC after nitriding.

King Post Assembly

- After removing the Discharge chute & Link conveyor, top king post was removed & found that inner plate surface of the king post was damaged. Rollers & their pins were found damaged. Repaired the damaged surface with welding (TIG welding with 45400 W hard facing steliting filler wire) after proper preheating at 150^{o} and then machining done to get the required size. D.P.test was done on the built up and machined area, scattered porosities were observed .No further defects were detected in D.P.test. All the rollers & pins were replaced with new one.
- Guide roller bracket assembly of bottom King-post inside the bunker of reclaim machine was removed and cleaned. Some portion of seating area was found worn out. The worn out area was built up by TIG welding process using the same stelliting filler wire. Then grinding and buffing was carried out. The proper matching of roller seating portion & diameter was maintained. The rollers were assembled and greasing carried out.

Link conveyor

- Pivot assembly of link conveyor was found in good condition
- Checking of head end & tail end pulley bearings found good condition.
- Gear box checked & 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 Gear box.

- Thruster oil replaced and brake shoes checked.
- Cardium compound provided on wire rope of hoisting mechanism.

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.

Spare Parts replaced in Reclaim machine

The following parts were replaced during overhauling:

- Scraper shaft, Bearings, Sleeves, Chains & End bearing block.
- Bucket elevator assembly.
- Belleville spring washer for scrapper chain.
- Spring washer for Bucket elevator chain.
- Roller & Pins of king post.(Partially replaced)
- Repaired gear box of slewing gear box.
- Slewing rack pins.

CONVEYOR M-2110 :

Following jobs were carried out.

- Replaced the Complete length of conveyor belt with new Conveyor belt (145 meter length & 800 mm width) NN 630 / 4 M/s Nirlon make procured against P.O.No.9921429 Dated 02/01/2008
- Preventive maintenance of Gear Box carried out & coupling done after proper alignment.
- 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.

CONVEYOR M - 2112 :

Following jobs were carried out :

- Preventive maintenance of Gear Box carried out & Coupling done after proper alignment.
- Replaced Gravity bend pulley with both end bearings.
- All noisy and damaged carrier, guide and return rollers replaced with new rollers.
- Greasing done in all bearings of head pulley, tail pulley, snub pulley and gravity pulley.
- Tripper Gear box over hauled and realigned with motor.
- Tripper wheel axle (Malathion plant side) bearings were replaced.

Complete cleaning of conveyor structure done.

CONVEYOR M-2117 :

Following jobs were carried out

- Preventive maintenance Gear Box and Coupling done after proper alignment.
- 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

- Replaced the Complete length of conveyor belt with new Conveyor belt (230 meter length & 800 mm width) with new NN630 / 4 M/s Nirlon make.
- Preventive maintenance of Gear Box carried out and Coupling done after proper alignment.
- Diverter flapper valve of M-2121 conveyor attended for free and easy operation.
- Air cylinders overhauled.
- Tail pulley, Gravity take-up pulley and Snub pulley replaced with rubber lagged pulley.
- Complete skirt board sealing system skirt blocks replaced with new one.
- Replaced all damaged and noisy Carrying, Return, Impact and guide rollers with new rollers.
- Complete greasing of all pedestal bearings done.
- Complete cleaning and painting of structure done.

CONVEYOR M - 2122 :

Following jobs were carried out

- Replaced the Complete length of conveyor belt with new Conveyor belt NN400/ 4 “Indus “Hindustan rubber make belt.
- Preventive maintenance of Gear Box and Coupling done after proper alignment.
- Replaced all damaged and noisy Carrying, return and guide rollers with new rollers.
- Skirt rubbers were replaced.
- Removed tripper assembly along with gearbox and motor.
- Complete greasing in all pedestal bearings done.
- Complete cleaning and painting of conveyor structure done.

CONVEYOR M - 2122 A:

Following jobs were carried out

- Replaced the Complete length of conveyor belt with new Conveyor belt NN400/ 4 “Indus “Hindustan rubber make belt. .
- 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
- Skirt rubber replaced.
- Cleaning and painting of complete structure done.

CONVEYOR M - 2122 B:

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 Skirt rubber with new one.
- Cleaning and painting of complete structure done.

CONVEYOR M - 2142 :

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

- Replacement of oil, oil-seals, coupling bolts and bushes.
- All damaged return rollers overhauled.
- All carrying rollers attended for free operation.
- New skirt rubber with inner rubber sheet 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 and painting of complete structure done

PREVENTIVE MAINTENANCE OF PACKER SCALES :

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

- Replacement of old gate assembly with modified gate assembly in packer scale no.1,2,3,4,7&8 procured from M/s PBL against P.O.No.9920540 Dated 30/05/2007.
- Overhauling of bucket assembly.
- Over hauling of bottom flapper assembly.
- Overhauling of sack grip assembly.
- Servicing of all cylinders.
- Alignment of stabilizer plate.
- Complete weighing machine replaced with PBL make weighing machine at packer scale no.9A procured against P.O.No.9921475 Dated 12/01/2008
- Calibration of packer scales.

SLAT CONVEYOR M-2124

Following jobs were carried out on all six slat conveyors

- Preventive maintenance of Gear box done.
- Gear box replaced at Slat conveyor no. 2 & 3 by new gear box and at slat conveyor no.4 by reconditioned gear box.
- Conveyor adjusting mechanism servicing.
- Cleaning and painting of all slat conveyors.

WAGON LOADER:

Following jobs were carried out.

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

TRUCK LOADER:

Following jobs were carried out.

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

AMMONIA PLANT

The following major inspection activities were performed in Ammonia Plant.

1. Inspection of primary reformer, catalyst tubes and risers with various NDT Techniques. Details are given at **Annexure-1 to 3**

2. Visual inspection of equipment.

3. Inspection of steam drum (GT-1632) and its related pipelines and equipment based on RLA study action plan.

4. Ultrasonic flaw detection and Radiography of New Converter(S-50) loop on selected weld joints and parent metal of elbows.(from 108D to 107C /105D to 108D.Details at **Annexure-4**

5. Thickness measurement of various equipment was carried out .Details are attached at **Annexure-5**

6. Thickness measurement of various pipelines was carried out .Details are attached at **Annexure-6**

7. Measurement of residual magnetism at various parts of rotating equipment and demagnetization of the same wherever required. Details are given at **Annexure-7**

8. Insitu metallography of selected equipment and pipelines were carried out.. Detailed summary of observations and microstructure analysis is given at **Annexure-8**

9. Inspection of newly fabricated pipelines and fabrication jobs carried out departmentally by Maintenance and Technical department.

10. Qualification tests of welders employed by contractors.

11. D.P.test & Radiography of weld joints related to Replacement of 102-C.

12. Tube Thickness measurement of leaky tube bundle of 101-CB on random basis was carried out**.** Detailed summary of observations is given at **Annexure-9**

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.

1.0 PRIMARY REFORMER 101-B:

1.1 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 316 nos. of tubes and between 0.17 to 0.70 % in 18 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 - 1.10 % for all 8 nos. of Riser tubes. The report is attached at **Annexure-2.**
- Spring hanger readings of catalyst tubes in cold condition were taken. The report is attached at **Annexure-3.**

1.2 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.
- Few bolts of west wall sheet were found missing/damaged.

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.
- Roof plate was found sagged/loosened at few locations.

2.0 AUXILIARY BOILER

HOT WELL AREA:

- North and West side Cladding sheet got distorted and also burnt off at various locations.
- Old distorted cladding was removed from east side to fix new sheet.
- Distributor plate for the flue gas got badly distorted at its bottom portion and at West side. The stiffeners were also badly damaged at scattered locations.

3.0 RLA STUDY RELATED EQUIPMENTS:(GT-1632)

Visual inspection, Dye penetrant testing, Insitu Metallography, Ultrasonic Flaw Detection,Hardness measurement of the following equipment / pipelines / structures was carried out as per the five year action plan recommended after RLA study carried out during June 2003. Observations made are mentioned as below.

3.1 VISUAL INSPECTION

(A) 101-F, STEAM DRUM:

- Grayish black coloration 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.

(B) Steam Superheater Coils

- Supports of LT/HT steam super heater coils were found in satisfactory condition.
- HT and LT super heater coils were found in satisfactory condition.
- Overall condition of the coils found satisfactory.

(C) High Temperature Headers

- Visually found in satisfactory condition.
- No surface defects observed.

(D) Auxiliary Boiler Coils

- Tubes of coil A&C found visually satisfactory.
- Minor pittings were observed on tubes of coil B at scattered locations. In general condition of the tubes were found satisfactory.
- Condition of the headers found satisfactory.

(E) Main Steam Pipes

- Main steam pipelines from super-heater coils outlet to Syn. gas compressor was visually inspected after removal of insulation at various places. Minor scales and pittings were observed. Overall condition of the pipeline was found satisfactory.

(F) Heat Exchangers (101 CA & CB, 103C)

- Nozzles weld joint of BFW inlet and outlet line were checked visually, no abnormality was observed. Condition of the weld joints were found satisfactory.

(G) Structure and Supports

- The structural supports of steam drum, heat exchangers & other pressure components were visually checked and found satisfactory.

3.2 DYE PENETRANT TESTING

(A) 101-F, STEAM DRUM:

- Accessible portion of long seams and circumferential seams from inside. No significant indications observed.
- All the accessible nozzle joints from inside – No significant indications observed.

(B) High Temperature Headers

DPT of selected weld joints of tube to header and header to pipe of LT superheater header- No significant indication observed.

(C) Main Steam Pipes

DPT of selected weld joints of main steam pipe - No significant indication observed.

(D) Heat Exchangers (101 CA & CB, 103C)

DPT of weld joints of nozzles of above heat exchangers - No significant indication observed.

3.3 INSITU METALLOGRAPHY

Replica was taken on weld joint of dish end to shell of steam drum covering parent metal, HAZ and weld from inside, High temperature header, Auxiliary Boiler coils, steam pipe line and nozzles of heat exchangers 101-CA, 101-CB and 103-C.

3.4 ULTRASONIC FLAW DETECTION

UFD of selected weld joint of main steam pipe was carried out & no significant indication observed.

3.5 HARDNESS MEASUREMENT

Sr. No.	Pressure Part	Hardness Readings in BHN		
		Weld	HAZ	Parent metal
1	LT superheater coil	160	128	132
2	HT superheater coil	235	135	125
3	Aux. boiler A coil	-	-	128
4	Aux. boiler B coil	-	-	134
5	Aux. boiler C coil	-	-	129

4.0 VESSELS AND OTHER EQUIPMENT:

4.1 101CB PRIMARY WASTE HEAT BOILER

Tube bundle of 101CB was found leaked during hydro test, hence it was removed from the shell. Before inserting the new tube bundle, shell was offered for visual inspection:

Visual inspection was carried out and observations were as under:

- Severe pittings upto the depth of 2mm were observed on weld joints as well as on shell area, particularly in top half of shell.
- Minor bulging was observed at bottom portion of shell.
- Few loose refractory pieces were found lying at the bottom.
- Condition of Gas Inlet Distributor was satisfactory.
- Condition of Gas Outlet Nozzle was satisfactory.
- Ultrasonic thickness measurement of tubes on random basis was measured. Detail report is given in **Annexure-9.**

4.2 103-D, SECONDARY REFORMER:

BOTTOM DOME :

- Erosion of refractory and scattered cracks was observed at few locations and same were found more prominent around both the gas inlet nozzles.
- Skirt liner was found buckled inward (away from shell) at scattered locations but it was prominent in south-east direction.

101-CA/CB GAS INLET NOZZLE

- Inward bulging and distortion of liner plates was observed in both 101-CA and 101-CB gas inlet paths.

4.3 107-C, M.P BOILER:(From outside)

Vessel inspection was carried out from top man hole from outside and observations are as under :

- Internal was found intact in position.
- Overall condition of the vessel was found satisfactory

4.4 107 - D ,TRANSFER LINE:(From outside)

- 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.

4.5 102-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.
- Stiffener pipe welding of distributor header support was found broken.
- U-Clamp holding nuts found missing/loose condition.
- South-west side distributor header was found sliding with the shell plate causing dent in the shell plate.

4.6 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 comparison to adjacent shell surface.
- Condition of bubble caps found satisfactory.
- Grinding mark(2mm deep x 3 mm wide x 1.5 feet long approx) observed on top dished end on south side.
- Some of the tray holding nuts and bolts found loose/missing.

SECOND (FROM TOP) MANHOLE COMPARTMENT:

- Rectangular riser box and other fittings found intact in position.
- Holding bolts of tray found loose at scattered locations.
- 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.
- One no. bolt of south side flange of 3” line was found missing.

4.7 105-E, AMMONIA WASH UNIT

Visual inspection of Ammonia wash unit was carried out and following observations were made :

FROM TOP MANHOLE

- Demister pads were found intact in its position.
- Oily surface and dirt was observed on the tray with caps, need to be cleaned.
- Reddish brown colouration was observed on the shell.
- One no. nut was found lying on the tray.
- 01 no. cap was found loose in mid segment, marked and need to be tightened. 01 no. cap towards south-east was found bent, marked & need to be straightened.
- 01 no. clamp of vertical stiffener plate in the skirt area just below Manhole was lying down & need to be placed.

FROM BOTTOM MANHOLE

- Reddish brown colouration was observed on the shell.
- Foreign particles and metal pieces were found lying in the perforated Gas inlet nozzle spool piece. Drain holes on the bottom of the same were found choked.
- Liquid ammonia outlet line vortex breaker was found intact.

4.8 101-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 .
- Six nos. of fastening clamps below the East/West side separator plates were found loose.
- One fastening bolt of 6" distribution pipe inlet flange was found loose.
- Holes of 6" distribution pipe found enlarged in haphazard shape.
- Deep cavities approx. 3mm. to 3.5mm. deep and 5mm. in dia. were observed on east side shell near circumferential weld joint of shell to South side dish end.

4.9 102-F , RAW GAS SEPARATOR

- Epoxy paint condition was found satisfactory.
- One segment of demister pads was found missing. Condition of remaining demister pad segments was found satisfactory.
- Corrosion attack was observed on inside face of manhole nozzle. Suitable protective coating may be applied at this location.
- 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.
- Minor corrosion attack was observed inside the gas inlet nozzle located at east side of the vessel.

4.10 103-F, REFLUX DRUM

- Demister pads were found intact in its position.
- Epoxy paint was found peeled off from the few small scattered locations at the bottom half of the vessel. However epoxy primer was found intact at such location.
- Minor corrosion has started at inner edge and weld joint of Man way nozzle. Marked with yellow chalk.
- Corrosion has occured at the weld joint of Co2 inlet line flange with vessel stub end from inside, causing pittings upto the depth of 3-4 mm, suitable corrective action is recommended. Marked with yellow chalk.
- Loose metallic pieces of various sizes, having maximum 8 inch long sizes and metallic dust were found lying at the dish end of the vessel.

4.11 104-F, SYN GAS COMPRESSOR SUCTION SEPARATOR

- Demister pad condition was found satisfactory.
- Scattered thin 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.
- Water was found lying at the dish end.

4.12 105-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.

4.13 107-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.

4.14 109-F, REFRIGERANT RECEIVER:

- The shell had assumed Grayish black coloration.
- 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 pittings / 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.

4.15 110-F, FIRST STAGE REFRIGERANT FLASH DRUM

- Brownish black colouration was observed inside the drum.
- Oil layer was found on the surface of shell.
- The Demister pad was found intact in position.
- Scattered mill scales were observed on the surface of the dish ends and shell.
- Overall condition of the vessel was found to be satisfactory.

4.16 111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

- The shell inside surface had assumed blackish gray coloration.
- Entire internal surface was found oily.
- The demister pads were found intact in position.
- Scattered scales were observed on both the dished ends.
- Condition of all nozzle and shell weld joints was found satisfactory.
- Overall condition of the shell was satisfactory.

4.17 112-F, THIRD STAGE REFRIGERANT FLASH DRUM

- The demister pads were found intact in position.
- The coloration of the inside surface of shell was dark blackish.
- Surface of the vessel was found oily.
- Hard scales were observed in the shell which were more prominent on the dished ends.
- Condition of all nozzles was found satisfactory.
- Condition of all weld joints was found satisfactory.

4.18 H-110, NAPHTHA PREHEATER:

- Cracks were observed on the shell refractory lining.
- Foreign particles as well as loose refractory materials were found lying surrounding the burner, proper cleaning is required.
- Tube support condition was satisfactory.
- Minor damage was occurred on bottom floor refractory linining
- Thin scales were observed on tube surface.

4.19 H-111, NAPHTHA SUPERHEATER

- Cracks were observed on the shell refractory lining.
- Bottom floor refractory was found damaged, particularly surrounding the manhole.
- Foreign particles as well as loose refractory material were found lying surrounding the burner, proper cleaning is required.
- Tube support condition was satisfactory.
- Edge of central pipe of the burners were found cracked / damaged and their burner tips were found missing.
- Scaling was observed on burner parts, proper cleaning is required.
- Pipe of one of the burner was found dislocated, corrective action is required.

4.20 R-112,PREREFORMER

- Crack approx. 4" long was observed on the weld of nozzle I.D. to stiffener annular circular rib. Confirmed by DP test. Marked for repair (Dump-out nozzle).
- Perforated holes of thermowell pipes found to be clogged.
- Wire mesh above the alumina balls (bottom) observed distorted and in damaged condition.
- Overall coloration of internal surface of the vessel observed grayish black.

5.0 MISCELLANEOUS JOBS:

5.1 WELDER QUALIFICATION TESTS:

- Performance qualification test of 20 Nos. welders offered by M/s General Engineering was carried out. 07 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 11 Nos. welders offered by M/s Shri Ganesh Engg. was carried out. 08 nos. of welders were qualified during the test. These welders were allowed to perform welding on various steam and process line modification work.
- Welder qualification test of 05 Nos. welders of M/S. Sayyed & Co. was carried out. 02 welders were qualified. These welders were qualified for performing general purpose welding jobs.
- Performance qualification test of 03 Nos. welders offered by M/s Skywin Erectors was carried out. 02 nos. of welders were qualified during the test. These welders were allowed to perform welding HP steam line and 102-C tube/plug welding job.

5.2 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.

5.3 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.

5.4 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-8**

5.5 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-4**

5.6 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-5** (for equipment) and **Annexure- 6** (for pipelines).

5.7 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-7**

5.8 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.

5.9 OVER SPEED TRIP TEST:

Before startup, speed measurement and vibration measurement of 101-BJ Turbine, 104-JAT,104JT, 103-JAT were carried out.

ANNEXURE-1 (1/3)

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

1 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:

1.1 BURNER BLOCKS: Following burner blocks were found damaged:

Burner Row No.	Burner Block No.
1	4,7,8,9,10
2	1,2,3,4,5,6,9,10,13
3	4,5,9,10,11,13
4	5,8,9,10,12,14
5	1,2,3,5,6,9,10
6	2,3,5,6,8,10,11,12,13,14
7	3,4.5.6
8	2,3,7,8,9,12
9	6,10,13

1.2 BOTTOM HEADER INSULATION:

Header insulation was found damaged near following tube nos.:

Header No.	Tube nos where insulation found damaged
1	15-16
2	16-17
4	21
5	10-13
7	1

1.3 ROOF INSULATION:

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

- Burner no. 4 of burner row no.9
- Riser of row no. 8
- Near tube no. 831 & 839
- Between burner no. 2 &3 of burner row no. 8
- Near tube no. 723
- Near tube no. 516 - 520
- Near tube no. 415
- Near tube no. 430-432
- Near tube no. 324

ANNEXURE-1 (2/3)

1.4 REFRACTORY WALLS:

East Wall:

- Zig zag surface was observed at south end.
- A crack was observed at approx. 5mt. height from tunnel slab level in approx. 1 mt length.
- Loose brick pieces were observed at appx. I mt. height from tunnel slab level at south end.
- Gap was observed in vertical joints.
- Erosion of top layer of refractory was observed at top south end.
- Bricks were found damaged at appx 2 mt. height from tunnel slab level ,just above the manhole.

South Wall:

- Excessive gap observed at the joints of brick panel at the location of tube row no. 4 & 5 at appx. 3 mt. above the tunnel slab level.
- Minor erosion of top panel of refractory brick was observed at the location of burner row no. 3,4 & 9, just above the peep holes.

1.5 TUNNEL SLAB:

1 no. of tunnel slab was found damaged in burner row no. 3, 4 & 9 each.

2 CONVECTION ZONE:

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

2.1 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.
- Few bolts of west wall sheet were found missing/damaged.

2.2 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.
- Roof plate was found sagged/loosened at few locations.

Annexure – 2 (1/5)

TUBE NOS 101 TO 242
CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

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

Annexure – 2 (2/5)

TUBE NOS 301 TO 442
CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
301	X			401	X		
302	X			402	X		
303		X		403	X		
304	X			404		X	
305	X			405	X		
306	X			406		X	
307	X			407		X	
308	X			408		X	
309	X			409	X		
310	X			410	X		
311	X			411	X		
312	X			412	X		
313	X			413		X	
314	X			414	X		
315	X			415	X		
316	X			416	X		
317	X			417	X		
318	X			418	X		
319	X			419	X		
320	X			420	X		
321	X			421	X		
322	X			422	X		
323	X			423	X		
324	X			424	X		
325	X			425	X		
326	X			426	X		
327	X			427	X		
328	X			428	X		
329	X			429	X		
330	X			430	X		
331	X			431	X		
332	X			432	X		
333	X			433	X		
334	X			434	X		
335	X			435	X		
336	X			436	X		
337	X			437	X		
338	X			438	X		
339	X			439	X		
340	X			440		X	
341	X	X		441	X		
342	X			442	X		
Total	40	02		Total	36	06	

Annexure – 2 (3/5)

TUBE NOS 501 TO 642
CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL:

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

Annexure – 2 (4/5)

TUBE NOS 701 TO 842
CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL

Tube No.	Creep in Percentage			Tube No.	Creep in Percentage		
	0 – 0.17	0.17 – 0.7	0.7 – 1.55		0 – 0.17	0.17 – 0.7	0.7 – 1.55
701	X			801	X		
702	X			802	X		
703	X			803	X		
704	X			804	X		
705	X			805	X		
706	X			806	X		
707	X			807		X	
708	X			808	X		
709	X			809	X		
710	X			810	X		
711	X			811	X		
712	X			812	X		
713	X			813	X		
714	X			814	X		
715	X			815	X		
716	X			816	X		
717	X			817	X		
718	X			818	X		
719	X			819	X		
720	X			820		X	
721	X			821	X		
722		X		822	X		
723	X			823	X		
724	X			824		X	
725	X			825	X		
726	X			826	X		
727	X			827	X		
728	X			828	X		
729	X			829		X	
730	X			830	X		
731	X			831		X	
732	X			832	X		
733	X			833	X		
734	X			834	X		
735	X			835		X	
736	X			836	X		
737	X			837	X		
738	X			838	X		
739	X			839	X		
740	X			840	X		
741	X			841	X		
742	X			842	X		
Total	41	01		Total	36	06	

Annexure – 2 (5/5)

RISERS

CREEP MEASUREMENT OF PRIMARY REFORMER RISER TUBES AT SLAB LEVE

Riser No.	Creep in Percentage		
	0 – 1.10	1.10 – 1.4	1.4– 1.55
1	X		
2	X		
3	X		
4	X		
5	X		
6	X		
7	X		
8	X		

Annexure – 3 (1/1)

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

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	0	-2	-2	-5	-7	-10	-9	-18	-10	-5	-3	0	-7	-2	-3	0	0	0	0	2	2	5
2	-5	0	-1	-5	-3	-2	-4	-6	-3	-3	-4	0	0	0	-5	-4	-6	0	2	0	0	0
3	-2	-2	0	-4	-7	-5	-5	-4	-5	-3	0	0	0	0	-2	-2	-2	0	0	0	2	2
4	8	5	2	0	0	0	0	0	7	0	2	0	0	-3	0	0	0	0	0	2	2	3
5	10	10	5	2	1	0	0	0	0	0	0	2	0	0	0	0	2	4	5	4	4	0
6	-1	7	4	5	0	2	0	0	0	0	0	0	-4	8	-2	0	-2	0	4	5	7	7
7	0	5	0	-2	0	0	2	0	0	1	0	-3	0	-5	-5	-6	-4	-4	-1	2	5	6
8	0	0	0	0	0	0	-3	0	0	0	0	0	0	0	-3	-1	0	0	0	4	2	6

TRANSFER LINE SPRING HANGER LOAD READINGS(in mm.)

ROW	1	2	3	4	5	6	7
READINGS	-40	-35	-28	-37	-44	-22	-18

BOTTOM DRAIN READINGS(in mm.)

ROW	1	2	3	4	5	6	7	8
READINGS	95	95	97	98	98	98	97	93

AUXILIARY BOILER SPRING READINGS(in mm.)

SPRING	S-E	N-E	S-W	N-W
READINGS	64	64	65	63

Annexure – 4 (1/1)

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	10	No significant defects were observed.
2	SG-1303-08-10”	10	120	SG-1303-08-14” (105-D)	108-D	08	
3	SG-1303-11-14”	14	140	107-C	123-C	12	
4	SG-1303-10-14”	14	120	108-D	107-C	10	
5	SG-1303-02-14”	14	100	121-C	137-C	10	
6	SG-1303-06-14”	14	100	121-C	124-C	14	
7	SG-1303-01-14”	14	100	120-C	SG-35-12	08	

Annexure – 5 (1/4)

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	103 – C	Primary Shift Effluent Waste Heat Exchanger	55.56	58.4	-	20.63	29.80	-	-	-	-
2	104 – C	Methanator Feed Heater	17.46	17.80	-	19.05	22.30	-	19.05	20.30	-
3	106-C	Shift Effluent Feed Water Heater	6.35	6.80	-	15.08	16.00	-	15.08	19.70	-
4	108-C1A	aMDEA Solution Cooler	12.70	12.00	5.51	12.70	15.40	-	12.7	12.80	-
5	108-CB2	aMDEA Solution Cooler	12.70	12.50	1.57	12.70	14.90	-	12.7	13.1	-
6	109-CA-1	aMDEA Solution Exchanger	12.70	12.20	3.93	12.70	14.40	-	25	25.2	-
7	109-CA-2	aMDEA Solution Exchanger	12.70	11.20	11.81	12.70	14.50	-	25	25.3	-
8	109-CB-1	aMDEA Solution Exchanger	12.70	13.30	-	12.70	14.10	-	25	24.9	0.4
9	109-CB-2	aMDEA Solution Exchanger	12.70	13.50	-	12.70	14.20	-	25	24.0	4.0
10	110-CA	CO2 Stripper Condenser	15.87	15.70	1.07	15.87	-	-	15.87	14.60	8.0
11	110-CB	CO2 Stripper Condenser	15.87	12.70	19.97	15.87	-	-	15.87	11.30	28.79
12	114-C	Methanator Effluent Feed Water Heater	58.00	59.0	-	18	19.1	-	15.87	-	-
13	115-C	Methanator Effluent Cooler	12.50	12.50	-	12.50	14.00	-	17.46	-	-
14	116-C	Synthesis Gas Compressor Interstage Cooler	11.11	9.10	18.09	11.11	12.1	-		33.4	-
15	124-C	Synthesis Gas Compressor After Cooler	20.00	22.3	-	16.00	19.60	-	88.9	92.80	-
16	127-CA	Refrigent Condenser	18.00	17.70	1.66	-	-	-	16.00	15.2	5.0
17	127-CB	Refrigent Condenser	18.00	18.30	-	-	-	-	16.00	14.6	8.75
18	128-C	Refrigerant Compressor Inter Cooler	NA	11.20	-	-	-	-		12.20	-
19	129-JC	Air Compressor Inter Stage Cooler No.1	12.00	12.70	-	-	-	-	-	-	-
20	130-JC	Air Compressor 2nd Stage Cooler	12.0	12.60	-	-	-	-	-	-	-
21	131-JC	Air Compressor 3rd Stage Cooler	15.80	16.0	-	-	-	-	-	-	-

Annexure – 5 (2/4)
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.
22	136-C	Synthesis Gas Methanator Feed Exchanger	15.80	15.6	1.26	NA	32.8	-	NA	33.4	-
23	150-C	Fuel Preheat Exchanger	8.38	9.7	-	12.70	12.30	3.14	12.7	12.5	1.57
24	151-C	Fuel Preheat Exchanger	8.38	8.30	-	9.52	8.1	14.91	8.38	8.2	2.14
25	170-CA	Condensate Stripper Feed Bottom Exchanger	9.50	9.10	4.21	-	-	-	NA	14.90	-
26	170-CB	Condensate Stripper Feed Bottom Exchanger	9.50	9.10	4.21	-	-	-	NA	13.30	-
27	171-C	Condensate Stripper Reboiler	NA	8.80	5.26	-	-	-	-	-	-
28	174-C	Boiler Blowdown Cooler	NA	9.50	-	-	-	-	-	-	-
29	173-C	Stripped Condensate Cooler	9.50	9.0	-	-	-	-	-	-	-
30	106-D	Methanator	44.50	45.10	-	43.70	-	-	-	-	-
31	104-E	Condensate Stripper	12.50	11.40	8.8	11.10	13.90	-	-	-	-
32	114-F	aMDEA Storage Tank	4.76	4.70	-	4.76	4.80	-	-	-	-
33	142-F	New Instrument Air Receiver	NA	13.70	-	NA	11.60	-	-	-	-
34	156-F	Blow Down Drum	11.11	11.0	-	NA	12.20	-	-	-	-
35	157-F	Process Gas Separator	19.84	22.70	-		-	-	-	-	-
36	158-FA	Natural Gas Separator	24.00	23.70	1.25	24.00	22.90	4.58	-	-	-
37	158-FB	Natural Gas Separator	24.00	22.70	5.41	24.00	22.30	7.08	-	-	-
38	172-F	Ammonia Liquor Tank	12.00	11.80	1.66	NA	12.0	-	-	-	-

Annexure – 5 (3/4)

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.
39	2000-SL,AD-A	New Instrument Air Drier	NA	6.70	-	NA	7.80	-	-	-	-
40	2000-SL,AD-B	New Instrument Air Drier	NA	6.30	-	NA	7.50	-	-	-	-
41	F-101	Naptha Deaerator	12.7	14.40	-	12.0	-	-	-	-	-
42	E-110A	Process Feed Stock Preheater	14.0	14.30	-	NA	10.70	-	-	-	-
43	E-110-B	Process Feed Stock Preheater	14.0	14.40	-	-	-	-	-	-	-
44	B-110	Condensate Drum for E-110	8.00	8.20	-	8.00	-	-	-	-	-
45	R-110	Naptha Hydrogenator	31.80	31.60	0.6		-	-	-	-	-
46	B-111	Knock Out Drum For R-110	6.00	6.50	-	6.0	9.20	-	-	-	-
47	R-111	Sulphur Absorber	35.00	34.80	0.5	-	-	-	-	-	-
48	R-112	Pre Reformer	86.9	86.0	1.06	-	-	-	-	-	-
49	B-112	Knock Out Drum For H-111	NA	6.50	-	-	-	-	-	-	-
50	E-3	Gas Exchanger	5.00	4.90	2.0	5.00	-	-	-	-	-
51	E-4	Regeneration Heater	5.00	6.10	-	-	-	-	-	-	-
52	K-1	Washing Tower	18.00	19.0	-	NA	18.10	-	-	-	-
53	R-1	Drying Vessel	36.00	36.40	-	36.00	36.10	-	-	-	-
54	R-2	Drying Vessel	36.00	36.50	-	36.00	36.10	-	-	-	-
55	B-201	K.O.Drum	10	10.1	-	-	-	-	-	-	-
56	B-201	Water Seal Drum for B-201	10	9.4	6.0	-	-	-	-	-	-
57	101-F	Steam Drum	106.4	109.50	-	106.4	111.80	-	-	-	-

Annexure – 5 (4/4)

CONVECTION SECTION COILS										
Sr. No.	DESCRIPTION	COIL			INLET HEADER			OUTLET HEADER		
		DESIGN	MEAS.	%RED	DESIGN	MEAS.	%RED	DESIGN.	MEAS	%RED
1	BFW COIL OFFSITES (LT Convection, bottom most)	5.54	4.5	18.77	--	--	--	--	--	--
2	BFW COIL OFFSITES (LT Convection, 2nd from bottom)	5.54	4.5	18.77	--	--	--	--	--	--
3	NG FUEL FEED COIL	3.9	3.7	5.12	-		--	--		--
4	MIXED FEED COIL	8.0	11.5	-	-					
6	BFW COIL AMMONIA	5.5	5.0	9.0	27	25.5	5.55	--	--	--
7	HT STEAM SUPER HEATER COIL	8.0	7.7	3.75	--	--	--	--	--	--
8	BFW COIL, BHEL BOILER	5.54	5.1	7.94	-					
9	LT STEAM SUPER HEATER COIL	7.01	6.8	2.99	-	--	--	--	--	--
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	6.6	5.71	--	--	--	--	--	--
13	H-111(CONVECTION COIL)	7.11	7.6	-	--	--	--	--	--	--

ANNEXURE- 6 (1/5)

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	5.3	25.46
2	BF-31	2	80	5.5	CS	104-JA	101-U	5.3	3.64
3	CW-06	36	0.313	7.93	CS	CW-5 (UG)	127-CA	7.6	4.16
4	CW-07	36	0.313	7.93	CS	CW-5 (UG)	127-CB	6.0	24.34
5	HS-12	6	100	13	P-11	HS-9	MICA-22	13	0.00
6	HW-06	4	40	6.02	CS	101J/105J	HW-10	5.4	10.3
7	HW-10	6	40	7.11	CS	HW-36	HW-15	6.2	12.8
8	HW-25	10	20	6.02	CS	124C	HW-5	5.2	13.62
9	HW-25	4	40	6.35	CS	124C	HW-5	5.1	19.69
10	HW-36	4	40	6.02	CS	LO CONSOLE	HW-10	5.6	7.0
11	aMDEA-02	4	40	6.02	SS-304	aMDEA-01	101-L	5.4	10.30
12	aMDEA-02	3	40	5.49	SS-304	aMDEA-01	101-L	6.2	---
13	aMDEA-24A	3	40	5.5	CS	108J	aMDEA-25	5.0	9.09
14	aMDEA-24B	3	40	5.5	CS	108JA	aMDEA-25	5.6	---
15	aMDEA-25	3	40	5.5	CS	aMDEA-24A/B	aMDEA-26B	4.8	12.73
16	aMDEA-26B	2.5	40	5.2	SS	aMDEA-25	102-EB	4.6	11.54
17	MS-06	6	40	7.11	CS	MS-1	107-JT	4.6	35.30
18	MS-17	2	80	5.5	CS	MS-2	2004-JA	5.3	3.64
19	MS-19	6	40	7.11	CS	MS-1	107-JAT	6.2	12.80

ANNEXURE- 6 (2/5)

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	MS-19	4	40	6.02	CS	CONTROL VALVE		5.7	10.29
2	MS-23	8	30	7	CS	MS-60	104-J	5.7	18.57
3	MS-24	8	30	7	CS	MS-60	104-JA	7.1	---
4	NG-02	6	40	7.11	CS	NG-01	101-D	6.4	9.99
5	NG-05	6	40	7.11	CS	NG-01	102-D	6.3	11.39
6	NG-06	8	20	6.4	CS	150-C	101-B	5.7	10.94
7	NG-11G	6	120	14.27	P-11	NG-9	101-B	13.3	6.80
8	NG-11G	6	80S	10.97	SS 304H	NG-10	101-B	11.6	---
9	NG-27	2.5	40	5.2	CS	NG-63	NG-25	4.7	9.62
10	NH-13	2	80	5.5	CS	109-F	126-C	5.4	1.82
11	NH-14	6	40	7.11	CS	109-F	NH-25A/B	6.5	8.58
12	NH-17	6	40	7.11	CS	109-F	NH-16	6.3	11.39
13	NH-25A	6			CS	127-CA	NH-14	10.4	---
14	NH-25B	6			CS	127-CB	NH-14	10.5	---
15	NH-88	8	40	8.18	CS	109-F	121-J	7.6	7.09
16	NH-88	4	40	6.02	CS	109-F	121-J	5.4	10.30
17	NH-88A	8	40	8.18	CS	NH-88	121-JA	7.1	13.20
18	NH-88A	4	40	6.02	CS	NH-88	121-JA	5.2	13.62
19	PG-06	18	0.313	7.93	P11	104-D TOP	103-C	10.7	---

ANNEXURE- 6 (3/5)

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	PG-07	12	30	8.38	P11	PG-6	103-C	8.2	2.15
2	PG-08	20	STD	9.525	CS	104-C	112-C	6.6	30.71
3	PG-14	16	40	12.7	CS	106-C	112-F	9.0	29.13
4	PG-18	12	30	8.4	P-11	104-C	106-D	10.3	---
5	PG-24	10	30	7.8	P-11	PG-17	PG-18	9.2	---
6	PW-02	2	40S	3.91	SS	PW-03	LC-3B	2.5	36.06
7	PW-03	2	40S	3.91	SS	PW-01	PW-12	3	23.27
8	PW-12	16	80	12.7	CS	PW-2+3	PW-13	13.4	---
9	PW-13	6	80	10.97	CS	PW-12	SEWER	7.1	35.28
10	PW-13	4	10S	3.05	SS	PW-12	SEWER	2.5	18.03
11	PW-18	4	10S	3.05	SS	170-CA	LC-3A	2.8	8.20
12	PW-18	2	80S	5.54	SS	170-CA	LC-3A	5.2	6.14
13	PW-19	4	120	11.13	CS	LC-3A	104-E	10	10.15
14	PW-19	2	10S	2.77	SS	LC-3A	104-E	3	---
15	PW-20A	6	80	10.97	CS	PW-20	170-JA	8	27.07
16	PW-29	10	60	12.7	CS	171-C	PW-30-14"	10.9	14.17
17	PW-30	14	40	11.3	CS	PW-29	PW-31	10.3	8.85
18	PW-31	12	40	10.31	CS	PW-30	104-E	10.6	---
19	SC-07	2.5	80	7.01	CS	SC-42	101-JC-A	4.8	31.53

Sr. No.	LINE NO.	N.B. (in.)	SCH.	NOM. THK. (mm)	MAT.	LINE DESCRIPTION		Minimum Thickness Observed (mm)	% RED.
20	SC-07	1.0	80	4.55	CS	SC-42	101-JC-A	4.6	---
21	SC-41A	4	40	6.02	CS	112J	SC-12	7.7	
22	SC-41B	4	40	6.02	CS	112JA	SC-41A	7.3	---
23	SC-47A	10	40	9.27	CS	101JC	112J	5.8	37.43
24	SC-47A	8	40	8.18	CS	101JC	112J	7.4	9.54
25	SC-47B	10	40	9.27	CS	101JC	112JA	5.9	36.35
26	SC-47B	8	40	8.18	CS	101JC	112JA	7.9	3.42
27	SG-02	14	20	7.92	CS	114-C	115-C	7.2	9.09
28	SG-07	10	60	12.7	CS	103-J	136-C	11.2	11.81
29	SG-08	10	40	9.27	CS	136-C	116-C	8.8	5.07
30	SG-09	10	40	9.27	CS	116-C	129-C	8.8	5.07
31	SG-12	14	100	23.8	CS	103-J	124-C	22.2	6.72
32	SG-13	12	80	17.45	CS	124-C	SG-14	17.1	2.01
33	SG-14	10	80	18.24	CS	SG-13	117-C	18.8	---
34	V-10	6	120	11.13	CS	PW-12	ATM	9.2	17.34
35	WA-01	36		7.93	CS	127-CA	WA-3	6.1	23.08
36	WA-02	36		7.93	CS	127-CB	WA-3	5.8	26.86
37	WA-03	36	5/16"	7.93	CS	HEADER	WA-15 & WA-8	5.8	26.86
38	WA-34	6	40	7.11	CS	WA-23	WA-37/38	6.2	12.8
39	WA-37	4	40	6.02	CS	WA-34	105J CONSOLE	3.3	45.1
40	WA-38	4	40	6.02	CS	WA-34	105J CONSOLE	4.6	23.5
41	PICV-005	6	40	7.11	CS	NG HEADER	AG HEADER	6.6	7.17
42		3		CS	101 U DRAIN LINE	---	5.1	---	
43		8		CS	101 U OVERFLOW LINE	---	7.6	---	

Annexure-7 (1/5)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
101-BJT			
Journal Bearing Liner	East Side	2.2	2.2
	West Side	2.7	2.7
Shaft Journal	East Side	3.0	3.0
	West Side	2.5	2.5
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	0.9	0.9
	West Side	1.3	1.3
Shaft Journal	East Side	2.6	2.6
	West Side	3.1	3.1
101-BJ			
Journal Bearing Liner	East Side	1.6	1.6
	West Side	1.8	1.8
Shaft Journal	East Side	3	3
	West Side	2.8	2.8
Thrust Collar	West Side	2.7	2.7
Thrust Bearing	West Side	1.2	1.2
101-JT			
Journal Bearing Pads	Thrust End	2.7	
	Non Thrust End	2.5	
Journal Bearing Base Ring	Thrust End	2.7	
	Non Thrust End	1.4	
Thrust Bearing Pads	Active	1.2	
	Inactive	1.8	
Thrust Bearing Base Ring	Active	3.0	
	Inactive	2.3	
Shaft Journal	Thrust End	7.8	2.3
	Non Thrust End	2.8	
	Thrust Collar	2.2	
101-JLP			
Journal Bearing Pads	Thrust End	2.6	
	Non Thrust End	2.2	
Journal Bearing Base Ring	Thrust End	2.5	
	Non Thrust End	2.3	
Thrust Bearing Pads	Active	1.8	
	Inactive	2.0	
Thrust Bearing Base Ring	Active	10	2
	Inactive	9.4	1.8

Annexure-7 (2/5)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
Shaft Journal	Thrust End	2.8	
	Non Thrust End	2.6	
	Thrust Collar	3.0	
101-JR			
Gear Journal Bearing	North	2.3	
	South	2.4	
Pinion Journal Bearing	North	1.1	
	South	2.2	
Thrust Bearing	Active	-	
	Non Active	-	
Shaft Journal	Thrust End	1.7	
	Non-Thrust End	1.1	
101-JHP			
Journal Bearing Pads	Thrust End	2.6	
	Non Thrust End	1.3	
Journal Bearing Base Ring	Thrust End	2.6	
	Non Thrust End	1.5	
Thrust Bearing Pads	Active	0.9	
	Inactive	0.6	
Thrust Bearing Base Ring	Active	13.0	
	Inactive	2.8	
Shaft Journal	Thrust End	3.2	
	Non Thrust End	2.4	
103-JBT			
Journal Bearing Pads	Thrust End	2.7	
	Non Thrust End	0.6	
Thrust Bearing Pads	Active	2.9	
	Inactive	0.8	
Thrust Bearing Base Ring	Active	2.8	
	Inactive	-	
Shaft Journal	Thrust End	0.9	
	Non Thrust End	10.8	
	Thrust Collar	1.9	
103-JAT			
Journal Bearing Pads	Thrust End	2.0	
	Non Thrust End	0.5	
Journal Bearing Base Ring	Thrust End	2.2	
	Non Thrust End	2.8	
Thrust Bearing Pads	Active	2.4	
	Inactive	2.4	
Thrust Bearing Base Ring	Active	2.8	
	Inactive	-	
Shaft Journal	Thrust End	2.0	
	Non Thrust End	11.5	

Annexure-7 (3/5)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
	Thrust Collar	2.0	
103-JLP			
Journal Bearing Pads	Non Thrust End	2.9	
Journal Bearing Base Ring	Non Thrust End	2.8	
Shaft Journal	Non Thrust End	2.2	
103-JHP			
Journal Bearing Pads	Thrust End	1.6	
	Non Thrust End	1.4	
Journal Bearing Base Ring	Thrust End	1.9	
Thrust Bearing Pads	Active	2.3	
	Inactive	2.3	
Thrust Bearing Base Ring	Active	2.8	
Shaft Journal	Thrust End	2.9	
	Non Thrust End	20.3	2.6
105-JT			
Journal Bearing Pads	Thrust End	1.6	
	Non Thrust End	1.0	
Journal Bearing Base Ring	Thrust End	2.0	
Thrust Bearing Pads	Active	0.9	
	Inactive	1.2	
Thrust Bearing Base Ring	Active	2.8	
	Inactive	1.4	
Shaft Journal	Thrust End	2.4	
	Non Thrust End	12.0	2.2
	Thrust Collar	2.4	
105-JLP			
Journal Bearing Pads	Thrust End	1.0	
	Non Thrust End	1.7	
Journal Bearing Base Ring	Thrust End	1.2	
	Non Thrust End	1.1	
Thrust Bearing Pads	Active	1.4	
	Inactive	1.7	
Thrust Bearing Base Ring	Active	2.2	
	Inactive	2.4	

Annexure-7 (4/5)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
Shaft Journal	Thrust End	2.7	
	Non Thrust End	2.8	
	Thrust Collar	1.4	
105-JR			
Gear Journal Bearing	North	1.6	
	South	1.5	
Pinion Journal Bearing	North	1.8	
	South	2.2	
Thrust Bearing	Active	1.3	
	Non Active	1.8	
Shaft Journal Bull Gear	North	1.8	
	South	1.2	
Shaft Journal Pinion Gear	North	2.6	
	South	1.3	
105-JHP			
Thrust Bearing Pads	Active	0.6	
	Inactive	0.3	
Thrust Bearing Base Ring	Active	1.2	
	Inactive	3.5	
Thrust Collar		1.8	
115-JAT			
Journal	Non drive end	1.02	
	Drive end	2.2	
Journal Bearing	Non drive end	0.6	
	Drive end	0.5	
Thrust Collar		1.3	
Thrust Bearing	Active	1.6	
	Inactive	1.0	
115-HT(hydraulic turbine)			
Journal	Non drive end	1.8	
	Drive end	0.9	
Journal Bearing	Non drive end	1.1	
	Drive end	1.2	
Thrust Collar		1.3	
Thrust Bearing	Active	2.6	
	Inactive	1.9	
Gear Box	High Speed Shaft		
115-JA (Gear Box)			
High Speed Shaft,Journal Bearing	West End	2.0	
High Speed Shaft,Journal	West End	1.0	
	East End	1.7	

Annexure-7 (5/5)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
Low Speed Shaft,Journal Bearing	East End	2.6	
Low Speed Shaft,Journal	West End	2.9	
	East End	2.6	
115-JA (Pump)			
Pump journal bearing	Inboard	1.3	
	Outboard	1.2	
Thrust Pads Outboard	Inactive	2.0	
	Active	2.4	
Shaft Journal	Inboard	1.5	
	Outboard	1.0	
Thrust Collar		3.5	

ANNEXURE-8 (1/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1.	Location: 1 (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.
2.	Location: 2 (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.
3.	Location: 3 (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.
4.	Location: 4 (Weld/Haz) SG-1303 11-14 (H-34) On 123C Gas outlet 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.
5.	Location: 5 (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. Where as 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.
6	Location: 6 (Weld/Haz) On weld between flange & Bend of gas inlet nozzle.PG-6 – 18” towards east side of 103-C	P-11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse-grained ferrite/pearlite structure. Parent metal shows fine grained essentially ferrite structure. Indications of creep cavities are observed at grain boundaries.	2nd stage of creep damage. Monitor after 1 year of service.
7	Location: 6 (Weld/Haz) On weld between flange & Bend of gas inlet nozzle.PG-6 – 18” towards east side of 103-C	P-11	Microstructure at weld metal shows ferrite and carbides in dendritic form. Where as at HAZ microstructure shows fine and coarse-grained ferrite/pearlite structure. Parent metal shows fine grained essentially ferrite structure. Indications of creep cavities are observed at grain boundaries.	2nd stage of creep damage. Monitor after 1 year of service.

ANNEXURE-8 (2/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
8	Location: 8 (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.
9	Location: 9 (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.	Monitor after two years of service.
10	Location: 10 (Parent Metal) PIC 13B inlet spool 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.
11	Location: 11 (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.
12	Location: 12 (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.
13	Location: 13 (Weld/HAZ) 101-F Steam drum (On circum weld joint of shell of north 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.
14	Location: 14 (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.

ANNEXURE-8 (3/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
15	Location: 15 (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.
16	Location: 16 (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.
17	Location: 17 (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.
18	Location: 18 (Parent metal) SG-1303 10-14 On 108-D outlet to 107C Gas inlet elbow-1	P-22	Microstructure shows fine-grained tempered bainite structure.	Monitor after 1 year of service.
19	Location: 19 (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.
20	Location: 20 (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. 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.
21	Location: 21 (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.

ANNEXURE-8 (4/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
22	Location: 22 (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.
23	Location: 23 (Weld/Haz) SG-34-14 On weld & Haz of pipe 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. Of in-stu Spherodization of pearlite is observed. Indications of creep cavities are observed.	IInd stage of creep degradations. Monitor after 1 year of service.
24	Location: 24 (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.	No significant degradation observed. Monitor after 2 years of service.
25	Location: 25 (Weld/Haz) NG-11 /H-6 On P11 to SS304H Dissimilar joint of inlet manifold Row No.8 towards P-11	P-11 to 304H	Microstructure shows proper fusion between parent metal and weld. No significant defect observed. HAZ microstructure shows fine-grained ferritic structure. Indication of creep cavities at suspected at P11 side.	IInd stage of creep damage monitor after 1 year of service.
26	Location: 26 (Weld/Haz) NG-11 /H-6 On P11 to SS304H Dissimilar joint of inlet manifold Row No.8 towards 304H	P-11 to 304H	Microstructure at parent metal (SS 304H) shows austenite grains with twins. Carbide precipitation observed at the grain boundaries. At HAZ microstructure shows coarse-grained austenitic structure, carbide precipitations.Weld metal shows dendritic structure of solid solution of nickel.	The oxalic acid etching confirmed the presence of carbide at the grain boundaries. Monitor after 2 years of service.

ANNEXURE-8 (5/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
27	Location: 27 (Weld/Haz) SG-1303, 09-10 (H-36) On 108D converter inlet nozzle	P-22	Microstructure at HAZ shows fine-grained ferrite/bainite/ pearlite structure. Where as parent metal microstructure shows ferrite and bainite/pearlite structure.	Monitor after 1 year of service.
28	Location: 28 (Weld/Haz) SG-1303, 0910 (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.
29	Location: 29 (Weld/HAZ) On Weld & HAZ of HT superheater coil bend (5th coil tube from South)	T 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.
30	Location: 30 (Weld/HAZ) On Weld & HAZ of LT super heater coil bend (5th coil tube from North)	T 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.
31	Location: 31 (Parent Metal) Aux. Boiler Coil-A side south to north (west side) tube no.5 Counting from south to north	106 Gr.B	Microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service
32	Location: 32 (Parent Metal) Aux. Boiler B side (east side) tube no.7 Counting from south to north	106 Gr.B	Microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service

ANNEXURE-8 (6/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
33	Location: 33 (Parent Metal) Aux. Boiler c side (North side) tube no.12 Counting from south to north	106 Gr.B	Microstructure shows fine-grained ferrite and pearlite structure.	No significant degradation observed. Monitor after 2 years of service.
34	Location: 34 (Parent Metal) On face of 1st Bend of NG-9-12" (101Bmixed feed coil outlet to NG-11)	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.
35	Location: 35 (Weld/Haz) On weld between Pipe & Bend of NG-9-12" (101B-mixed feed coil outlet to NG-11)	P 11	Microstructure at weld shows ferrite and bainite in dendritic form where as at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows 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.
36	Location: 36 (Weld / Haz) Between Pipe & bend	P 11	Microstructure at weld shows ferrite and bainite in dendritic form where as at HAZ shows fine-grained bainite and ferrite structure. Microstructure at parent metal shows ferrite and spheroid 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.
37	Location: 37 (Weld / HAZ of P-11) On dissimilar Weld between pipe & Nozzle of header	P 11 to 304H	Microstructure at parent metal (P11) shows essentially ferrite structure with carbides. Where as at HAZ microstructure shows fine and coarse-grained ferrite and carbide structure. Possibility of creep damage is observed at P11 side. Weld metal shows dendritic structure of solid solution of nickel.	Fusion is normal, no cracking observed at interface/alloyed region. AT P11 side approaching 3rd stage of creep damage. Monitor after 1 year of service.

ANNEXURE-8 (7/8)

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
38	Location: 38 (Weld/Haz) On dissimilar Weld Between pipe & Nozzle of Header	304H to 304H	Microstructure at parent metal (SS 304H) shows austenite grains with twins. Carbide precipitation observed at the grain boundaries. At HAZ microstructure shows coarse-grained austenitic structure, carbide precipitations. Weld metal shows dendritic structure of solid solution of nickel.	The oxalic acid etching confirmed the presence of carbide at grain boundaries. Monitor after 2 years of service.
39	Location: 39 (Weld/Haz) On weld between shell and steam outlet nozzle on 101CB (towards south)	CS	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.	No significant degradation observed. Monitor after 2 years of service.
40	Location: 40 (Weld/Haz) On weld bet. shell & steam outlet nozzle on 101CA (towards north)	CS	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.	No significant degradation observed. Monitor after 2 years of service.
41	Location: 41 (Parent metal) On LT steam super heater (top) header	T-11	Microstructure shows fine-grained ferrite pearlite and bainite structure.	Monitor after 2 years of service.
42	Location: 42 (Weld/Haz) Main steam pipe HS-2H-12" On weld/HAZ toward elbow before safety valve	Carbon Steel	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.	No significant degradation observed. Monitor after 2 years of service.
43	Location: 43 (Weld/Haz) 102B SG-62 A-4 line	Carbon Steel	Microstructure shows fine-grained ferrite and pearlite structure. In situ spherodization observed both at HAZ and parent metal.	IInd stage of creep degradations. Monitor after 2 years of service.
44	Location: 44 (Weld/Haz) 102B SG-62 B-4 line	Carbon Steel	Microstructure at HAZ shows fine-grained ferrite and pearlite structure with initial stage of spherodization Where as parent metal microstructure shows ferrite and in-situ spherodized pearlite.	IInd stage of creep degradations. Monitor after 1 year of service.

ANNEXURE-8 (8/8)

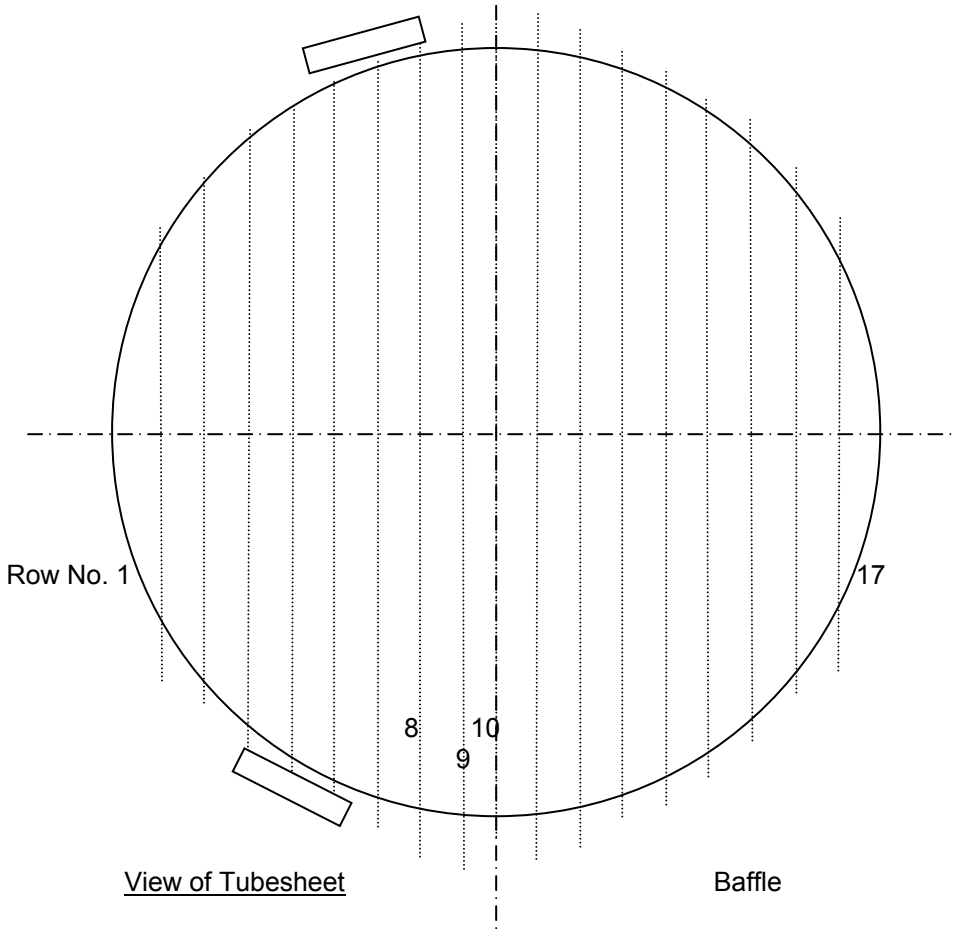
DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

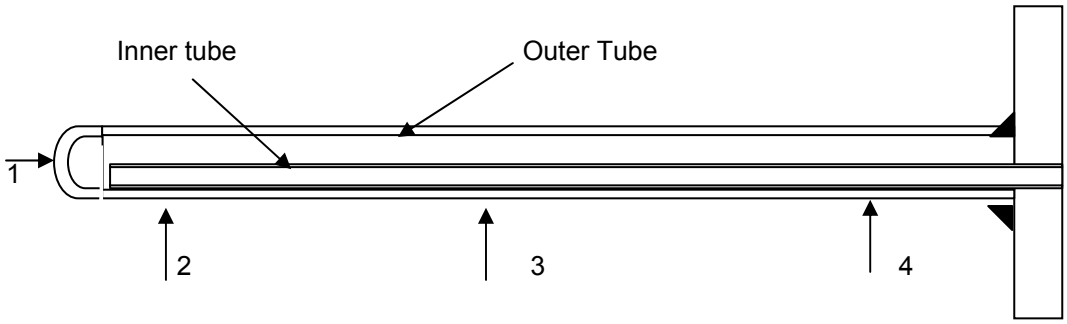
SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
45	Location: 47 (Parent Metal) ON HT steam super heater (top) header	T-22	Microstructure shows fine-grained ferrite pearlite and bainite structure.	Monitor after 2 years of service.
46	Location: 48 (Parent Metal) Pre reformer R-112 Outlet line pipe 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.
47	Location: 49 (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.	Monitor after 2 years of service.

ANNEXURE-9 (1/2)

THICKNESS MEASUREMENT REPORT OF 101-CB

Plant : Ammonia
Testing Equipment : Panametrics MG 2XT **Accuracy:** 0.01mm.
Equipment : 101-CB Outer tube bundle
Date of testing : Outer tube-3.434mm., End cap-5.0mm.





View of Outer tube

ANNEXURE-9 (2/2)

Thickness measurement report of outer tube bundle of 101-CB

Row No.	Location-1 (End cap)	Location-2	Location-3	Location-4
1	5.8, 5.8	3.54, 3.7	3.8, 3.74, 3.61	3.74, 3.65
2	6.1, 6.0	3.52, 3.5, 3.8	3.78, 4.14	3.67, 3.92
3	6.1, 6.4	3.72	3.75	3.74
4	5.3, 5.4, 6.3, 5.9	3.79, 4.0	4.1	3.81
5	5.8, 5.9	3.7	3.8	3.9
6	6.3, 6.4	3.67	3.56	3.7
7	5.9, 5.8	3.79	3.78	3.82
8	5.0, 5.1, 4.89, 5.0	3.68	3.78	3.89
9	6.3, 6.2	3.87	-	-
10	6.3, 5.8	3.79	3.8	3.96
11	6.0, 6.2, 5.5, 5.1	3.71	3.72	3.91
12	5.8, 6.0, 5.9	3.72	3.7	3.71
13	5.4, 5.3	3.63	3.72	3.84
14	6.0, 6.1, 6.2	3.71	3.67	3.73, 3.81
15	6.4. 6.2	3.79, 3.56	3.95	3.76
16	6.2, 6.3, 6.1	3.72	3.59, 3.72	3.75, 3.88
17	5.8, 6.0, 5.7	3.55, 3.66	3.63, 3.72	3.67, 3.76

All measurements are in mm.

UREA PLANT

During Shutdown 2008, the following major inspection activities were performed in the Urea plant.

1 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).

2 Internal inspection of other vessels in the Plant.

3 Ultrasonic thickness measurement of HP lines in the Plant. Detailed report is attached at **Annexure-1.**

4 Ultrasonic thickness measurement of lines other than H.P lines in the plant. Detailed report is attached at **Annexure-2.**

5 Ultrasonic thickness measurement of various equipment in the Plant. Detailed report is attached at **Annexure-3.**

6 Dye Penetrant examination and radiography of weld joints of lines fabricated, erected and offered by Mech. Maint./Technical Department as per the requirement.

7 Qualification tests of welders employed by contractors.

8 Residual magnetism measurement and demagnetization, wherever required of Hitachi compressor (K-1801) Train. Detail report is attached at **Annexure-4**.

9. Insitu-Metallography at selected spots on some equipment was carried out. Summary of observations and microstructure analysis is given in **Annexure-5**.

10. ½" NC metering line to H-1201(H.P Stripper) was replaced based on thickness measurement report. Existing Schedule 40S line was changed to Schedule 80S. DPT and Radiography of weld joints of Installed pipeline was carried out,also chemical analysis of the Installed Schedule 80S pipeline was carried out to conform the requirement of SS 304L.

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

HIGH PRESSURE VESSELS:

High-pressure equipment of the Urea Plant 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 observed and also grayish oxide layer was observed on dome and man way surface.
- Crevice cavities of approx 7" and 4" long observed on the south west side L-seam which was marked.
- Some of the tray holding nuts were found loose.

Compartment No.2:

- Minor roughening of tray holding Cleats and grayish brown oxide layer was observed on bottom side of trays.
- 4 Nos. of J-bolts were found loose.
- 3 Nos. of corrosion cavities were observed in south west side longitudinal seam,
- 2 No. of crevice cavities was observed in C-seam, 1 No. spot welding and 2 No.
- old clit marks observed to have corroded.
- Some of the tray holding nuts were found loose.
- Cavity of approx 3mm dia and 05-1.0 mm deep was observed in liner in north east direction at about 75mm below C seam.

Compartment No.3:

- Very minor roughening was observed on insert liner.
- 01 No. of undercut/corrosion cavity was observed in north east side long seam and also 01 No. of undercut/corrosion cavity was observed in south west side long seam which were marked.
- 2 Nos. of 'J' bolts were found loose which were marked.
- Minor corrosion of J-bolts was also observed.
- 2 nos. of corrosion cavities were observed in C seam.
- 2 Nos of old clit marks and 2 nos of spot welds were also observed to have corroded.

Compartment No.4:

- Slight roughening of insert liner plate and tray holding Cleats was observed.
- Approx. 30 mm below circumferential weld, a depression of approx. 100 mm dia. and 3 mm depth was observed on 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 from North to West side in approx. 300mm length.
- Concave depression of approx 2-5 mm depth observed at approx. 200mm below the C-seam in approx. 60% of the periphery.
- Grayish and brownish oxide layer was observed on the bottom side of trays.
- 9 No. of corrosion cavities and 1No. of old clit mark were observed to have corroded which were marked.
- 6 Nos. of 'J' bolts and some tray holding nuts and bolts were also found loose which were marked.
- Concave depression of liner plate of approx 4.5 mm depth was observed at approx 200mm 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.
- 03 Nos. of 'J' bolts and some tray holding nuts and bolts were also found loose which were marked.

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.
- 5 Nos. of 'J' bolts and some tray holding nuts and bolts were also found loose which were marked.
- 03 Nos. of corrosion cavities and 6 Nos of spot welds were also observed to have corroded which were marked.

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.
- 3 Nos. of corrosion cavities, 2 nos. of spot welds and 2 Nos of old clit marks were observed to have corroded which were marked.
- 9 No. of 'J' bolts was found loose which was marked.

Compartment No.8:

- 3 nos. of spot welds observed to have corroded which were marked.
- 3 Nos. of old clit marks were observed to have corroded which were marked.
- Some of the tray holding nuts and bolts were found loose.

Compartment No.9:

- 1 No. of corrosion cavity was observed which was marked.
- 6 Nos. of old clit marks were observed to have corroded which were marked for repair.
- Some tray holding nuts and bolts were also found loose which were marked.

Compartment No.10:

- Concave depression of approx 5mm depth at approx 70mm below the C-seam in south side of shell in approx. 100 mm dia was observed.
- 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.
- Vertical bulging of approx. 2-3 mm height, 6" long & 10mm wide was observed at approx. 12" below the C-seam 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.

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.
- 10 to 12 mm gap was observed between tray and shell liner from East to South side.

- 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.
- Some of the tray holding nuts were found loose.

Compartment No.12 (Bottom Compartment.):

- Weld joints of all nozzles, petal plates, crown plates and the circumferential weld of the bottom dished end liner were DP tested. 15 nos. of defect indications were marked for repair.
- 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.

NOTE :

1. **Total 13 Nos of corrosion cavities/clit marks were repaired, which were more severe.**

2. **Ferrite was also measured on liner, welds and at repaired locations and observed nil.**

Main Liner Thickness				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks (Mini.thk. observed on)**	**Design/ Installed Thk.(mm)**
Compartment 1	4.08	4.85	East side.	6.50 (new) 5.00 (old)
Compartment 2	3.75	4.74	East side.	5.00
Compartment 3	3.86	4.59	East side.	5.00
Compartment 4	3.96	4.62	West side	5.00
Compartment 5	4.41	5.15	North side	5.00
Compartment 6	4.45	4.94	North side	5.00
Compartment 7	4.39	4.81	North side	5.00
Compartment 8	4.39	5.02	West side	5.00
Compartment 9	4.45	5.04	East side	5.00
Compartment 10	4.83	5.10	South side	5.00
Compartment 11	4.53	4.83	North side	5.00
Compartment 12	4.76	4.70	North side	5.00

Downcomer Thickness				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks**	**Design/ Installed Thk.(mm)**
Compartment 2	7.76	8.37		9.50
Compartment 3	7.80	9.85		9.50
Compartment 4	7.95	8.72		9.50
Compartment 5 (new/replaced portion)	9.65	9.89	The replaced downcomer part has a wall thk. of 9.8-10.0 mm.	9.50
Compartment 5 (old)	8.09	9.84		9.50
Compartment 6	8.20	8.53		9.50
Compartment 7	8.18	8.64		9.50
Compartment 8	8.43	8.58		9.50
Compartment 9	8.58	8.92		9.50
Compartment 10	8.99	9.09		9.50
Compartment 11	9.25	9.25		9.50

Tray Thickness measurement				
Location	**Min. (mm)**	**Max. (mm)**	**Remarks**	**Design/ Installed Thk.(mm)**
Compartment 1	5.27	5.73		8.00
Compartment 2	5.69	5.69		8.00
Compartment 3	5.46	6.05		8.00
Compartment 4	5.68	5.93		8.00
Compartment 5	5.75	6.00		8.00
Compartment 6	6.31	6.54		8.00
Compartment 7	6.35	6.47		8.00
Compartment 8	6.64	7.34		8.00
Compartment 9	7.21	7.84		8.00
Compartment 11	8.14	8.14		8.00

INSERT LINER:

Other Areas

Top Cover			Overlay welding	
Man way	6.67	6.79	Replaced 2002	6.5
Top dome	6.58	6.67	Replaced 2002	6.5
Liner below dome	6.95	7.38	750 mm section BC. 05 – replaced 2002	6.5
Bottom Dome	6.1	6.5	Replaced 1993	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.
- The tube welds were bright and smooth. At many places between the tubes heavy oxide deposition was observed on tube sheet area. It is advised to remove these deposits.
- The tubes were found smooth from inside.
- In few tubes shiny surface was observed from inside the tube at the location of the tube sheet welds.
- At the central tube sheet area ,6 nos of tube ends were found minor damage.

BOTTOM CHANNEL :

- The condition of sealing face was satisfactory.

Compartment Nos.	Thickness observed(MM)	Installed Thickness (MM)	Year of Replacement
3		-	1997
4	6.28-6.32	-	1999
8	6.50-6.72	-	2000
9	6.69-6.93	-	2001
10	6.51-6.68	-	2002
11	6.75-6.80	-	2002

- The overlay welds in the man way were grey and slightly etched.
- The gaps of appx. 1-2 mm depth observed between the strip beads.
- 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.
- The liquid outlet pipe and the gas inlet pipe were bright shiny and showed no defects. Their nozzles and welds were in satisfactory condition.

BOTTOM COVER:

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

THICKNESS REPORT OF OVERLAY WELD AND LINER :

The weld overlay thickness is measured with a Fischer DualScope MP4 (accuracy 0.5 mm).

BOTTOM DOME:

``	**Minimum Thickness mm**	**Maximum Thickness mm**	**Design Thickness mm (Minimum)**
Man way (Overlay)	12.20	13.90	8.0
Dome area (Overlay)	8.90	11.20	8.0
Cylindrical area (Liner)	8.20	8.60	8.0
Tube sheet-Overlay weld	9.10 (Machined)	10.20 (Machined)	8.0
Bottom Cover (Overlay)	11.50	12.80	8.0

TOP DOME:

H.P. CONDENSER H-1202:

	Minimum Thickness mm	**Maximum Thickness mm**	**Design Thickness mm (Minimum)**
Man way (Overlay)	9.67	13.15	8.00
Dome area (Overlay)-minimum 7.5 mm betn.the strip beads	8.00	10.00	8.00
Cylindrical area (Liner)-Gas phase	8.20	9.65	8.00
Cylindrical area (Liner)-Liquid phase	8.10	10.32	8.00
Tube sheet-Overlay weld	9.02 (Machined)	10.00 (Machined)	8.00
Top Cover (Overlay)	8.76	9.76	8.00

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 liner around the gas inlet was partly covered with a blue grey oxide scale.
- The tray support clips were grey and slightly etched.
- The tube-to-tube sheet welds were found satisfactory .
- The few tube ends were found slightly damaged.
- A lot of tubes showed burn-through defects. Some burn-through defects were repaired during manufacturing.
- Also some tubes showed inside some grinding spot around the burn through defects. Keep attention to these spots during next general shutdowns.

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.
- Also at the bottom section many tubes showed burn-through defects (some already repaired during manufacturing).

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 a Panametrics Epoch LT with a 5 MHz DA-301 probe (accuracy 0.1 mm).

The weld overlay thickness has been measured using a DualScope MP4 (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)	6.52	7.10	6.0
Cylindrical area (Liner)	6.44	7.20	6.0
Tube sheet-Overlay weld	7.80	10.35	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)	6.10	7.40	6.0
Dome area (Liner)	6.35	6.95	6.0
Cylindrical area (Liner)	6.30	6.86	6.0
Tube sheet-Overlay weld	7.05	9.20	8.0 (min)
Top Cover(Liner)	19.0	19.85	18.0

H-1203, HP SCRUBBER

VISUAL INSPECTION

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 found corroded along with its fillet weld.
- Two nos. of deep pin holes were observed in the seal weld of CO2 inlet pipe (3/4”) with diaphragm ring and the same is marked with yellow chalk.
- Condition of liquid inlet and gas outlet pipe found satisfactory.
- Pin holes and cavities were observed in the fillet weld of diaphragm ring to top shell and the same were marked for repair.
- Thickness measurement of top half of shell liner was carried out and found in range of 4.75 to 5.1mm.

BOTTOM SHELL

- Visual condition of the tube bundle was found to be 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 corroded.
- Thickness measurement of bottom half of shell liner carried out and was found in range of 5.21 to 5.37 mm.

INSPECTION OF OTHER VESSELS:

H-1104 ($C0_2$ SPRAY COOLER):

- Demister pad condition was satisfactory.
- Fasteners of the Grating below the 1st tray were found missing.
- Weld joint condition was satisfactory.

H-1204 (RECIRCULATION HEATER):

- 01 no. top tube to tube-sheet weld joint has a cavity in ID of the tube. Row No. 10 (Counting from East to West), Tube No. 11(Counting from South to North). 04 nos. tubes were found chocked as water is filled in the tubes.
- Minor scaling was observed inside the tubes.
- Orifice plugs in the bottom were found intact in position.
- Brownish scaling was observed inside the plugs.

H-1207 (CIRCULATION SYSTEM –II COOLER):

- Heavy corrosion/ pitting and scaling were observed on the tube sheet area**.**
- Corrosion & pittings were observed on the inside of end covers.
- Scaling was observed on the inside of all tubes.
- 01 no. tube to tube sheet weld joint has a pinhole, marked.

H-1352 (REFLUX CONDENSER):

TOP TUBE SHEET:

- Tube to tube sheet welding was found satisfactory.
- Hard scaling were observed on the inside surface of all the tube looking from the top end.

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, grey scaling & dust was observed inside almost all the tubes.
- Entire inside surface of cooling water outlet line found covered with thick gray color scales.
- Brownish rusting scales were observed on entire surface of Inlet & Outlet channel and also on the inner surface of CW inlet line.

H-1419 (PRE-EVAPORATOR CONDENSER) :

BOTTOM TUBESHEET:

- Tube to tube sheet weld found satisfactory.
- Scaling was observed on the inside surface of tubes on CW outlet side.

TOP TUBESHEET:

- Tube to tube sheet weld found satisfactory.
- Minor 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/ brownish scaling was observed on inside surface of channel covers.
- Inside surface of the tubes was found clean.

H-1421 (FLASH TANK CONDENSER):

- Tube to tube sheet welding was found satisfactory.
- Minor scales were observed inside the some tubes.
- All tubes were found filled with water.
- Minor scaling was observed on the tube to tubesheet weld joint.

H-1422 (1ST STAGE EVAPORATOR) :

- The shell and Dish ends have assumed grayish black in coloration with scattered brownish and whitish patches.
- Coloration of the tube sheet was shiny.
- Tube to tube sheet weld joints were found satisfactory.
- Grayish scales were observed on the inside surface of tubes.
- Condition of impingement cone was found satisfactory.
- Impingement cone to support welding was found satisfactory.
- Condensate distributor 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.) have their drain hole chocked.

H-1423 (FIRST STAGE EVAPORATOR CONDENSER):

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

H-1424 (2ND STAGE EVAPORATOR) :

- Shiny surface was observed inside the vessel.
- Tube to tube sheet weld joints were found satisfactory.
- 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):

- Tube to tube sheet welding was found satisfactory.
- Whitish scale was observed inside the tubes.
- Overall condition of vessel was found satisfactory**.**

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.
- Cooling water inlet line flange welding joint from inside in east direction has cavities.

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.
- Few tube ends were found damaged on west end ,which were marked .

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.
- Epoxy coating was found damaged at many locations.

BOTTOM HALF:

- Tube sheet was found in satisfactory condition.
- Minor scaling was observed inside some of the tubes.
- Water was found coming out from some of the tubes**.**

NORTH SIDE HALF (EAST SIDE COVER):

- Tubes and tube sheet surface condition was found satisfactory.
- Epoxy coating was found peeled off at several locations from seating surface, edge of partition plate and adjacent area near tube sheet, channel cover.
- Scaling was observed inside the tubes of top portion.

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.
- Water was found lying on the floor of backside compartment.
- Roof condition was 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.
- 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):

- 01 no. support out of two of 6" west most condensate inlet line was found broken.
- Weld joints condition was found satisfactory.
- Dark brown coloration was observed inside the tank.
- Dust and weld spatters were observed lying inside the tank, need to be cleaned.
- Water was found at the bottom of the vessel.

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, need to be fixed. 2nd no. pad in east half from north was also found slightly lifted, need to be fixed. At few locations it was found with yellow color debris.

V-1102 (NH_3 SUCTION FILTER) :

- Coloration of vessel was found brownish from inside.
- Approx. 1" weld metal of filter support ring with shell in South-East direction was found peeled off.

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 position and blackish at dome and shell portion.
- Black hard scales were observed on the top dish end and also on the shell portion.
- Shell portion of approx. 1"x1" area & 3 to 4 mm. depth was observed to be peeled off in south direction just above tray support ring.
- 06 nos. tacked nuts on the tray support ring have bolts with sheared head.
- 03 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 grayish coloration was found on bottom-dished end.
- 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.
- Bulging approx. 01" deep was observed approx. in 01 foot dia. in west side of shell above Cir. Seam near LT top nozzle.

V-1206 (ATMOSPHERIC VENT SCRUBBER):

- Demister pads were found intact in position and condition of the same was found satisfactory.
- One no. bolt of inlet flange was found loose, need to be tightened.
- Reddish brown coloration was observed inside the vessel with brownish patch at east side.
- Overall condition was found satisfactory.

V-1207 (L. P. SCRUBBER):

- Coloration of shell portion was observed grayish black.
- Grating condition on top was satisfactory.
- Irregular and insufficient welding was observed in ID of 4" nozzle at bottom end of the vessel in west direction.

V-1301 (SECOND DESORBER):

BOTTOM COMPARTMENT:

- Brownish coloration was observed inside the vessel.
- One clamp of the tray was found loose.
- 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.
- Scaling inside was observed in 4" nozzle at south end.

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" nozzle in the east side on shell was found having slightly loose scale from inside.

BOTTOM COMPARTMENT:

- Grayish black coloration was observed from inside.
- 03 nos. fasteners of 2nd tray from south were found missing.
- 01 no. of bolt/nuts of steam inlet flange was found loose and highly eroded. Need to be replaced.
- Clamping bolt washer of steam inlet pipe to shell was found eroded /corroded.

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-1418 (PRE EVAPORATOR SEPARATOR):

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

V-1423 (1ST STAGE EVAPORATOR SCRUBBER):

- Reddish Brown coloration was observed inside the vessel.
- Demister pads were found slightly damaged, loosened & lifted at several locations.
- Solidified urea solution particles were found adhered at demister pads at few locations.
- Support channels and outer ring of demister pads were found lifted at few locations.

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 at bottom of the vessel.
- Condition of all weld joints were found satisfactory.
- Minor petting 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.

V-1503 (9 ATA STEAM DRUM):

- Grayish black coloration was observed inside the vessel.
- Scattered scales were observed on both the dished ends.
- Support welding of $1^1/_2$" condensate inlet line from 4 ata drum with shell was found cracked.
- Nut of the south side U-clamp of inlet steam header was found missing.
- Approx. 3 mm. deep pit was observed at the bottom of the shell at the center.

V-1811 (IST STAGE SEPARATOR):

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

V-1813 (IIIrd STAGE SEPARATOR);

- A cavity of appx. 2mm depth and 3mm dia was observed inside 6" nozzle at south end of vessel, it was marked by yellow chalk. No other abnormality was observed looking through this nozzle.

ANNEXURE-1 (1/2)

UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY OF HP LINES

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	%AGE RED.	MRT
					FROM	TO			
1	CO-E10-2122	6	80	10.97	H-1813	V-1813	10.10	7.93	9.60
2	CO-F10-2124	8	160	23.01	K-1801,IV diacharge	GA-1602-8"-F2	22.40	2.65	20.13
3	CO-F10-2140-PP25	4	160	13.49	CO-F10-2119-PP25	CO-E10-2139-PP25	12.90	4.37	11.80
4		0.75	160	5.56	CO-F10-2140-PP25	DRAIN	4.40	20.86	4.87
5	CO-F10-2119	8	160	23.01	K-1801,HP case 3rd discharge	H-1813	22.60	1.78	20.13
6	GA-1112	6	F2	14.27	K-1101-2	GA-1201	13.60	4.70	12.49
		1.5	F2	7.14	BYEPASS LINE		4.10	42.58	6.25
		0.75	F2	5.54			6.50	-17.33	4.85
7	GA-1201	6	X4	13.33	GA-1112	H-1201	9.70	27.23	11.66
		1.5	X4	5.08	GA-1112	H-1201	5.40	-6.30	4.45
8	GA-1202	1	F2	6.35	GA-1112	GA-1203	5.50	13.39	5.56
9	GA-1203	1	X1	4.55	GA-1202	SCRUBBER	4.20	7.69	3.98
		0.5		3.73			2.60	30.29	3.26
10	GA-1204	1	F2	6.35	GA-1202-1"-F2	PR-1231	4.30	32.28	5.56
		0.5		5.54	GA-1203-1"		2.60	53.07	4.85
11	GA-1602	8	F2	23.01	K-1801,CO-2124-8"-F10	H-1201,GA-1112-6"-F2	22.30	3.09	20.13
12	GA-1603	4	F2	11.13	GA-1602-8"-F2	PIC-1810	10.90	2.07	9.74
13	MA-1106/A-4"	4	E2	8.56	P-1102-A DISCH	MA-1123-4"	7.80	8.88	7.49
		1		4.55	DRAIN LINE		4.60	-1.10	3.98
14	MA-1106/B-4"	4	E2	8.56	P-1102-A, MA-1605-6"	MA-1123-4", MA-1203-4"	7.20	15.89	7.49
		1.5		5.08			6.10	-20.08	4.45
		0.75		5.54			5.10	7.94	4.85
15	MA-1123	4	E2	8.56	P-1102/B	MA-1605-6"	7.30	14.72	7.49
16	MA-1201	3	E2	7.62	MA-1605-6"	MA-1202-3"	7.10	6.82	6.67
17	MA-1201	2	E2	5.54	MA-1605-6"	MA-1202-3"	4.50	18.77	4.85
18	MA-1202	3	X4	7.62	MA-1201/MA-1605-6"-E2	V-1201	8.30	-8.92	6.67

ANNEXURE-1 (2/2)

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	%AGE RED.	MRT
					FROM	TO			
19	MA-1203	4	X4	9.14	MA-1106-B-4"	PR-1230-6"	9.80	-7.22	8.00
20	MA-1603	6	C2	7.11	MA-1122-6"	MA-1603-4"	6.40	9.99	6.22
21	MA-1603	4	C2	6.02	MA-1603-4"	P-1102/C SUCTION	4.80	20.27	5.27
22	MA-1604	3	E2	7.62	P-1102/C DISCH.	MA-1604-4"-E2	5.20	31.76	6.67
23	MA-1604	4	E2	8.56	MA-1604-3"	MA-1605-6"	8.00	6.54	7.49
24	MA-1605	6	E2	14.27	MA-1123-4"-E2	MA-1106/B-4"-E2	13.80	3.29	12.49
25	MA-1607	4	C2	6.02	MA-1604-4"	MA-1116	5.50	8.64	5.27
		0.75		3.91			3.10	20.72	3.42
26	MA-1609	4	C2	6.02	P-1102/C RV	MA-1503-6"-C2	5.30	11.96	5.27
27	PR-1201	8	X1	19.58	V-1201	H-1201	18.10	7.56	17.13
28	PR-1202	10	X1	24.33	H-1201	HP-CONDENSER	22.20	8.75	21.29
29	PR-1203	8	X1	19.58	H-1202	V-1201(VAPOR LINE)	18.70	4.49	17.13
30	PR-1204	8	X1	19.58	HP-CONDENSER	V-1201(LIQUID LINE)	17.50	10.62	17.13
31	PR-1205	6	X1	15.24	PR-1205-8"	V-1202	11.80	22.57	13.34
32	PR-1205	8	X1	19.58	STRIPPER BOTTOM	V-1202	17.80	9.09	17.13
33	PR-1208	4	X1	10.41	AUTOCLAVE TOP	PR-1206-4"-X1	8.90	14.51	9.11
34	PR-1212	4	X1	10.40	SCRUBBER	AUTOCLAVE BOTTOM	7.80	25.00	9.10
35	PR-1224	3	X4/80S	7.62	P-1201B (Disch)	PR-1638-4"-X4A	6.40	16.01	6.67
36	PR-1230	6	X1	15.24	MA-1203-4"	H-1202 (HPCC)	14.50	4.86	13.34
37	PR-1231	3	X1	8.12	H-1203	PRCV-1201	7.30	10.10	7.11
38	PR-1234	3	X4/80S	7.62	P-1201A (DISCH)	PR-1638-4"-X4A	7.10	6.82	6.67
39	PR-1637	3	X4A	9.14	P-1201C	PR-1638-4"	9.80	-7.22	8.00
40	PR-1225	3	X4/80S	7.62	P-1201 A/B,PR-1638-4"	H-1203	7.10	6.82	6.67

ANNEXURE-2 (1/3)

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.	MRT
					FROM	TO			
	CO-B22-2114	8	20	6.35	V-1812	K-1801,III SUC	5.80	8.66	5.56
2	GA-1102	30	B3	6.35	H-1104	V-1101	5.80	8.66	5.56
3	MA-1105	4	C2	6.02	MA-1106/A-4"-E2	MA-1116-4"-C2	7.10	-17.94	5.27
4	MA-1116	4	C2	6.02	MA-1106	V-1103	7.50	-24.58	5.27
5	MA-1126	4	C2	6.02	MA-1123	MA-1116	7.10	-17.94	5.27
6	PR-1207	6	X10	3.40	LICV-1201	PR-1207-14"-X10	3.50	-2.94	2.98
7	PR-1207	14	X10	4.78	PR-1206-6"-X10	V-1406	4.80	-0.42	4.18
8	PR-1216	16	X6	4.78	V-1202	H-1205	5.00	-4.60	4.18
9	PR-1219	8	X3	3.76	H-1205	V-1205	3.50	6.91	3.29
10	PR-1223	4	X3	3.05	LP SEPARATOR , V-1205	P-1201 A/B SUCTION	2.30	24.59	2.67
11	PR-1232	4	X1	10.41	PRCV-1201	ATMOS/V-1203	7.00	32.76	9.11
12	PR-1259	6	X3	3.40	V-1206	P-1210 A/B	2.90	14.71	2.98
13	PR-1260	6"	X3	3.40	P-1210 A/B	H-1210	2.30	32.35	2.98
14	PR-1302	3	X3	3.05	P-1302 A/B/C	H-1301	2.40	21.31	2.67
15	PR-1308	10	X3	4.19	RV-1301	PR-1309	3.60	14.08	3.67
16	PR-1311	4	X3	3.05	PR-1625-6"-X3	P-1302-A/B	2.70	11.48	2.67
17	PR-1333	2	X3	5.54	P-1305A	PR-1334-2"-X3	3.00	45.85	4.85
18	PR-1334	2	X3	2.77	P-1305B	LICV-1281 (PR-1632-2"-X6)	3.20	-	2.42
19	PR-1351(S.S.)	4	X3	3.05	V-1301	H-1301A/B/C	2.20	27.87	2.67
20	PR-1363	4		3.05	LICV-1351 D/S	V-1301	3.10	-1.64	2.67
21	PR-1401	8	X10	3.76	V-1406	PR-1614-8"-X10 (T-1401/T-1401A)	3.70	1.60	3.29
22	PR-1403	4	X3	3.05	PR-1618-6"-X3	P-1401A/B	2.80	8.20	2.67
23	PR-1405	6	X10	3.40	H-1422	H-1424	3.00	11.76	2.98
24	PR-1406	4	X3	3.05	V-1409	H-1422	2.80	8.20	2.67
25	PR-1407 (JACKET)	10	X10	4.19	H-1424	P-1408	3.90		3.67
26	PR-1408 (JACKET)	8	X10	3.76	P-1408	M-1401	3.50	6.91	3.29
27	PR-1413	3	X3	3.05	P-1421	ATMOS	2.70	11.48	2.67

ANNEXURE-2 (2/3)

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	% AGE RED.	MRT
					FROM	TO			
28	PR-1416	2	X10	2.77	H-1423	P-1422	3.00	-8.30	2.42
29	PR-1421	16	X10	4.78	H-1425	P-1424	4.60	3.77	4.18
30	PR-1422	12	X10	4.57	P-1424	H-1426	4.40	3.72	4.00
31	PR-1424	2	X10	2.77	H-1426	P-1425	2.50	9.75	2.42
32	PR-1440	30	X10	9.52	H-1422	V-1423	8.40	11.76	8.33
33	PR-1440	32	X10	9.52	V-1423	H-1423	8.60	9.66	8.33
34	PR-1444	20	X10	5.53	V-1406	PR-1446-14"-X10	6.20		4.84
35	PR-1446	14	X10	4.78	V-1421	PR-1444-20"-X10	4.60	1.60	4.18
36	PR-1458	3	X10	3.05	H-1421	P-1421	2.60	14.75	2.67
37	PR-1615	4	X10	3.05	PR-1401	H-1418	2.60	14.75	2.67
38	PR-1616	8	X3	3.76	T-1401/A	PR-1403	3.00	20.21	3.29
39	PR-1618	6	X3	3.40	T-1401	PR-1616	3.50	-2.94	2.98
40	PR-1620	3	X10	3.05	P-1422	H-1420	2.70	11.48	2.67
41	PR-1625	6	X3	3.40	T-1301A	PR-1311-4"-X3	3.00	11.76	2.98
42	PR-1663	44	X10	9.52	H-1424	P-1423	9.90	-3.99	8.33
43	PR-1664	36	X10	9.52	P-1423	H-1425	10.50	-10.29	8.33
44	PW-1103	8	B6	3.76	B/L(DM PLANT)	H-1104	3.70	1.60	3.29
45	PW-1105	8	B6	3.76	P-1106	B/L (To H-4401)	3.70	1.60	3.29
46	SC-1210	8	C2/40	8.18	P-1204	SC-1210-10"-C2	10.60	-29.58	7.16
47	SC-1210	10	C2/40	9.27	SC-1210-8"-C2	H-1207	9.60	-3.56	8.11
48	SC-1216	4	B4	6.02	V-1204	H-1207A	5.30	11.96	5.27
49	SC-1216	2	B4	3.91	V-1204	H-1207A	3.70	5.37	3.42
50	SC-1233 I FROM N	12	B4	9.53	V-1501	H-1202	9.50	0.26	8.33
51	SC-1234 II FROM N	12	B4	9.53	V-1501	H-1202	9.70	-1.84	8.33
52	SC-1235 III FROM N	12	B4	9.53	V-1501	H-1202	9.30	2.36	8.33
53	SC-1236 IV FROM N	12	B4	9.53	V-1501	H-1202	9.20	3.41	8.33
54	SC-1237 I FROM NE	16	B4	9.53	H-1202	V-1501	9.10	4.46	8.33
55	SC-1238 II FROM NE	16	B4	9.53	H-1202	V-1501	10.30	-8.14	8.33
56	SC-1241 I FROM NW	16	B4	9.53	H-1202	V-1501	8.90	6.56	8.33
57	SC-1244 IV FROM NW	16	B4	9.53	H-1202	V-1501	9.90		8.33
58	SC-1523	3	B4/40	5.49	HEADER	SC-1409-4"-B4	4.30	21.68	4.80
59	ST-1211	2	B4	3.91	ST-1409	H-1202	3.30	15.60	3.42
60	ST-1302	6	B4	7.11	4 ATA STEAM HEADER	V-1301	7.30	-2.67	6.22

ANNEXURE-2 (3/3)

Sr. No	LINE NO.	NB (inch)	SCH.	NOM. THK. (MM)	LINE DESCRIPTION		MIN. THK. OBSERV.	% AGE RED.	MRT
					FROM	TO			
61	ST-1402	3	B4	5.49	ST-1415	P-1421	5.20	5.28	4.80
62	ST-1412	6	B4	7.11	ST-1415	P-1424	6.90	2.95	6.22
63	ST-1413	1.5	B4	5.04	4ATA STEAM HDR/ ST-1415	EJECTOR P-1425	4.20	16.67	4.41
64	ST-1505	14	B4	9.53	PICV-1502B	ST-1506	8.80	7.61	8.33
65	ST-1509	10	B4	9.27	T-1501	H-1502	8.50	8.31	8.11
66	ST-1510	10	B4	9.27	T-1501	H-1502	8.10	12.62	8.11
67	SC-1502	3	B4	5.49	P-1501/6	V-1501	5.40	1.64	4.80
68	ST-1124	6	B1	9.52	ST-1104	PICV-1128	10.20	-7.14	8.33
69	ST-1129	10	B2	9.27	PICV-1128	ST-1116	9.20	0.76	8.11
70	ST-1123	20	B4	9.53	PICV-1129	ST-1106	8.90	6.56	8.33
71	ST-1125	10	B4	9.27	ST-1116	PICV-1129	7.80	15.86	8.11
72		8	80	12.70	60 ATA STEAM LINE ON PIPE RACK		11.60	8.66	11.11
73	ST-1409	4	B4	6.02	ST-1504	H-1424	5.20	13.62	5.27
74	SC-1514	4	B4	6.02	T-1501	SEAL POT	5.60	6.98	5.27
75	ST-1212	6	C1	7.11	H-1201	BD-1202	6.60	7.17	6.22
76	PR-1217	10	X3	4.19	RV-1202	PR-1309	4.00	4.53	3.67
77	SC-1501	4	B4	6.02	T-1501	P-1501 & P-1506	5.70	5.32	5.27
78	SC-1102	14/40	B1	9.53	SC-1228	SC-1101	5.80	39.11	8.33
79	MA-1118	1	B2	3.38	MA-1106	T-1301	4.30	-27.22	2.96
80	PW-1303	4	B1	5.40	H-1303	B/L	5.00	7.41	4.73
81	PW-1110	10	B6	4.19	H-1104	P-1106 A/B	3.60	14.08	3.67
82	ST-1507	6	B4	7.11	ST-1506	ST-1302	9.00	-26.58	6.22
83	HP FLUSH LINES	2	B4	3.91			3.30	15.60	3.42

ANNEXURE-3 (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-1102	LP NH3 PREHEATER	8.0	9.8	-	8.0 / 10.0	12.2	-			
2	H-1104	CO2 SPRAY COOLER	10.0	7.8	22.0	9.0 / 13.0	11.8	-			
3	H-1204	RECIRCULATIO N HEATER	11.0	11.0	-	7.0 / 9.0	9.7	-			
4	H-1207	CCS-II COOLER	10.0	9.0	10.0	8.0 / 10.0	8.0	-	8.0	7.8	2.5
5	H-1209	LP ABSORBER COOLER	10.0	9.9	1.1	7.5 / 11.5	7.6/11.4		6.0	6.7	-
6	H-1303	DESORBER SURFACE COND. HEAT EXCHANGER	10.0	9.9	1.0	10.0 / 12.0	10.9	-	10.0	10.3	-
7	H-1419	PRE-EVAPORATOR CONDENSER	9.5	9.6	-	12.7	12.6	-			
8	H-1421	FLASH TANK CONDENSER	8.0	7.6	5.0	9/7 11/13	8.2 11.6	-			
9	H-1423	1ST STAGE EVAPORATOR CONDENSER	10/7	11.0/8.0	-	12/15 7/10	13.1- 10.8	-	13.0	13.0	-
10	H-1425	2ND STAGE EVAPORATOR 1ST CONDENSER	14.0	13.4	4.28				15.0	15.6	-
11	H-1426	2ND STAGE EVAPORATOR 2ND CONDENSER	7.0 / 10.0	8.1/9.4	-/6.0	10/13 7/9	13.6 9.1	-	10.0	9.4	6.0
12	H-1502	VENT CONDENSER DM WATER HEATER	10.0	10.2		10.0 / 13.0	9.6	4.0	10.0	10.3	-
13	H-1811	1ST STAGE INTER COOLER FOR K-1801	12.0	11.0	8.33	12.0	10.9	9.16	12.0	12.7	-
14	H-1812	2ND STAGE INTER COOLER FOR K-1801	10.0	11.1	-	10.0	11.4	-	12.0	12.7	-
15	H-1813	3rd STAGE INTER COOLER FOR K-1801	10.0	10.5	-	10.0 / 20.0	9.6/20.6	4.0	10.0 30.0	9.7 31.8	3.0
16	H-1814A	MAIN LUBE OIL COOLER FOR K-1801	12.0	11.1	7.5				12.0	11.5	4.1
17	H-1814B	MAIN LUBE OIL COOLER FOR K-1801	12.0	11.3	5.83				12.0	11.5	4.1

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	H-1815	SURFACE CONDENSER FOR Q-1801	NA	15.0	-						
19	T-1501	STEAM COND. TANK	10.00	9.9	1.0	10.00	10.9	-			
20	T-1814	MAIN LO TANK	06.00	5.4	10.0						
21	V-1101	CO2 K.O DRUM	10.0	10.0	-	13.0	12.4	4.61			
22	V-1102	LIQUID NH3 FILTER	11.0	10.9	1.0						
23	V-1103	NH3 SUCTION VESSEL	21.0	20.8	1.0	21.0 / 23.0	22.3	-			
24	V-1301	SECOND DESORBER	6.0	6.2	-	6.0	8.3	-			
25	V-1202	RECTIFYING COLUMN	9.0	9.3	-	11.0	10.4	5.45			
26	V-1351	HYDROLYSER	28.0	28.5	-	28.0 / 32.0	29.9	-			
27	V-1352	FIRST DESORBER	8.0	7.9	1.25	10.0	9.8	2.0			
28	V-1353	LEVEL TANK FOR REFLUX CONDENSER	6.0	5.7	5.0	4.5 / 6.0	5.8	-			
29	V-1401	FIRST STAGE EVAPORATOR CONDENSER POT	NA	8.4	-	NA	8.4	-			
30	V-1406	FLASH TANK SEPARATOR	8.0	8.6	-	10.0	9.9	1.0			
31	V-1409/A	UREA SOLUTION FILTER	6.0	6.4	-						
32	V-1409/B	UREA SOLUTION FILTER	6.0	6.3	-						
33	V-1418	PRE EVAPORATOR SEPARATOR	12.0	11.9	-	10.0 / 12.0	10.7	-			
34	V-1501	4 ATA STEAM DRUM	15.0	14.21	5.26	15.0 / 18.0	16.72	-			
35	V-1502	23 ATA STEAM SATURATOR	30.0	29.8	0.6	34.0 / 37.0	35.4	-			
36	V-1503	9 ATA STEAM SATURATOR	13.0	12.71	2.23	13.0 / 15.0	14.04	-			
37	V-1811	1^{ST} STAGE EVAPORATOR	6.0	5.3	11.66	6.0	5.8	3.33			
38	V-1812	2^{ND} STAGE EVAPORATOR	10.0	10.1	-	10.0	11.6	-			
39	V-1813	3^{RD} STAGE EVAPORATOR	30.00	30.2	-	30.00	29.4	2.0			

ANNEXURE-4 (1/2)

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT OF

K-1801 (HITACHI COMPRESSOR)

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
K-1801 TURBINE (SOUTH END)			
Journal Bearing Liner	Governor side	2.3	
Shaft Journal	Governor side	1.4	
Thrust Collar	Governor side	1.7	
Thrust Bearing	Governor side	0.6	
Thrust Base Ring	Governor side	1.9	
Thrust Bearing Pads	Governor side	0.6	
TURBINE(NORTH END)			
Journal Bearing Pads	Thrust End	2.7	
	Non Thrust End	2.5	
Journal Bearing Base Ring	Thrust End	2.7	
	Non Thrust End	1.4	
L.P. CASE (TURBINE END)			
Shaft Journal		2.2	
Journal Bearing Pads		1.5	
Journal Bearing Base Ring	Top	2.1	
	Bottom	1.7	
L.P. CASE (G.B. END)			
Shaft Journal		2.4	
Journal Bearing Pads		2.7	
Thrust Base Ring	L.P. Outboard	2.1	
	L.P.Inboard	2.9	
Thrust Bearing Pads	Inboard side (Old)	1.0	
	Outboard side (New)	1.6	
Thrust Collar		1.8	
GEAR BOX			
L.S. Shaft Journal Bearing L.P. Side	Top half	1.7	
	Bottom half	2.0	
L.S. Shaft Journal Bearing H.P. Side	Top half	2.3	
	Bottom half	1.4	
H.S. Shaft Journal Bearing L.P. Side	Top half	1.6	
	Bottom half	1.5	
H.S. Shaft Journal Bearing H.P. Side	Top half	1.4	
	Bottom half	1.8	

ANNEXURE-4 (2/2)

DESCRIPTION	POSITION	BEFORE (Gauss)	AFTER (Gauss)
L.S. Shaft teeths and Journal portion		2.2	
H.S. Shaft teeths and Journal portion		1.5	
Thrust pads	Inboard side	1.8	
	Outboard side	0.9	
Thrust Base Ring	Inboard side	1.8	
	Outboard side	2.1	
Thrust Collar L.S. Shaft		1.7	
H.P. CASE (FREE END SIDE)			
Shaft Journal		2.2	
Journal Bearing Pads		1.7	
Journal Bearing Base Ring	Top	2.7	
	Bottom	3.0	
Thrust Base Ring	Inboard side	2.8	
	Outboard side	2.2	
Thrust Pads	Inboard side	1.8	
	Outboard side	2.2	
Thrust Collar		2.7	
H.P. CASE (G.B. SIDE)			
Shaft Journal		2.5	
Journal Bearing Pads		1.7	
Journal Bearing Base Ring	Top	2.0	
	Bottom	2.5	

ANNEXURE-5

DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO.	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	Location: 45 (Parent Metal) **HP STRIPPER H-1201** Stub end Liquid inlet top side	Carbon Steel	Microstructure shows ferrite and pearlite structure, in situ spherodization of pearlite is observed. Indications of creep cavities are observed.	Monitor after one year of service.
2	Location: 46 (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.	IInd stage of creep degradations. Monitor after 1 year of service.

OFFSITE & UTILITY PLANT

During Shutdown 2008, the following major inspection activities were performed in Utility Plant.

1. Inspection of BHEL boiler drums and furnace tubes

2. Inspection of Deaerator.

3. Thickness measurement of H_2SO_4 Tank in cooling tower area.

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:

1. The internal surface of the drum had assumed blackish brown coloration.

2. All the weld joints were found in satisfactory condition.

3. Overall condition of the steam drum was found to be satisfactory.

4. Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 102.8 mm against nominal specified thickness of 97 mm in cylindrical shell area and 83.2 mm on dished end against nominal specified thickness of 77 mm. Detailed report is attached at **Annexure- 1**

MUD DRUM:

1. The shell had assumed blackish brown coloration.

2. The condition of the weld joints was found satisfactory.

3. The tube stub ends were found satisfactory.

4. In general, the overall condition of the mud drum was found satisfactory.

5. Ultrasonic thickness measurement was carried out. Min. thickness was observed to be 82.4 mm in cylindrical shell area against nominal specified thickness of 78 mm and 58.7 mm on dished end against nominal specified thickness of 57 mm. Detailed report is attached at **Annexure - 2**

DEAERATOR:

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

Deaerator Head :

1. Two nos. spring loaded distribution valve located on the top observed to have leakage from “O” ring.

2. Angle supports provided below the trays are in two segments and observed to have sagging downwards as their welding in center got cracked almost in all the supports.

3. All the three segments of the 5th tray (Bottom most) found lifted/dislocated from its position.

4. Crack was observed in support weld of tray structure with pad on Deaerator shell toward north-west direction.

Deaerator Storage Shell :

1. Brownish coloration was observed inside the shell.

2. Condition of the weld joint was found satisfactory.

3. 4th U clamp from east of north side steam distribution line was found loose and its nut was missing, to be provided.

4. From inside Condensate inlet nozzle on top(west side) has no weld with 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 Stage-I & Stage-II Primary and Secondary Super heater tubes, 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	MIN. THK. (MM)	DESIGN THK.(MM)	%RED	REFER ANNEXURE
1	**SOUTH MANHOLE:**				
(A)	BAFFLE WALL TUBES	4.8	4.5		**Annexure - 3,7**
(B)	D-PANEL TUBES	4.7	4.5		**Annexure - 3,7**
(C)	CUT CORNER TUBES	4.7	4.5		**Annexure - 3,7**
(D)	REAR WALL TUBES	4.7	4.5		**Annexure - 3,7**
(E)	FRONT WALL TUBES	4.7	4.5		**Annexure - 3,7**
2	**NORTH MANHOLE:**				
(A)	BANK TUBES	3.2	3.6		**Annexure - 4,7**
(B)	BAFFLE TUBES	4.9	4.5		**Annexure - 4,7**
(C)	NORTH SIDE WALL TUBES	4.4	4.5		**Annexure - 4,7**
3	PRIMARY SUPERHEATER TUBES INSIDE FURNACE(STAGE-I)	6.0	7.1		**Annexure - 5,7**
4	SECONDARY SUPERHEATER TUBES INSIDE FURNACE (STAGE-II)	5.1	5.6		**Annexure - 6,7**

MISCELLANEOUS JOBS:

D.P. TEST:

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

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 wherever required.

ANNEXURE -1

THICKNESS MEASUREMENT REPORT OF STEAM DRUM

SHELL	**Design Thickness : 97 mm**			
POINT NO.	**TOP**	**BOTTOM**	**NORTH**	**SOUTH**
(W to E)				
1	103.4	104.5	104.4	104.3
2	-	-	104.7	105.2
3	-	-	104.4	104.3
4		-	104.4	104.2
5	-	-	104.0	104.4
6	102.8	105.3	103.6	104.7
DISH END:	**Design Thickness : 77 mm**			
POINT NO.	**TOP**	**BOTTOM**	**NORTH**	**SOUTH**
East	83.2	83.5	83.3	83.2
West	83.3	83.1	83.7	83.3

ANNEXURE -2

THICKNESS MEASUREMENT REPORT OF MUD DRUM

SHELL:	**Design Thickness : 78 mm**			
POINT NO.	**TOP**	**BOTTOM**	**NORTH**	**SOUTH**
(W to E)				
1	82.5	83.0	82.8	82.4
2	82.6	82.9	82.7	82.7
3	82.9	83.1	83.1	82.6
4	83.1	83.4	83.0	83.1
5	83.3	83.9	83.0	83.2
6	82.9	83.1	82.9	83.2
DISH END:	**Design Thickness : 57 mm**			
POINT NO.	**TOP**	**BOTTOM**	**NORTH**	**SOUTH**
East	58.7	58.8	59.0	59.0
West	59.1	59.0	59.1	59.0

ANNEXURE -3

THICKNESS MEASUREMENT REPORT OF D-PANELTUBES ,CUT CORNER TUBES, REAR WALL TUBES, FRONT WALL TUBES AND BAFFLE WALL TUBES:

D-PANEL TUBES			**FRONT WALL TUBES**:		
TUBE NO.	**TOP**	**BOTTOM**	**SL. NO.**	**TOP**	**BOTTOM**
2	5.1	5.5	2	4.7	4.7
7	5.2	5.2	6	4.8	4.8
12	5.0	5.1	10	4.8	4.8
19	5.2	5.1	14	4.8	4.8
25	5.0	4.8	19	5.0	5.3
37	5.0	5.0	23	5.2	5.0
42	5.0	5.0	26	5.2	5.0
49	5.0	4.7	30	5.1	5.0
55	4.7	4.8	34	4.9	4.9
61	5.1	5.1	38	5.4	4.9
65	5.4	5.0	42	5.0	4.8
69	5.2	5.3			
			BAFFLE WALL TUBES:		
CUT CORNER TUBES:			**TUBE NO.**	**TOP**	**BOTTOM**
TUBE NO.	**TOP**	**BOTTOM**	1	5.2	5.4
72	4.7	4.9	4	5.1	5.0
75	5.1	4.9	9	5.1	5.2
78	5.2	5.1	14	5.1	5.3
82	4.8	4.9	19	5.0	5.0
87	5.1	5.0	24	5.1	5.0
92	4.9	4.8	28	5.2	5.1
98	5.0	5.0	34	5.0	5.0
103	5.0	5.1	39	5.3	4.8
			44	5.0	5.1
REAR WALL TUBES:			49	5.1	5.0
TUBE NO.	**TOP**	**BOTTOM**	54	5.1	5.1
107	4.9	4.8	59	5.1	5.2
110	5.1	4.7	63	5.1	5.1
113	4.9	4.8			
116	4.9	5.2			

Note : 1. All readings are in MM
2. Refer annexure-7 showing tube layout & numbers identifying the individual tubes.
3. Design thickness of tubes : 4.5 mm

ANNEXURE -4

THICKNESS MEASUREMENT REPORT OF BANK TUBES, BAFFLE WALL TUBES AND SIDE WALL TUBES:

BANK TUBES "A" WALL(Design Thickness : 3.6 mm)		
TUBE NO.	**TOP**	**BOTTOM**
1	3.5	3.5
4	3.6	3.8
7	3.4	3.5
10	3.5	3.3
12	3.2	3.3
BANK TUBES "B" WALL(Design Thickness : 3.6 mm)		
TUBE NO.	**TOP**	**BOTTOM**
13	3.6	3.7
15	3.3	3.3
17	3.7	3.6
BANK TUBES "C" WALL(Design Thickness : 3.6 mm)		
TUBE NO.	**TOP**	**BOTTOM**
19	3.5	3.5
22	3.6	3.6
25	3.8	3.7
29	3.5	3.6
BAFFLE ("D") WALL TUBES (Design Thickness : 4.5 mm)		
TUBE NO.	**TOP**	**BOTTOM**
33	5.3	5.3
36	5.1	5.0
41	5.0	4.9
45	5.1	5.0
NORTH SIDE WALL TUBES: (Design Thickness : 4.5 mm)		
TUBE NO.	**TOP**	**BOTTOM**
1	5.1	5.0
4	5.2	5.1
7	5.1	5.1
10	5.0	5.1
13	4.9	4.8
16	4.4	4.6
19	5.0	5.1

Note : 1. All readings are in MM
2. Refer annexure-7 showing tube layout & numbers identifying the individual tubes.

ANNEXURE -5

THICKNESS MEASUREMENT REPORT OF PRIMARY SUPERHEATER TUBES (STAGE-1):

BEND-A	
TUBE NO.	**Minimum Measured Thickness**
1	7.0
6	7.4
11	6.8
16	6.5
21	7.3
26	6.3
31	6.3
36	7.3
BEND-B	
TUBE NO.	**Minimum Measured Thickness**
1	6.8
6	6.5
11	6.8
16	6.8
21	6.9
26	6.8
31	6.7
36	7.2
BEND-C	
TUBE NO.	**Minimum Measured Thickness**
1	6.7
6	6.7
11	6.1
16	6.0
21	6.3
26	6.3
31	6.6
BEND-D	
TUBE NO.	
1	6.9
6	6.5
11	6.6
16	7.3
21	6.9
26	6.6
31	6.8

Note : 1. All readings are in MM
2. Refer annexure-7 showing tube layout & numbers identifying the individual tubes.
3. Design thickness of tubes : 7.1 mm

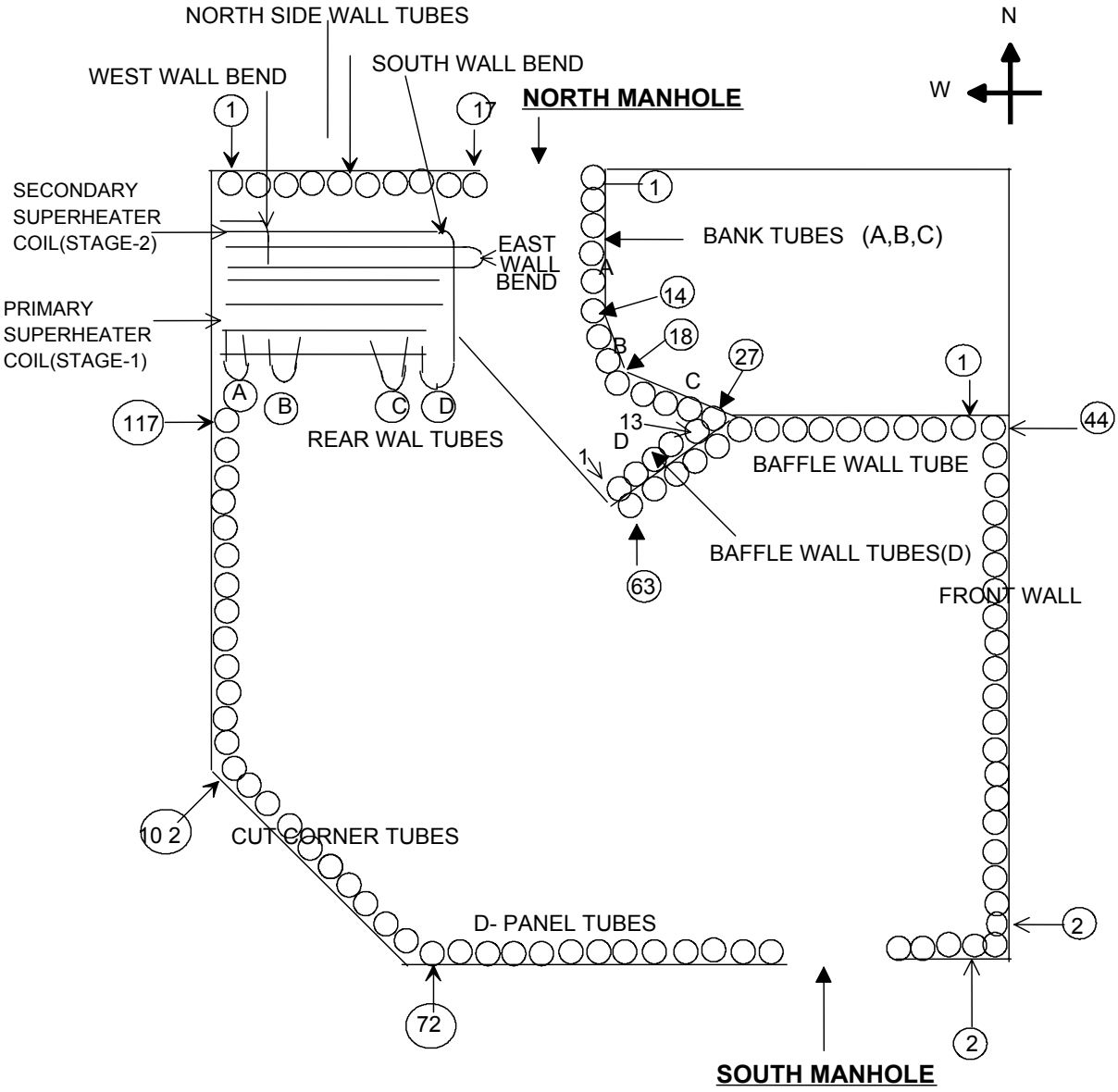
ANNEXURE -6

THICKNESS MEASUREMENT REPORT OF SECONDARY SUPERHEATER TUBES (STAGE-2):

WEST WALL BEND	
TUBE NO.	**Minimum Measured Thickness**
2	5.7
7	5.8
12	5.6
17	5.6
22	5.8
27	5.6
32	5.9
37	5.6
SOUTH WALL BEND	
TUBE NO.	**Minimum Measured Thickness**
2	5.9
7	5.7
12	5.8
17	5.8
22	5.7
27	5.8
32	5.6
EAST WALL BEND	
TUBE NO.	**Minimum Measured Thickness**
2	5.1
7	5.3
12	5.2
17	5.4
22	5.3
27	5.5
32	5.3
NORTH WALL BEND	
TUBE NO.	**Minimum Measured Thickness**
2	6.2
7	6.4
12	6.4
17	6.3
22	6.2
27	6.2
32	6.4

Note : 1. All readings are in MM
2. Refer annexure-7 showing tube layout & numbers identifying the individual tubes.
3. Design thickness of tubes : 5.6 mm

ANNEXURE-7



BHEL BOILER FURNACE LAYOUT
(GT-2068)

AMMONIA PLANT

Control Valve : Maintenance jobs

1. **FRCV- 1**: C/V diaphragm opened & checked. General cleaning of positioner was carried out. Gland packing was replaced. C/V stroke was checked.

2. **FRCV-2:** Replaced all gland packing. Actuator diaphragm was opened and checked, found ok. Gland packing was replaced. Finally checked stroke.

3. **PICV-24:** Butterfly valve was removed from line and inspected the baffle

4. **FRCV-3:** C/V removed from yoke, seat & plug were checked. All parts were cleaned and overhauled. Plug guided bottom flange was opened & cleaned. General cleaning of valve positioner was carried out. Replaced gland packing. C/V stroke was checked.

5. **ARCV-3:** C/V was opened from line & Plug and seat were taken out for inspection. All parts were cleaned and overhauled. Machining done on plug & checked it for tight shut off on test bench. Provided new gland packing and stroke was checked.

6. **FICV-485:** C/V was opened from bonnet. Inspected Plug and seat. Cage lapping & general cleaning were carried out. A new hand-jack assembly was provided. Checked it for tight shut off on test bench. Finally reinstalled & checked stroke.

7. **LCV-490:** C/V was opened from bonnet. Inspected Plug and seat & machining were done on plug/seat & checked it for tight shutoff on test bench. Finally reinstalled & checked stroke.

8. **LCV-27 & LCV-2 :** C/V were opened from bonnet. Inspected Plug and seat & machining were done on plug/seat & checked it for tight shutoff. Finally reinstalled & checked stroke.

9. **PICV-10:** C/V was opened from bonnet. Inspected Plug and seat & overhauled the hand jack assembly. Finally reinstalled & checked stroke.

10. **MICV 24 to 32:** All 9 control valves were opened from line flanges. Inspected the diaphragms and Plug and seat & overhauling checked it for tight shutoff on test bench. Finally reinstalled & checked stroke.

11. **MICV- 27**: New valve positioner was installed after the modified the mounting bracket and checked stroke.

12. **MICV-27 ,28, 32** : Replaced the actuator diaphragms

13. **FRCV-5:** Actuator diaphragm was opened and checked. Provided new gland packing and carried out general overhauling and finally Stroke was checked.

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

15. **FICV-487:**.As per the requirement of Production Dept. locking provision at 20% opening was incorporated and finally checked stroke.

16. **PICV-178:** C/V was opened from bonnet. Inspected Plug and seat & machining were done on plug/seat, modified the mounting bracket & new valve positioner was installed finally checked stroke.

17. **MICV 1A TO 9A:** General cleaning & checking was carried out & finally checked the stroke.

18. **MICV 1 TO 9:** General cleaning & checking was carried out & finally checked the stroke. Replaced the diaphragm of MICV-1.

19. **LCV-16:** General cleaning was carried out & provided gland packing & checked stroke.

20. **LCV-18:** General cleaning was carried out & provided gland packing & checked stroke.

21. **LCV-19:** General cleaning was carried out & provided gland packing. & checked stroke.

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

23. **PICV-13A, 13B & MICV-22:** Gland packing was replaced. Carried out general overhauling of air regulators, Air volume boosters and spool valves finally checked the performance for quick operation and checked the stroke.

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

25. **FICV-7, 8, 15:** Preventive maintenance was carried out for all three valves. Checked the stroke, found ok.

26. **PICV-1017:** General cleaning was carried out & provided new gland packing. Finally checked stroke.

27. **PICV-1027:** Control valve removed from line & dismantled all parts & overhauling carried out. Machining done on plug, seat & cage. Also provided new GN seal rings & gland packing and checked it for tight shut off on test bench. Finally installed on line and stroke was checked.

28. **PRCV-6:** General cleaning was carried out, provided gland packing & checked stroke.

29. **PRCV-4:** General cleaning was carried out, provided gland packing & checked stroke.

30. **FICV-14:** C/V was opened from yoke. Inspected Plug, seat, cage. General cleaning & overhauling of positioner was carried out finally reinstalled and checked stroke.

31. **PICV-44:** General cleaning was carried out, hand-jack was checked. Finally the stroke was checked.

32. **USY-400**: Removed the valve from line overhauled the parts, Machining on seat & plug was carried out. Checked it for tight shutoff on test bench. Finally reinstalled & checked stroke.

33. **General Maintenance & stroke checking :**

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

Tag no. of control valves is as below:

V-18		FV-1008		FICV-002		PRCV-2		FV-100A
FRC-18		PICV-17		V-7		LCV-15		LIC-8
FV-1005		PCV-181		FCV-100A/B		PICV-20		PC-27
PICV-16		LICV-416		PICV-137		LCV-23		PCV-181
FICV-1016		FICV-1017		HICV-1004		FRCV-1005		LCV-23
LICV-470		PICV-004		LCV-13		PICV-139		PRC-1
FICV-7		TRCV-11		V-4		V-3		PV-1011
PRCV-25		PGR-E2		V-5		PICV-20		MIC-13

COMPRESSOR HOUSE JOBS:

Air Compressor (101J):-

1. Removed all Radial, Axial and key-phasor probes along with relevant junction boxes, speed pick-ups,T/C, pressure gauges and local TI 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.

2. 101-J LP case axial Probe Pt. No. EA, EB were relocated near to the LP case to gearbox coupling. New coupling was installed by mech. People. For that necessary drilling/Tapping, New probe brackets preparation work was carried out. Replaced the proximate JB location nearby probes. Finally checked the float clearance & adjusted the probe gap voltage.

3. HIC-101J: General cleaning and overhauling of governor positioner carried out , replaced its loading regulator and feed back link. Checked lock out relay, cylinder leakage. Positioner was fixed and stroke checking was performed.

4. VS-101J: The Trip solenoid valve was checked and overhauled.

5. 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

6. 101J/105J MOP Lube Oil Pressure switch setting was changed from 9.5 Kg/cm^2 to 8.5 Kg/cm^2.

7. Calibration of I/P converters of Governor Positioners HIC-101J were carried out.

8. Replaced flexible hose conduits of extension cable of vibration probe wherever it was found damage.

Ammonia Refrigeration Compressor (105J):-

1. Removed all Radial, Axial and Key-Phasor probes along with relevant junction boxes, speed pick-ups, RTD, pressure gauges and local TI to facilitate mechanical jobs. After completion of jobs the same were fixed back after cleaning/functional checking and gap voltage adjustments for radial and axial probes were carried out.

2. PRC-9: 105J Governor's pneumatic actuator assembly was checked. Checked its stroke and lockout relay function.

3. VS-105J: The Trip solenoid valve was checked and overhauled and also changed its coil with new one.
4. Turbine main steam valve Open/Close feedback limit switches was checked and mounted back.

5. Calibration of I/P converters of Governor Positioners PRC-9 were carried out.

6. Replaced flexible hose conduits of extension cable of vibration probe wherever it was found damage.

Synthesis Gas Compressor (103J):-

1. Removed all radial, axial and key-phasor probes along with relevant junction boxes, proximiters , speed pick-ups, T/C, RTDs pressure gauges and local TI to facilitate mechanical jobs. After completion of jobs the same were fixed back after cleaning/functional checking and gap voltage adjustments for radial and axial probes.

2. PRCV-12: Replaced the Piston/Cylinder & Positioner assembly with spare one. Its air regulator, gauges were replaced. Its air lock relay was also replaced. Checked air failure action. Stroke-checking from control room was performed.

3. MIC-23: Cylinder/positioner assembly was replaced by calibrated one. Feed back block was set at 45mm in the actuator. Top side travel stopper was provided in the cylinder.

4. 103J Manual Trip switch was provided at a new location as per the requirement of the Production Dept. for that welding. cabling & wiring job was carried out.

5. Trip solenoid valves VS-103J & VS-103 were overhauled. The coil of VS-103 was changed.

6. Calibration of I/P converters of Governor Positioner MIC-23 and PRC-12 were carried out.

7. T/C sensor of TI-103-8 was replaced with a new one.

8. Replaced flexible hose conduits of extension cable of vibration probe wherever it was found damage.

FIELD INSTRUMENTS JOBS:

1. Removed & reinstalled different instruments (RTD, MPU, SV etc.) at 115-JA & 115-JB to Facilitate Mech. Maint. Jobs and 115-JB trip sov was relocated, cable laid & tubing job carried out

2. PDR-26, 27, 34, 35, 36 & 37 – Transmitters and its cable were removed to facilitate 102-C related Mech. jobs. After completion of Mech. jobs the transmitters were reinstalled.

3. Replaced TI-0120 as the T/C was found open. And also Replaced TI-0018 as the T/C was found damage

4. Removed entire tunnel T/Cs for inspection and re-fixed after checking. Found damage three nos. thermocouple replaced with new one.

5. Various instruments were removed at 107-J and 104 -J to facilitate Mech. maint. jobs. After completion of Mech. jobs the instruments were reinstalled.

6. 115-JA & 115-JB – cables were re-routed.

7. PY-18 was relocated, cable laid & tubing job carried out.

8. Provided tubing for cooling water sample line at 115-C, 116-C & 124-C.

9. Orifice of FRC-482 was changed. and provided new DPT TX. (0-5000 mmwc)

10. Provided new sample tubing for R-111 & R-112.

11. Mechanical DP measurement / Hydro testing machine tubing done. Provided high range pressure gauges for hydro test of vessels and lines.

12. Tapping & fittings of PT-25 were changed.

13. Instrument air headers flushing were carried out in different locations.

14. LT-103D (Sec. Reformer jacket water) the transmitter impulse line was flushed & calibrated. Found ok. (0-10000mmwc)

15. Boiler Inspection: Provided Pressure gauges on HP pump and steam drum, 102C, pressure transmitter flushing and zero checking and other related work with Boiler inspection were carried out.

16. PT-87: transmitter & its impulse line were removed to facilitate Mech. maint. jobs. After completion of Mech. jobs the transmitter was reinstalled.

17. Pressure transmitters of 101-F, 112-C & 107-C were calibrated for 0-250 Kg/cm^2, 0-10 Kg/cm^2 & 0-100 Kg/cm^2 respectively.

18. 101F: Steam drum level monitoring system- "LEVELSTATE": Cards were replaced by Hi-tech service engineer. Finally level performance and alarm, trip contacts were checked. Found satisfactory.

19. TI-0046 & TI-0047: new T/C with thermo wells were checked & hydro test was carried out, no leakage was found.

20. PT-82: Installed a new transmitter having range 0-160 Kg/cm^2 (ABB make) & new impulse tubing job was carried out.

21. 104-J: provided a new Press gauge at pump discharge (range 0-250 Kg/cm^2).

22. 103-J: Local manual Trip switch was shifted to a new location as per the requirement of Production Dept.

23. Instrument Air Drier-A – the heater was checked & found faulty so replaced it.

24. Removing and re-fixing of instruments at different location to facilitate mech. Job and as per requirement of production people were carried out

25. C.G.Circulator: Rota meters removed from line then overhauled & fixed back. General cleaning of other instruments were carried out & checked performance.

26. 136-C T/C with thermowell were removed for purging purpose& re-fixed

27. Provided new ¼'' s.s. tubing of control valves LCV-490, FRCV-485 , LCV-15 & PICV-10

28. PT-87 refixing and provided it's tubing.

29. MICV-145 provided ¼'' s.s. Tubing of valve positioner and regulator. and provided new cable for it's I/p converter. Checked all loop found ok.

30. Provided ½'' s.s.tubing for PDR-35 & 37

31. Provided new Tx. For FR-6 (0-5000 MMWC)

32. LC-25 (101 CA/CB LEVEL) changed air supply and output gauge. also provided new output copper tube.

33. Replaced AOP switch of 115-JB for lube Oil line & set it.

34. Replaced PT-651 with new one. (0-10 kg/cm^2)

35. Removed old impulse line of PIC-16 and it's local controller.

Following ISO related quality/Safety affecting instruments were calibrated:-

1.	PT-7	33.	PT-8	17.	PT-10	25.	PT-80
2.	PT-150	34.	PT-5	18.	PT-4	26.	FT-1
3.	PT-62	35.	PT-9	19.	PT-36	27.	TI-104E
4.	FT-2	36.	FT-3	20.	FT-100	28.	FT-1005
5.	AR-1	37.	PT-1027	21.	FT-1006	29.	TI-0011
6.	PT-1A	38.	TI -0117	22.	TI-0007 (TRC-10)	30.	TIC-1025
7.	TI-0026	39.	TI-0039	23.	TI-0036		
8.	PT-501	40.	PT-503	24.	PT-28		

Following CDM related instruments were checked & calibrated:-

1.	FR-33	2.	FR-6	3.	FQI-181
4.	PI-82	5.	FI-65	6.	PI-676
7.	TI-0043	8.	TI-0023	9.	TI-0065
10.	FS-1101	11.	AR-5		

CONTROL ROOM JOBS:

1. Bently Vibration monitoring Panel to DCS (ALR-121 card) communication cable was replaced with a new one.

2. Replaced faulty communication cable (between PLC cabinet no 5 & Auxiliary console).

3. 115-JAT, 115-JBT: Provided indication of Governor Valve position in DCS, as per the requirement of Prod. Dept. Necessary engineering jobs carried out in Peak-150 as well as in DCS, two pair cable was also laid to implement that.

Technical Dept. Jobs:

1. MICV-145: Necessary cabling, wiring for I/P converter & tubing job for positioner was carried out. Finally checked the stroke.

2. PIC-007, LIC-007: New loops were defined in DCS.

Annual Maintenance of DCS, PLC & UPSS:

AMCO Battery:

1. The old battery bank was replaced with the new battery bank. (Total cells 175).

2. Electrolyte was poured into the new cells. New racks were kept ready.

3. The old battery bank was isolated from both UPS-I & II. Then cells were de-linked from each other. Old cells were removed from the battery room; old racks were replaced with new racks. New cells were kept on the new racks & they were interconnected. The bank was connected to the power cables coming from UPS.

4. 2 cycles of charging and 2 cycle of discharging were carried out. Voltage reading of each battery cell as well as the bank was taken.

5. Load testing for the new battery bank was carried out. Duration for that was 15 minutes. After 15 min. the battery bank voltage was found as 220V DC.

6. Checking of Battery operation was carried out and found ok. Details are as under :

1. Duration of charging	:	18 Hours
2. Duration of discharging	:	5 Hours @ 53 amps. With water load
3. Battery float charging voltage	:	252.7 V DC
4. Battery equalizing voltage	:	292 .4V DC
5. Battery discharged up to	:	220 V DC

YIL DCS:

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

1. 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 both ENGS were also taken. Saved tuning parameters of BCV and FCS0101 on CS3K ENGS. Project back up was taken.

2. 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.

3. 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.

4. 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.

5. Calibration of I/O cards of selected 2 cards in each nest was checked and performance was found OK.

6. Redundancy checking 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.

7. 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.

8. 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.

1. Cleaning of filters, fans, cabinets etc. was carried out for all the four PLC stations.

2. Checked the redundancy of all the four PLC at card, CPU and power supply level.

3. Batteries in all CPU cards & in one power supply monitoring card were replaced with new ones.

4. The following Faulty F-3237 cards were replaced with spare cards:
   1. Location: 1305, 2402 in PLC-1, 1309 in PLC-2, and 2401 in PLC-3.

5. Back up copy of all the programs (ELOP and Wizcon) were taken.

ABB CO2 and CH4 Analyser(AR-1 & AR-2):

1. Preventive maintenance of ABB make CO2 and CH4 analyser was carried out. CO_2 and CH_4 Analyzer were checked. Condition of sample cells was good. Optical alignment and phase alignment performed and sensor CPU board, detector and cells were checked. Manual Calibration of CO_2 and CH_4 analyser was performed & found ok.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND:

1. **LIC-105 (PGR -B3B Level) :** New level transmitter (Guided wave Radar) installed, cabling & glanding jobs carried out. Calibration was checked. Related engineering jobs carried out in DCS also alrm & Trip setting were done.

2. **PEAK-150 FOR 101BJT TURBINE:** Installed new Peak-150 Woodward Governor & Driver module in control room and speed Pick up probes(MPU) on PGPL Actuator and necessary cabling, JB mounting, wiring jobs were carried out. Finally checked the operation of ID Fan from Peak-150, found satisfactory. All the jobs were carried out in presence of supplier service engineer and Mech. Staff.

3. **LI-2801 Naphtha Tank Level:** New level transmitter (Guided Wave Radar) installed, cabling & glanding jobs carried out. Related engineering jobs carried out in DCS.

ISO 9001:2000

PREVENTIVE MAINTENANCE JOBS WERE CARRIED OUT As per the ISO 9001:2000

1.0 **FUJI UPSS:** The preventive maintenance of UPSS was carried out. The general cleaning, servicing & checking were done. Battery back up test carried out. Redundancy test and smooth change over function for the UPS1 and 2 were checked.

2.0 **YIL DCS: The** preventive maintenance of DCS was carried by M/s YBL as per the AMC. All EFCD, EOPS, EFMS and Engineering station cards were removed from cabinet / panel and cleaned. Replaced the fans, cleaned the filter, panels and cabinets. Checked the redundancy for CPUs, MAC2 cards, power supply and HF buses. Engineering station and EOPS healthiness checked through software.

3.0 **HIMA PLC: The** preventive maintenance of HIMA PLC was carried out by M/s L&T Ltd. as per the AMC. Cleaned filters, fans, cabinet and physical inspection were carried out. Checked the redundancy for CPU, input and output cards, power supply cards and HIMA buses.

4.0 **AMCO Batteries Bank:** The whole batteries were replaced by new upgraded version of M/s AMCO Ltd. make batteries bank.

5.0 **Control Valves:** Preventive maintenance of control valves were carried out by general cleaning, greasing, positioner & I/P checking, gland replacement / tightening, stroke checking.

6.0 **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 & MIC-23 for 103JAT & JBT: 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.

7.0 **Continuous Improvement activities:**

Replaced old pneumatic level transmitters with new SMART electronic transmitters for better reliability & performance. (LIC-105 & LI-2801)

Replaced old mechanical governor of 101BJT (ID Fan) with new Woodward make Peak-150 for better performance.

8.0 **Calibration of Instruments:** Safety & Quality affecting instruments were checked and calibrated.

UREA PLANT

HITACHI (CO_2) COMPRESSOR:

1.0 All RTDs and Thermocouples were removed to facilitate Mech. Maintenance jobs. Checked and installed back after mech. Maintenance job was over/ completed.

Following RTDs were replaced by new RTDs with pads.

TI-1820, TI-1821, TI- 1822, TI-1840.

2.0 All vibration probes and extension cables were removed and checked and installed back to facilitate Mech. Maintenance jobs.

3.0 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.

4.0 Local Control Panel and PLC Box were cleaned, all wiring connection were tightened.

5.0 I/H converter for Turbine HP Valve was replaced by new one and calibrated from “Woodward Governor”.

6.0 PT-1965 Transmitter was replaced by smart one. (Fuji Transmitter)

7.0 Followings transmitters were calibrated:-

LICT-1803, LICT-1805, LICT-1807, LICT-1203, LICT-1235.

8.0 All junction boxes were cleaned, terminal tightened.

CONTROL/ MARSHALLING ROOM:

1.0 Annual preventive maintenance of DCS, like cleaning of Cards, Software backup of FCS and all ICS, Batteries Voltage of all ICS and FCS were taken and found to be O.K .Functionality checking of FCS and all ICS by diagnostic software was carried out, by Yokogawa representatives and found to be O.K.

2.0 Panel cleaning & checking of OMRON PLC was done and CPU Battery voltage were checked and found alright.

3.0 New Alarm Information and Management System was installed and commissioned to replace obsolete serial printer of DCS.

4.0 Cleaning of wood ward Governor Console was carried out.

5.0 Radiac Relay unit for LR- 1201 was calibrated.

6.0 Radioactive sources of LR-1201 and LRC-1201were removed to facilitate Mech. Maint. Job and reinstalled.

OTHER PLANT JOBS:

1.0 LRC-1201 and LH-1201 detectors were removed and installed back to facilitate Mech. Maintenance jobs and installed back.

2.0 9 nos. HP Thermowell removed, hydro tested, and all Thermowell were re-fixed.

3.0 Preventive maintenance of turbine flow meter for cooling water was carried out.

4.0 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

5.0 All Plant J. B. 's terminal were tightened.

6.0 FS-1101(Old FS) - Micro motion Ammonia mass flow meter was removed for calibration at Palghat .Micro motion Ammonia mass flow meter was boxed up in line after calibration and put in line.

7.0 FS-1101A (New FS) - New Ammonia mass flow meter was installed in place Of obsolete Turbine type flow meter. Its commissioning is completed and put In line.

8.0 Following Transmitters were calibrated:

LRCT-1421 . PT-1282, PT-1481, LT-1481, LT- 1701 A & 1701 B. LRCV-1201. PT- 1202. LT-1202. PT -1201C.

9.0 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,

10.0 Coordinated with Production/ Maintenance persons for miscellaneous plant Jobs related to instruments.

11.0 PICV-1181 – Cable of I/P was damage near control room. It was rectified and Control valve stroke checked from control room and found alright.

12.0 Air Supply Lines at old Comp. - Air Supply Lines of below Valves were modified.

PICV-4801, FRCV-1102 and FICV-4801.

13.0 Instrument air header was flushed at various points.

WEEP HOLE CHECKING OF HP VESSELS:

1.0 Coordinated with production persons for weep holes tubing.

CONTROL VALVES:

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

2.1 LRCV-1201 –Control valve was Dropped from line and following jobs carried out. Diaphragm checked.. Plug and seat were replaced by spare good one(repaired). Angle of plug slightly increased to have higher flow capacity.Gland packing and sleeve replaced by new. Control valve was boxed up in line and Calibration carried out.

2.2 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.

2.3 PICV-1130 Control valve was dropped from line. Plug and seat were repaired / modified. Provided new gland packing. Control valve was boxed up in line. Calibration carried out and put in line.

2.4 HICV-1422 B – Control Valve was opened from line. Actuator link and baffle was repaired/ modified. Control Valve was overhauled. C/V was boxed up in line. Calibration carried out and put in line.

2.5 N/C Ratio meter - Monoblock valve was replaced by new one and put in line.

2.6 Actuator of Prill Divert three-way valve was replaced with spare one (Repaired)

2.7 PRCV-1201 Control Valve was opened from line. Plug and Seat lapping was done. Control Valve was overhauled. C/V was boxed up in line. Calibration carried out and put in line.

2.8 TICV-1353 – C/V was opened from line. Soft Seat Teflon & Gasket Teflon was replaced by new one. Hand wheel servicing done. C/V was assembled and hydro test done. C/V was boxed up in line. Calibration carried out.

2.9 PICV-1105 Control Valve was dropped from line. Machining was done on plug Control Valve was overhauled. C/V was assembled. C/V was boxed up in line.

2.10 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.

2.11 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.

2.12 HICV-1352 Control Valve was dropped from line. Machining was done on plug and Seat. C/V was overhauled. C/V was assembled. Gland packing was replaced by new one. C/V was boxed up in line. Calibration carried out.

2.13 TICV-1701B- Control Valve was removed from line. Machining was done on plug and Seat. Control Valve was overhauled. Gland packing was replaced by new One. C/V was assembled. C/V was boxed up in line. Calibration carried out.

2.14 PICV-1502A Control valve was opened from line. Machining done on plug and seat. O- Ring set of actuator was replaced by new one. Gland packing was replaced by new one. C/V was assembled. C/V was boxed up in line. Calibration carried out.

2.15 HICV-1422A Control valve was opened from line. Machining was done for plug and seat. C/V was assembled. Gland packing was replaced by new one. Pressure test done. C/V was boxed up in line.. Calibration carried out.

2.16 LICV-1235 – Control Valve was removed from line. Machining was done on plug and Seat. C/V was overhauled. Control Valve was assembled. Gland packing was replaced by new one. Control Valve was boxed up in line. Calibration carried out.

2.17 FICV-1281 Control Valve was dropped from line. Machining was done on plug and Seat. Gland packing was replaced by new one. C/V was assembled. Control Valve was boxed up in line. Calibration carried out.

2.18 HICV-1221A Control valve was dropped from line. Inspection of Baffle & Body, founds its normal. Checking of stroking found it's normal. Provided new gland packing.

2.19 LICV-1805 & LICV-1807 control valve are to be removed from line & inspect the plug & seat, it found normal, minor lapping done, changed gland packing & assemble the valves. Stroking of both control valves are found normal.

2.20 PICV-1979A & PICV-1979B control valve are to be removed from line & inspect the plug & seat , it found normal , Minor lapping done, Changed gland packing & assemble the valves. Stroking of both control valves are found normal.

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

2.1 HICV-1801 and PICV-1810 Control valve were opened from bonnet. Lapping done on plug & seat of both valves and carbon seal rings of both valves were replaced by spare one. Boxed up the valves and calibration carried out.

2.2 PRCV -1504 Control valve was opened from bonnet. Plug, seat was repaired / modified. Provided new gland packing. Control valve assembled installed back in line. Calibration carried out.

2.3 FICV-1481 Control Valve was opened from line. Machining was done on plug and seat. Control Valve was overhauled. C/V was assembled. Gland packing was replaced by new on. Control valve was boxed up in line. Calibration carried out.

2.4 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-1102,FICV-1481,FRCV–1421,LICV-1201,LICV-1351,LICV-352, MICV-1101,PICV-1128,PICV-1129,TRCV-1422

2.5 Following control valves overhauled & checked for operation.

2.6 HICV-1202, HICV-1208, HV-1802, HV-1803, PICV-1481, PRCV-1131, TICV-1808, TRCV-1201, TRCV-1202, TRCV-1421.

OFFSITES & UTILITY PLANT

BOILER PLANT:

Control Room Jobs:

(1) **Cleaning of DCS & PLC panels & and checking of hardware functionality were done under the CAMC Contract. Following jobs were carried out.**

1.1 Redundancy check of DCS and PLC were done. Found o.k.
1.2 Push buttons on operator console were covered with protective covers.
1.3 DCS/PLC trip logic was checked.
1.4 FD Fan turbine bearing temperature (TI-16A,TI-16B,TI-16C,TI-16D) were removed from FD FAN Trip logic. These are now only for Indication.
1.5 DCS / PLC Back-up was taken in CD

Field Jobs:

(1) **Following field switch set value were checked:**

1.1 LSLL-1, LSL-2, LSL-3 of steam drum level.
1.2 LLCO-5111, LAL-5111 and LAH-5111 of Deaerator.
1.3 PSL-1 F.D. Fan lube oil pressure low AOP START.
1.4 PSL-11(set at 300mmwc), PSH-12 (set at 400mmwc)
1.5 PSL-24, PSL-25, PSN-26 & PSL-27 of Ignition and fuel gas line.
1.6 PSL-21 ,PSL-22 & PSL-23 fuel oil header

(2) **Checked set value of following lube oil system switches of motor and turbine driven BFW pump.**

2.1 PAL-5114, PLCI-5113, PLCO-5112 for P-5111
2.2 PAL-5113, PLCI-5112, PLCO-5111 for Q-5111
2.3 PAL-5115, PLCI-5114, PLCO-5113 for P-5112
2.4 PLCI-5115 M-5112 AOP

(3) O2 Analyser sample filter assy. was cleaned with air.

(4) TR-13 Furnace Temp. T/C was replaced with a new OE.

(5) **Following Damper's limit switches, solenoids valves, air regulators etc. were overhauled and checked its operation.**

5.1 F.D. fan inlet damper and F.D. fan outlet damper.
5.2 Air heater inlet damper and Air heater outlet damper.

(6) **EYE-HYE Electrodes were checked and tighten the entire terminal.**

(7) **Pressure gauges PI-2, PI-3, PI-4 & PI-5 were calibrated w.r.t. Boiler inspection.**

(8) **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.**

(9) **Checked instruments as per ISO calibration schedule.**

CONTROL VALVES:

(1) **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.)**

TIC-2,PICV-51, GHTV, BTV-4A, BTV-4A, pHCV-4401, BTV-4B, BTV-4B, FICV-2201, FICV-2202, FICV-2203, FICV-2204, FICV-2205,UV-22,FCV-1

- FCV-01 (Control Valve was replaced with new IL make c/v)
- LRCV-04(replaced v/p with electro-pneumatic- ymc make),
- PCV-1(replaced v/p with electro-pneumatic- ymc make),
- TCV-1(replaced plug with new one so as to increase cv of valve),

(2) **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-1, PICV-1, PICV-5114,

(3) **Following control valve's preventive maintenance was carried ut. (General cleaning & c/v stroke checking.)**

BTV1-1, BTV1-2, BTV1-3, BTV-2-1, BTV-2-2, BTV-2-3, TICV- 5114, HOHTV, PCV-2, FCV-21, PCV-3008

IGNITORS:

1.0 Both Burner's ignitor gun, spark plug, gas & Oil flame scanners were cleaned and checked.

2.0 All furnace draft PI impulse lines were flushed with 7.0 kg/cm2 air.

D.M. WATER TREATMENT PLANT:

(1) DCS RELATED JOB:

Installation of additional Node in DCS for SSNNL job was carried out by service engineer from YIL in our presence.

Cleaning of DCS panels & checking of hardware functionality were done. Redundancy check of DCS was done. Found o.k.

NH3 STORAGE:

(1) Cleaning of Tata Honeywel PLC was carried out. Replaced Battery with new one. Checked PLC programme by connecting PLC with PC.

COOLING TOWER:

1. Q- 4411 (Elliott Turb.) All radial vibration probes , speed pick-up probe,
2. Local THI & PI were removed & reinstalled to facilitate Mech. Maint.
3. LT-01, Hotwell level transmitter of Surface condenser was cleaned & calibrated.
4. All the three level switches (LSAL-01, LSAH-01 & LSHH-01) of Surface condenser were cleaned & calibrated.
5. Tacho-generaor. of Q-4402 & Q-4403 were cleaned, checked and fixed back.
6. R.W. inlet flow element (ANNUBAR) was removed from line. Same was cleaned & fixed back.
7. C.T.Basin level trans. (Electronic) was checked.
8. Both the Amm. & Urea side cooling water pH control valves were removed from line for overhauling. Same were fixed back.
9. Checked diaphragm of LCV-01 & LCV-02 of surface condenser.
10. Cleaning of control panel & tightening of all terminals inside panel was carried out.

I.G. PLANT:

1. Servicing and calibration of ABB make H2 analyzer of new I. G.
2. Plant was carried out by Service engineer from M/s ABB in our presence.
3. Attended all running jobs.

WEIGH BRIDGE:

1. Calibration of Ashbee make weigh bridge (near main gate) was carried out with standard weights. Painting of platform was also done.

EFFLUENT TREATMENT PLANT:

1. Overhauling of SBA control valve and its valve positioner.
2. Cleaning of sampling system and calibration of Ammonia analyzer.

B&MH PLANT

1.0 Power Build make Automatic Bagging M/c.:
(P/S No. 1,2,3,4,7, 8,10A & 10B)

Checked wiring terminals in the main panel, local panel,
Solenoid boxes and load cell boxes.
Cleaned and checked CIC-25, relays board, fuses, and all sensors.
Checked function and calibration of all Packer Scales.
All solenoid valves were overhauled**.**

NOTE: Installation & commissioning of new PBL make automatic bag filling machine in place of JRSL make bag filling m/c No.9Awas carried out. New panel was taken in service and checked performance, found satisfactory.

2.0 J.S.R.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**.**

2.0 Weigh Scales (Mettler-Toledo make):

Cleaned the weighing scales and Digital Indicators.

Calibrated all weighing scales.

Weigh scale platforms were cleaned & painted.

4.0 Belt Weigher System:

4.1 Cleaned/Overhauled the Tacho-meter assembly.

4.2 Checked the healthiness of load cells, Tacho-meter. D

4.3 Digital indicator was replaced with spare one.

4.4 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 engineer from EMTIC in our presence.

5.0 Dust Extraction System:

Cleaned the Dust Extraction Panel.

Cleaned all field instruments (C/V, FlowTx, LevelTx etc.) related to DES.

AMMONIA PLANT

1.0 AMMONIA PLANT

1.1 Preventive maintenance carried out on transformers: TR-6, TR-21 & TR-22 and the job details are as under:

1.1.1 Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
1.1.2 Measurement for Insulation resistance, BDV of transformer oil.
1.1.3 Alarm & tripping contacts of Buchholz relay and MOG were checked.
1.1.4 Condition of silica gel was checked. Discharged silica gel was recharged.
1.1.5 Oil leakages from the transformers were attended and damaged gaskets were replaced.

1.2 Preventive maintenance carried out on all the feeder compartments in MCC-5, MCC-5 A/B, MCC-13 & MCC-16 and the job details are as under:

1.2.1 Checked the tightness of outgoing terminals.
1.2.2 Cleaned the feeder compartments.
1.2.3 Replaced damaged/ worn out contacts, etc.

1.3 Overhauling of the following motors was carried out:

101BJ, 104J, 104 JA, 104 JT, 104 JTA, 106J, 107 JT, 118 JB, 2004 J, 116 JB and 103 JLO.

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

SP1, SP3, SP4, SP5, SP70, SP151, SP152, SP156,SP 158 & SP159.

1.5 Existing Limitorque actuator of MOV SP154 is replaced with new ROTORK actuator and modification in wiring is done accordingly.

1.6 The Existing SP-4 valves was replaced with new spare valve. We have replaced the drive bush of existing actuator and done the necessary machining according to the new spare valve.

1.7 Testing and calibration of power analyzer installed in MCC16 for 117J syn-gas compressor were carried out.

1.8 Preventive maintenance of L & T Breakers installed in MCCs was carried out.

UREA PLANT

1.1 Preventive maintenance carried out on transformers: TR-7B, TR-17, TR-18, TR-20 and the job details are as under:

1.1.1 Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
1.1.2 Measurement for Insulation resistance, BDV of transformer oil.
1.1.3 Alarm & tripping contacts of Buchholz relay and MOG were checked.
1.1.4 Condition of silica gel was checked. Discharged silica gel was recharged.
1.1.5 Oil leakages from the transformers were attended and damaged gaskets were replaced.

1.2 Preventive maintenance of all the feeder compartment in MCC 6 and MCC 14, MCC 15 were carried out:

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

1.3 Preventive maintenance of following MOV's was carried out: MOV1501, MOV1203, MOV1202, and MOV1801

1.4 Overhauling of the following motors was done:
P-1131/A, B & C, P-1231/ A/B, P-1408, P-1501, M-1402/1&2,M-1419, M-1421, M-1401/A&B, K-1401/1, 2, 3 & 4 , P-1204/B, P-1302 C, P-1506, M-1703.

1.5 Commissioning & testing of **MOV-1102** with the new Rotork make actuator.

1.6 Installation, commissioning & testing of **three part conveyor motors & panel** in urea plant.

1.7 **Overhauling the transformer TR-7A by lifting the entire core. Inspection and cleaning of winding was done and transformer oil was replaced.**

1.8 Modification of indication logic on DCS in urea control room for actuator of following MOVs—MOV1501, MOV1203, MOV1202, MOV1801

1.9 Successful interchanging & testing of Reflux pump **(P-1352 A)** with Process water pump **(P-1305 A)** in urea plant under energy saving project.

1.10 Preventive maintenance of blowers for internal cooling of variable speed drive for following equipments in urea plant—P-1102B, P-1102C, P-1201A & P-1201C

1.11 Preventive maintenance of rope switches installed on following conveyors—M-1419 & M-1421

1.12 Preventive maintenance of Siemens and L&T Breakers installed in MCCs was carried out.

OFFSITES PLANT

1.1 Preventive maintenance carried out on transformers: TR-1A, TR-1B, TR-1C, TR-4A, TR-4B, TR-15, and job details are as under:

1.1.1 Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
1.1.2 Measurement for Insulation resistance, BDV of transformer oil were carried out on each transformer.
1.1.3 Alarm & tripping contacts of Buchholz relay and MOG were checked.
1.1.4 Condition of silica gel was checked. Discharged silica gel was recharged.
1.1.5 Oil leakages from on the transformers were attended and damaged gaskets were replaced.

1.2. Preventive maintenance of all the feeder compartments in MCC-3, DG MCC was carried out:

1.2.1 Checking the tightness of cable & wiring terminals in the feeders.
1.2.2 Cleaned the feeder compartments.
1.2.3 Replaced damaged / worn out contacts, etc.
1.2.4 Tightness of the bolts of bus bars in DG Panel was checked.

1.3 Preventive maintenance jobs were carried out in 66 KV switchyard:

1.6.1 Cleaning of insulators of all the CT & PT units, bus bar support, lightning arrester, breakers, etc.
1.6.2 Insulation Resistance was measured of all the CTs & PTs.
1.6.3 All the moving parts of isolators were cleaned and lubricated.
1.6.4 11 KV VCB panels were cleaned and outgoing cable terminals were checked for its tightness or hot spot.

1.4 Preventive maintenance jobs were carried out in 11 KV MPSS:

1.4.1 Checked the tightness of outgoing terminals.
1.4.2 Cleaned the feeder compartment of both Jyoti and Siemens panel
1.4.3 Replaced damaged /worn out contacts, etc.

1.5 Preventive maintenance and overhauling of HT Siemens Breakers installed in 11KV MPSS were carried out.

1.6 Preventive maintenance of Minimum Oil circuit Breakers (MOCB) installed in 66KV Switchyard was carried out.

1.7 Preventive maintenance of Siemens and L&T Breakers installed in MCCs was carried out.

UTILITY PLANT

1.1 Preventive maintenance carried out on transformers: TR-2B, TR-3A, TR-3B, TR-8, TR-11, TR-12, TR-13 & TR-14 and the job details are as under:

1.1.1 Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
1.1.2 Measurement for Insulation resistance, BDV of transformer oil were carried out on each transformer.
1.1.3 Alarm & tripping contacts of Buchholz relay and MOG were checked.
1.1.4 Condition of silica gel was checked. Discharged silica gel was recharged.
1.1.5 Oil leakages from the transformers were attended and damaged gaskets were replaced.

1.2 **Overhauling of transformer TR-2A by lifting the entire core. Inspection and cleaning of winding was done and transformer oil was replaced.**

1.3 Preventive maintenance of the entire feeder compartment in MCC 1, 2, 2B/2E, 2A, 2F, was carried out:

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

1.4 Overhauled the following motors.
P-5113, E-5111, E-5116, E-5117, E-5118/A, E-5118/B, E-5118/C, E5119, M-5120, P-5111/A, P-5111/B, P-5112/A, P-5112/B, P-4405, P-4403, P-4411/B, P-4412

1.5 Checking of terminal box of all HT Motors:
P-4402B, P-4401C, P-4401D, P-4404, and E-5112.

1.6 Damaged Cooling Water Pump actuator P4401/A replaced with new ROTORK actuator, commissioning, testing and modification in wiring is done accordingly.

1.7 Preventive maintenance of Siemens and L&T Breakers installed in MCCs was carried out.

B&MH PLANT

1.1 Installation of (MCC-4) new Siemens panel LT MCC at new location:

1.1.1 Testing, commissioning and shifting of all power and control cables from old MCC to new.
1.1.2 Providing power supply to module for Narmada clear water MCC etc.

1.2 Preventive maintenance carried out on transformer: TR-5A, TR-5B, and the job details are as under:

1.2.1 Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
1.2.2 Measurement for Insulation resistance, BDV of transformer oil were carried out on each transformer.
1.2.3 Alarm & tripping contacts of Buchholz relay and MOG were checked. Servicing of Buchholz Relay of Tr-5B was carried out.
1.2.4 Condition of silica gel was checked. Discharged silica gel was recharged.
1.2.5 Oil leakages from on the transformers were attended and damaged gaskets were replaced.

1.3 Preventive maintenance of all the feeder compartments in MCC 4A (New &Old) were carried out:

1.3.1 Checked the tightness of outgoing terminals.
1.3.2 Cleaned the feeder compartment.
1.3.3 Replaced damaged /worn out contacts, etc.

1.4 Overhauling of the following motors was done:
M2110, M2112, M2117, M2121, M2122

1.5 Preventive maintenance carried out on all rope switches installed on Conveyors: M2110, M2112, M2117, M2121, M2122 & M2123 and replaced defective one with new.

1.6 Preventive maintenance of Siemens and L&T Breakers installed in MCCs was carried out.

1.7 Overhauling of all motors and replacement of two no. of power sockets installed on M-2117 walk way for Reclaim machine.

1.8 Preventive maintenance of Siemens and L&T Breakers installed in MCCs was carried out.

AMMONIA PLANT

AUXILIARY BOILER:

1.0 Repairing/replacement of burner blocks for burner no. 1, 2, 3, 4 and 5.

2.0 Repairing of Header and other refractory works in side the auxiliary boiler.

3.0 Repairing existing hot point panels on north side of auxiliary boiler by insulating castable materials.

PRIMARY REFORMER:

1.0 Repair of insulation bricks along with back up insulation after the removal of old damaged refractory in east and south side walls.

2.0 Removing / reconstruction of tunnel walls in primary reformerincluding bottom floor, tunnel slabs.

3.0 Refractory works in 102-C waste heat boiler.

4.0 Replacement of AC sheets roofing for pent house area of primary reformer.

UREA PLANT

1.0 Repairing of scrapper floor of Prill tower by filling the joints of existing tiles and replacement of damaged acid proof brick lining, repair of Vatas by epoxy system.

2.0 Civil works for modification of conveyor belt in Urea plant

3.0 Providing and laying IP Net painting on outside surface of bucket room, lift cabin, RCC structure for top area of Prill tower, IP Net coating for first floor and second floor area of Urea plant including column, slab, beam etc.

4.0 Epoxy painting of RCC structure of Prill bucket room, lift cabin room, stair case at Prill tower top level .

5.0 Painting of conveyor gantry from Prill tower to Silo.

6.0 Bitumastic lining for conveyor gantry from Prill tower to transfer tower.

7.0 Replacement of damaged AC sheets for Prill cooling system, Hitachi compressor shed and control room shed area.

8.0 Making RCC pedestal for modification of conveyor at Prill tower.

9.0 Repair of damaged pre-cast slab near Urea plant.

OFFSITES & UTILITY PLANT

WATER TREATMENT PLANT:

1.0 Repairing of floor by bitumastic lining for Anion assembly unit and around Anion tank in water treatment plant.

2.0 Outside/Inside RCC repairing work in new cooling tower sump.

3.0 Replacement of water proof plywood on cooling water spreading area of Ammonia side cooling tower.

4.0 Construction of open channel for maintenance of ammonia side cooling tower.

BOILER HOUSE:

1.0 Repairing of castable refractory for burner's side, floor and superheated zone inside BHEL boiler.

2.0 Replacement of AC sheets in BHEL Boiler roof.

3.0 Painting of RCC pedestals/foundations in B&MH plant.

COOLING TOWER:

1.0 Repairing of damaged top cover plywood sheets of cooling tower

2.0 Filling of coal tar for leakage water planks of cooling towers.

3.0 Strengthening of wooden structure for new cooling tower.

4.0 Making line open by carryout excavation for the repair of leakage cooling tower line near sand filter,

5.0 Construction of open channel for maintenance of ammonia side cooling tower.

B & MH PLANT

1.0 Epoxy painting of Transfer tower and conveyor gantry from Silo to B & MH.

2.0 Repairing of Hopper floor / Packer scale floor with epoxy monolithic plaster.

3.0 IP Net coating of RCC columns, ceiling, slab, beams and other RCC structure in Bagging plant (Hopper floor) at ground floor area and repair work for the RCC suspenders.

4.0 Replacement of AC sheets roofing for truck loading area and wagon loading area of B&MH plant.

5.0 Epoxy painting to RCC columns, beams and slabs at GF.

6.0 Jacketing and strengthening of columns at the GF and repairing of floor (raising the height of floor) in hopper floor of bagging plant.

7.0 Bitumastic lining in transfer tower floor area.

8.0 Bitumastic lining from transfer tower to B&MH plant.

9.0 Fixing of glazed tiles on ground floor wall of B&MH plant.

AMMONIA PLANT

INSTALLATION OF CONTROL VALVE (TICV-145) ON LP STAEM SUPPLY LINE OF LNG PREHEATER OF AUXILARY BOILER::(Ref.:Sugg.No. SS/Amm/05/05)::

As per approved scheme(Ref. Suggestion No. SS/Amm/05/05) , temperature control valve of size 2'' NB has been installed in LP steam line to LNG pre-heater.

Control valve was procured from M/s Instrumentation Ltd. Vide PO. No. 9920702 Installation of control valve will facilitate in maintaining LNG temperature from the control room.

TAPPING OF SYN GAS LINE FROM AMMONIA TO BHEL BOILER AND RELATED PIPING JOB IN AMMONIA PLANT B/L:

i) Tapping from line no. SG-17-14''(from 136-C outlet to 104-C) has been taken.
ii) Tapping for syn gas line RV outlet in vent line to sp-75 has been taken.
iii) Out let line of new syn gas separator(Equipment no. 182-F of NG Booster Compressor) has been installed upto ammonia plant battery limit. Balance will be completed in running plant.

TAPPING FOR INSTALLATION OF PRESSURE ACTUATION PUMPS:: (Suggestion no. SS/Amm/27/06 & SS/Amm/30/06):

i) Tappings of ½'' from steam line and 1'' NB has been taken in condensate from turbine casing and 1'' NB from turbine to condenser exhaust line for installation of PAP for BFW pump turbine(104-JAT).
ii) Tappings of ½'' and 1'' NB has been taken in steam , condensate and exhaust lines for installation of PAP for ID fan turbine (101-JBT). Pumps will be installed in running plant.

REMOVAL OF STEAM LINES CONNECTED TO NG / NG BOOSTER COMPRESSOR TURBINES:

Since NG/ NG Booster compressor train are not required and have been isolated/ redundant, MP & LP steam lines of NG & NG Booster compressor has been removed as per approved IBR drawings 01-DL-13515-SH 1OF 1Rev0

PROVISION OF FULL CAPACITY BYPASS OF FRCV-485::EWR A255Dt.24/05/08:

Full capacity by-pass valve of FRCV-485 has been provided by installation of 1.5'' globe valve of 1500# .This will facilitate to maintain MP boiler level and stopping of back end can be avoided in case of failure of FRCV-485.

UREA PLANT

INSTALLATION OF INDEPENDENT EJECTOR SYSTEM FOR PRE-EVEPORATOR::(Ref. EWR NO.U-229):

As per approved scheme vide TM/02/1306 Dated 05/11/2005 for installation of independent ejector system for pre evaporator, New more efficient pre evaporator ejector (P-1418) has been installed. The design steam consumption of new ejector is 188 Kg/Hr against 397Kg/Hr. of redundant ejector.

Ejector has been procured from M/s New Field Industrial equipment vide P.O. NO. 61/01570/KLL/17811YN/9918889Dated18.03.2006(Vendor's W.O. NO. EJ2961).

Following benefits are achieved with independent evaporator ejector system:

1. Pre evaporator vacuum is maintained during isolation of evaporation system.
2. Pre evaporator ejector outlet vapors are scrubbed in two bed atmospheric scrubber (V-1206) instead of releasing to atmosphere.
3. About 209 kg/h LP steam is saved with use of efficient pre evaporator ejector.

TO PROVIDE CONTROL VALVE AT COOLING WATER OUTLET OF H-1207 : CCS-II COOLER ::EWR-U235:

The scheme was approved vide TM/02/1300 dated 23/01/2008 to install a redundant Control valve on CW outlet line(CW-1204-10''-B13) of CCS-II cooler. Accordingly, as per isometric drawing no. 02-EL-13464 bypass control valve (HICV-1204) is provided on 80 mm NB cooling water bypass line in place of isolation valve on bypass line of C.W. outlet from CCS-II cooler (H-1207) and 2" globe type control valve (Redundant LCV-1123B) having Cv-50, class 300 # RF is installed as HICV-1204. By above modification the operational flexibility to control CCS-II temperature during plant start up is increased.

RELOCATION OF CONDENSATE POT (V-1204) LEVEL CONTROL VALVE (LICV-1204) FOR RECIRCULATION HEATER:

The scheme was approved vide TM/02/1309 dated 15/03/08 for relocation of LICV-1204 downstream of H-1207 A to avoid water hammering. Accordingly, the level control valve (LICV-1204) was relocated in the condensate outlet line from H-1207A to T-1501. After implementation of the above scheme, there is no water hammering in H-1207 A and heat exchanger (H-1207 A) performance has improved.

INSTALLATIONS OF RUPTURE DISC ON CCS-II OUTLET FROM HP SCRUBBER TO AVOID SUDDEN PRESSURE SHOOT UP IN CCS-II:

Rupture disc procured from M/s BS& B vide P.O. NO. 61/01564/9918814 has been installed on CCS-II outlet line from HP Scrubber. The rupture disc inlet isolation valve has been provided and blow-off line connected at an angle of 45 degree to vent stack as per isometric drawing no. 01-DL-13444. The burst pressure of the rupture disc is 13Kg/Cm2 @ 183Deg C With implementation of the scheme safety of CCS-II system against failure of HP scrubber tubes will be ensured.

OTHER UREA PLANT JOBS:

i) Re-routing of 2 inch vapour outlet line with slope of Pre-evaporator condenser(H-1419) in Urea plant to avoid choking in the line.

ii) Cooling water tapping location changed from bottom to top of cooling water headers for H-1208, H1427 to avoid going of piping rust, debris etc. in heat exchangers.

iii) PHE H-1301 shell and plate nozzle piping modification has been done so as to make plate inlet from bottom as suggested by OEM.

iv) Installation of new PHE (H-1351) and associated piping job in hydrolyser section. This is a new heat exchanger with higher capacity to replace existing Shell -Tube Heat exchangers. Performance is to be evaluated

UTILITY PLANT

HOOK UP OF NEW COOLING WATER RETURN HEADERS AND RISERS OF AMMONIA & UREA COOLING TOWERS:

Headers at bottom of CT along with risers were fabricated and erected in the running plant. Hook up these bottom headers was carried out during shutdown.

Following jobs have been carried out for hook –up job:

i) East & west side header cutting & removal.
ii) Edge beveling of 36 inch horizontal header at deck for Ammonia CT and 30inch vertical header for Urea CT.
iii) 36" / 24/ 18" / 14"(For Ammonia CT) and 30" / 24/16" (For Urea CT) distribution pipe spool erection/fit-up/welding and hook up.
iv) Riser spool welding /valve hook up.
v) Hole cutting of existing header and hook up of new header.

INTERCONNECTION OF AMMONIA AND UREA COOLING WATER RETURN HEADERS:

Ammonia and Urea CT return headers were hooked up for flexibility purpose.

Following jobs were carried out for connecting of ammonia and urea headers:

i) West side header beveling & blinding of holes by patch plate (On Header Removed from Top)
ii) East side header beveling and blinding of holes by patch plate (On Header Removed from Top)
iii) West side and east side header erection.
iv) West side/ east side header welding completion.