2005=1

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PREFACE

Plant Turnaround for the year 2005 was carried out from 22-05-2005 to 29-06-2005 for preventive maintenance of the plant equipment / miscellaneous jobs pending for the plant shutdown, including installation & commissioning of various equipments and vessels for the ambitious energy saving schemes of the Ammonia plant.

After ensuring availability of all the required material for shutdown as well as awarding of contracts for various shutdown jobs, it was decided to stop Ammonia and Urea plants on 22-05-2005. This Shutdown report contains details of the jobs carried out during the shutdown which are given plant wise and section wise. Ammonia Plant was put back into service on 29-06-2005 after a total shutdown period of 39 days from production to production & Urea Plant was put back in to service on 24-06-2005 after a total shutdown period of 34 days from production to production.

Main thrust for this turnaround was given on meticulous planning of all activities like planning for manpower, material and other resources. Due to the efforts put in by one and all, at all the levels, turnaround jobs could be completed within the scheduled period of 39 days for Ammonia plant & 34 days for Urea plant.

Safety was one of the major aspects which was given top most priority during the execution of various jobs. All outsourced manpower of the contractors was given necessary training for safe working in the plant and strict vigilance was also kept by Fire & Safety Section during execution of critical jobs. As a result, the shutdown was successfully completed without a single accident.

MECHANICAL

AMMONIA PLANT

- In addition to routine preventive maintenance jobs of various rotating equipments, Air compressor LP & HP cases (101J LP & HP) were taken for major overhauling.
- Synthesis Compressor Drive Back pressure Turbine (103-JAT) was also overhauled with new spare rotor as the high vibration problem was faced during startup of the equipment. Rotor found damaged after opening of the turbine.
- The new complete governing valve assembly with casted body procured from M/S Coppus, USA installed on 101-J / 105-J & 103-J turbines.
- New flexible couplings procured from M/S Euro flex, Hydrabad were installed between 107 JT turbine & 107 JA pump and 104 JAT turbine & 104 JA pump.
- In the Auxiliary Boiler, Coil "C" complete replaced with pre-fabricated Coil C and In-situ replacement of 60 tubes (30 each) of the Coil A & B.
- Both Waste Heat Boiler(101-CA/CB) and 112-C were offered for IBR inspection.
- Ultrasonic scanning was carried out of all the reformer tubes by M/s PDIL.
- During radiographic weld examination of C-Joint of catalyst tube; cracks were found in several catalyst tubes. All 8 Nos of defectives tubes were replaced with salvaged catalyst tubes.

- Under the energy saving scheme (ESP), Phase – I ; following new equipments were installed and were taken in line at the time of startup of the ammonia plant:
  115 JA/JB - Semi lean pump

115 HT – Hydraulic turbine for 115 JA

116 J/JA - Split pump

104 D3 – LTS Guard

155 C - Knock out drum

101 EA – New CO2 Absorber

103 E1 – HP Flash vessel

103 E2 – LP Flash vessel

142 CB – LTS Guard exit BFW heater

- Under ESP, Phase – I ; following equipments were modified:

  101 BJT – ID Fan turbine- converted from back pressure to condensing type of turbine

  107 JB/JD – AMDEA pump – decoupled and lines were disconnected.

  105 CA – CO2 stripper gas exchanger – shifted and installed on 102 EB.

- Due to installation of new equipments energy saving scheme, the following equipments were removed from plant:

  101 E – CO2 Absorber (old)

  102 EA – CO2 Stripper

  111 CA/CB – Steam reboiler

  108-C, A/B – aMDEA Coolers

- Erection of New CO2 Absorber & HP - LP Flash vessel was carried out in the month of Jan-Feb, Demag crawler crane (capacity 450 ton) from Aonla was used for erection of these equipments..

UREA PLANT

- In Urea plant, the major overhauling of "Siemens" make drive turbine (Q-1801-1) of Hitachi CO_2 Compressor was taken up for the first time since its installation and commissioning during KEP in the year 1997. Simultaneously, preventive maintenance of L.P case, HP case & gear box (M-1801) of Hitachi compressor (K-1801) was attended.

- All heat exchangers were cleaned by hydro jetting & boxed up. Complete set of 182 Nos. channel plates of plate type heat exchanger (H-1206) were replaced with cleaned, inspected & re-gasketted channel plates. Various RV's were overhauled & tested. New "Tyco" make RV was installed in discharge line of HP Carbamate Pump (P-1201C).

- Inspection of H.P. Vessels and L.P. Vessels was carried out and necessary repairs were undertaken depending on inspection findings. The major fabrication repair work was undertaken in CO_2 Spray cooler (H-1104), L.P. Absorber (V-1203) & Atmospheric Scrubber (V-1206). The corroded structures & railings in the HP Scrubber area (Approx. 4 Ton) were replaced.

- Prill tower ID Fans, Prill cooling system (PCS) Fans & Urea Scraper were taken for preventive maintenance. Rubber belts, Pulleys & Rollers of M-1403, M-1419, and M-1421 and PCS silo flat conveyor were replaced. All three silos of PCS system were replaced as the existing silos were badly corroded due to urea dust atmosphere and due to loose UHMW polymer liner.

OFFSITES PLANT

- RLA Study of BHEL Boiler was carried out.
- Q-5111 & Q-4401-B Cooling water pump turbines were overhauled.
- The Cooling Water distribution header of Urea Cooling tower was replaced with SS304 pipe header.
- Hot End baskets of RAH unit was replaced.
- All Cooling water & BFW pumps and turbines were taken for preventive maintenance. Various RV's were overhauled and tested.
- IBR inspection of BHEL boiler was carried out.

B&MH PLANT

- Preventive maintenance of Reclaim Machine M-2116 was carried out.

INSTRUMENT

AMMONIA PLANT

- Obsolete 7200 series of M/s Bentley Nevada,USA make vibration monitoring system for 103- J (The Synthesis compressor) was replaced by latest 3500 series system of M/s Bently Nevada, USA. Next replacement of 7200 series for 105 J will be carried out in phased manner in next shutdown.

- Three nos. of obsolete pneumatic leveltrols were upgraded to electronic type by M/s Masoneilan, France make leveltrols retrofitting kits. The job is done in phased manner. This was phase III.

  The ESP – Phase I & II related Instrumentation jobs in HIMA PLC ESD were carried out.

- Migration to Yokogawa latest Centum CS – 3000 DCS from Centum – XL operating stations was carried out also incorporation of CS- 3000 Field Control Station was done for ESP phase I & II schemes. New Engineering station for new DCS was installed. Communication with old (CENTUM XL) and new DCS systems was established successfully.

- Annual servicing of DCS/PLC systems/Analyzers/UPSS and its batteries with the help of supplier's service engineers under AMC was carried out.

- Preventive maintenance of control valves was done.

- Various Instrumentation related Jobs related with LNG and other suggestion schemes were executed.

UREA PLANT

- various EWR related jobs were carried out .Three nos. of new control valves were installed.

- Servicing and overhauling of the control valves was done.
- PRCV -1504, the 23 ata vent valve control valve passing was stopped.

- All Automatic weighing machines in bagging plant were overhauled and calibrated. The belt weigher was overhauled and calibrated.

OFFSITE PLANT

- Instrumentation modification jobs in BMS as well as main panel related with 100% MCR burner modification were successfully executed .installation and commissioned was done in coordination with M/s Thermax, Pune, and the supplier.

- In BHEL Boiler DCS /PLC system installation, erection commissioning was carried out along with control room modification. DCS was hooked up. This was inaugurated by our MD.

- Ammonia UPS power distribution for new DCS / PLC system in Utility boiler was hooked up.

- Maintenance of control valves was done.

- It is also placed on record that IFFCO – Kalol leap forward to Introduction of 100 % gas firing burners in BHEL burners, eliminating of limitations of natural gas supply from GAIL by successfully introducing LNG, to achieve full load capacity of gas firing during this shutdown and DCS and PLC was successfully introduced in BHEL boiler.

CIVIL:

- Repair of damaged Top cover Plywood sheets of Cooling towers

- Repairs of Bitumastic lining, acid alkalis proof brick lining in strong / weak effluent pit and HCl storage tank in water treatment plant.

- Epoxy monolithic plaster on RCC Suspenders, walkway for converyor, beams, columns and staircase of transfer tower of silo building.

- IP Net protective coating on RCC wall of Conveyor gallery and other structures in Silo, B & MH, Urea plant .

- F.R.V. Lining on floor drain in water treatment plant and repairing of open channel near lagoon Phase-B.

- Epoxy painting for RCC Structure of bagging plant transfer tower, prill cooling systems and hydrolizer urea plant area.

- Repairs of Insulating brick lining inside Primary Reformer, Secondary reformer and auxilary boiler.

- Repair of damaged ground floor flooring of Urea plant Prill cooling system.

- Repair of damaged AC sheet of cooling tower, reformer and BHEL boiler etc.

ELECTRICAL

AMMONIA PLANT

Following modification in relay and protection system was carried out in MCC-16.

- Replaced extremely inverse relay CDG34 relay with normal inverse CDG31 relay .
- Replaced Motpro replay with CDG34 relay in feeder for Fire MCC.

- Modifications carried out in control circuits of 112-J, and112-JB for auto starting of motors in case of high level of surface condenser.

- Modifications carried out in control circuits of 2004–J for auto starting of motor in case of low level of water in deaerator.

UREA PLANT

Following modification jobs carried out in Relay & Protection system:

- Earth fault protection was provided in MCC-14 by installing CDG-11 relay.
- Replaced extremely inverse relay CDG34 relay in MCC-15 with normal inverse CDG31 relay .

- 2.2 Power and control supply of Motors P1351A, P 1352A i.e Hydrolyser feed pump and Reflex pump shifted from MCC-14 to MCC-15.

UTILITY PLANT

- Modification carried out in control circuits of motors P4203 A and P4203 B for auto starting in case of low discharge pressure of DM water..

OFFSITES

Modification jobs in relay and protection system were carried out as under:

- Earth fault unit CDG-61 relay from DG bus coupler panel , CDG14 from new DG Panel, earth fault unit CDG61 of DG panel were removed. High set feature of CDG61 in DG panel were also by passed.

- Modification in Over-current and earth fault protection were carried out for outgoing feder of 11 KV panel in 66 KV switchyard to 11 KV MPSS panels.

- Modification carried out in Feeder 52-P by providing double bus bars to suit 1250-A breakers.

TECHNICAL

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- The equipment's viz New CO2 Absorber, HP / LP Flash Vessels, Semi lean Solution Pump, Lean Solution Pump, LTS Guard Bed, Knock Out Drum, BFW Pre heaters which were erected for ESP Phase-I were hooked up by connecting with associated piping, commissioned and taken in the operation.

- The equipment's which were become ideal / obsolete due to implementation of ESP Phase-I were disconnected / removed. These equipment's are called CO2 Absorber, one of the CO2 Stripper (101-EA, 108-C1A & C1B).

- Above jobs of erection / dismantling, commissioning and piping were carried out by M/s Neo Structo Construction Limited.

- Semi lean Solution Pump 115-JA & JB with their drive turbine, Split Stream Pumps 116-JA & JB with their drive turbine / motor, which were erected before shutdown were commissioned. This job was carried out by M/s SPIC SMO.

- In the Fuel Gas System the 4 Nos. of control valve which were under size were replaced. Necessary piping was carried out. This job was carried out by M/s Smitha Engineering.

- Installed and commissioned CENTUM-CS 30000 DCS System. This system was supplied and commissioned by M/s Yokogava India Limited.

- Expansion of HIMA PLC System was carried out. This system was carried out by M/s Chemtrol India Limited.

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

PLANT TURNAROUND MAY - JUNE - 2005

GENERAL - DETAILS

SR. NO.	CATEGORY	QUANTITY
(A)	**EQUIPMENT UTILIZED :**	
	IFFCO :	
	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
	03 T Forklift	03 Nos.
	10 T Truck	01 No

(B) **MANPOWER UTILIZED :**

(I) **IFFCO MANPOWER :**

1	Mechanical	Existing strength
2	Mechanical Services	
3	Electrical	
4	Instrument	

(II) **HIRED - CONTRACT MANPOWER :**

Sr. No.	Category	Man days
1	Mill Wright Fitter	63
2	General Fitter	887
3	Rigger	1168
4	S.S. Rigger	3288
5	Fabricator	159
6	Grinder	254
7	Gas Cutter	92
8	IBR Welder	62
9	Non-IBR Welder	74
10	Carpenter	88
11	Mason	74
12	Forklift Operator	36
13	Machinist	68
14	Draftman	18

MAINTENANCE JOBS CARRIED OUT BY OUTSIDE AGENCIES

SR. NO.	WO NO. DATE	DESCRIPTION OF JOB	VENDOR'S NAME
1	9916306 14/12/2004	Aux.Boiler coil-C, A & B replacement.	M/s Skywin Engineering, Ahmedabad.
2	9916650 01/02/2005	Refurbication of valves.	M/s EFCO Machinenbau India P Ltd, Hyderabad
3	9916685 04/03/2005	Scaffolding, Blinding, Deblinding	M/s Anu Engineering,Vadodara
4	9917161 25/04/2005	Over hauling of Relief valves	M/s Dembla valves pvt.Ltd,Thane
5	9917153 20/04/2005	Over hauling and preventive maint. of rotary machines.	M/s SPIC-SMO Ltd,Mumbai
6	9917154 20/04/2005	Over hauling and preventive maint. Of rotary machines.	M/s Turbo Engg. Services Pvt.Ltd, Hyderabad.
7	9916945 06/04/2005	Condenser tube cleaning	M/s Arudra Engg., Chennai
8	9916852 15/02/2005	Contract for scaffolding, removal of insulation & reinsulation of Autoclave V-1201	M/s Balaji Insulations Pvt.Ltd, Mumbai
9	9916837 31/03/2005	Shot Blasting & Painting of exterior Surface of Autoclave V-1201.	M/s Evershine corrosion contract Pvt.Ltd, Mumbai
10	9916997	Overhauling of rotary equipments of Urea plant.	M/s SPIC- SMO, Mumbai
11	9915577 14/07/2004	Replacement of Urea Silos.	M/s Engineers & Consultants,Ghaziabad
12	9916819 28/02/2005	Tube sampling for RLA study of BHEL Boiler	M/s Skywin Erectors, Ahmedabad
13	9916948 16/03/2005	Removal of old header & fabricatation of new s.s. header for Urea cooling tower.	M/s J & J Engineers Shertha
14	9917255	Complete RLA study of BHEL boiler	M/s TBW, Pune
15	9917041 17/03/2005	Supply of material & Errection of FRP & wall of cooling towers.	M/s Paharpur cooling tower,Vadodara
16	9916071 04/04/2005	Services for Gland packing of valves	M/s Amrutha Engineering New Panvel, New mumbai
17	9917310 30/04/05	Hot end basket replacement of RAH in BHEL boiler	M/s Aneesh engrs, Kalol
18	9915362 21/05/2004	ARC for rubber lining.	M/s J.K.Rubber Works, Ahmedabad
19	9916844 05/03/2005	Overhauling of Reclaim Machine.	M/s EMTICI LTD., V.V.Nagar
20	9916832 16/03/2005	Hydro jetting of Heat Exchangers tubes	M/s Deluxe Hydro Services , Mumbai
21	9917285 07/05/05	Assisting IFFCO during shut down /plant turnaround jobs	M/s Saiyed & co, Saij

22	9917284 07/05/05	Assisting IFFCO during shut down /plant turnaround jobs	M/s General Engg,Bharuch
23	9916643 31/01/05	Opening & boxed up of Heat exchanger	M/s General Engg,Bharuch
24	9916832 16/03/05	Hydojetting of heat exchanger tubes for better performance.	M/s Deluxe hydro blasting services.Mumabai
25	9916820 30/03/2005	Hot & cold insulation in Urea & B& MH Plant.	M/s Khandelwal Insulation Pvt ltd
26	9916275 17/01/2005	Automatic Ultrasonic scanning of reformer tubes	M/s PDIL , Sindri
27	9916267 08/12/2004	Radiography team, on round the clock basis	M/s NDT Services, Ahmedabad
28	9916269 10/12/2004	In-Situ metlography	M/s.TCR Advance,Vadodara
29	9916409 27/12/2004	Thickness Teams	M/s.Quality Industrial X-Ray Co, Mumbai
30	9916334 13/12/2004	Dye Penetrate Teams	M/s.NDT Services,Ahmedabad
31	9916350 09/12/2004	MPI Teams	M/s.NDT Services,Ahmedabad
32	9916349 13/12/2004	UFD Teams	M/s.NDT Services, Ahmedabad
33	9916446 06/01/2005	Replacement of Rotark make valve actuators	M/s.ROTORK Controlls India Pvt.Ltd,Mumbai
34	9916559 23/03/2005	Maint.of transformers at plant site	M/s.Volt AMP transformers Pvt.Ltd, Vadodara
35	9916988 23/04/2005	Servicing of TMG make LT circuit brackers	M/s.Heatex Industries,Mumbai
36	9917217	Servicing of Jyoti make 11 KV vaccume circuit	M/s.Jyoti Ltd,Vadodara
37	9917295 30/04/2005	Electrical Relay System.	M/s.Elcon Engineers ,Vadodara
38	9914363 17/01/2005	Pre.Maint.of Ammoni & Urea Plant DCS	M/s.Yokogawa Blue Star,Vadodara
39	9916296 28/12/2004	Pre.Maint.of Amm.plant PLC	M/s.Chemtrol Engg.,Mumbai
40	9916234 27/11/2004	Pre.Maint./ Checking of Amm.plant UPSS	M/s.Instrumentation Ltd,Kota
41	9912994 10/03/2003	Retrofitting job of Ammonia plant leveltrols.	M/s.Dresser Valves,Mumbai
42	9916368 14/11/2003	**Installation / Commissioning of 3500 series vibration monitoring system for Synthesis Gas Compressor of Ammonia plant**	M/s.Bently Nevada, New Delhi
43	9915013 29/03/2004	Pre.Maint./Checking/Calibration of Methane/CO2/Silica Analyzers of Ammonia/Offsites plants	M/s.ABB Analytical Ltd,Faridabad
44	9916725 18/02/2005	AMC UPS Batteries	M/s.AMCO Power System Ltd,Banglore

45	9916636 29/03/2005	Maint.of Control Valves	M/s.Hi-tech Controls,Vadodara
46	991559 30/08/2004	Servicing of belt weigher	M/s.EMTICI Engg.Ltd,V.V.Nagar
47	9917032 08/04/2005	Assisting IFFCO in S/D Jobs	M/s.A-Z Instruments Servics,Vadodara
48	9916375 15/12/2004	Servicing & Stamping 40 ton Weigh-Bridge	M/s.Ashbee Systems
49	9915881 21/09/2004	Servicing of Allen-Bradley PLC	M/s.Prima Controls
50	9916539 16/03/2005	To carryout repair of damaged Top cover Plywood sheets of Cooling towers	M/s.Akruti , Ahmedabad
51	9916535 27/01/2005	Repairs & Maint.Biumastic lining,acid alkalis proof briack lining in strong/weak effluent pit and HCL storage tank in water treatment plant and other plant area.	M/s.Western Corrossion,Baroda
52	9917132 07/04/2005	Providing & applying epoxy monolithic plaster on RCC Supenders,walkway for conveyor,beams,columns and staircase of transfer tower of silo building & misc work in B&MH building.	M/s.Wester Corrossion,Vadodara
53	9917348 16/05/05	Providing and applying IP net protective coating on RCC wall of conveyor gallery and other structures (Silo,B&MH,Urea plant etc.)	M/s.Krishna conchem Mumbai
54	9916588 17/01/2005	F.R.V.Lining on floor drain in water treatment plant & repairing of open channel near lagoon Phase-B and other plant area.	M/s.Indo-chem, Ahmedabad
55	9916493 28/12/04	Shifting of debries/malvas etc from various location at plant site.	M/s.Perfect, Handlers
56	9917136 07/04/2005	Providing & applying epoxy painting in RCC structure of bagging plant tranfer tower, prill cooling systems & hydrolyser urea plant	M/s B. Chauhan
57	9916180 27/11/2004	Repair of Insulation brick lining inside Primary Reformer	M/s MH Datric IndiaB
58	9916587 17/11/2004	Repair of damaged flooring of Urea plant Prill cooling system	M/s Western corrosion Vadodara
59	9916690 31/01/2005	Repair of damaged AC sheet of cooling tower, reformer & other area in plant	M/s Sad Guru Const.

MECHANICAL

AMMONIA PLANT

AIR COMPRESSOR TRAIN

101-JT Air Compressor Drive Turbine - Preventive maintenance

Turbine was decoupled and both the journal bearings as well as thrust bearing were inspected and found O.K. Gauss measurement of rotor shaft and bearings carried out. Gauss reading of opp thrust end shaft journal, thrust collar was found to be ok. Thrust journal shaft (15 Gauss) was higher and the same was reduced to 4.6 Gauss.

Governor drive gear box

Governor drive gear box was opened. The pinion shaft was found to be having some stepping and therefore was decided to be replaced along with the bearings.

Following parts were replaced with new one issued from store:

- Pinion, Code No.: 104893029 -1 No.
- Bearing, Code No.: 1048933020 – 2 Nos.

To get the required thrust the bearing face had to be machined.

101-JT Governing Valve Assembly

The steam chest valve assembly was opened and placed on wooden supports. After visual inspection it was decided to change the following components.

- Packing Glands, Code : 104895625 , NOS : 2
- Bearing(Aluminum Bushing) , Code : 104895687 , NOS : 2

To get the required clearance of 0.003", the length of the spacer of lifting bar spindle assembly was increased by adding 2 nos shims (0.1mm) on each spacer. Final clearance obtained was 0.004".

Nozzle Valve setting

The following procedure was used :

- Lifting bar with valves placed inside steam chest
- Bar rested on 4th valve(i.e C=0), the other readings maintained on drawing sheet.
- All values were found to be ok

Spindle adjustment

The spindle assembly was opened and readjusted as follows:

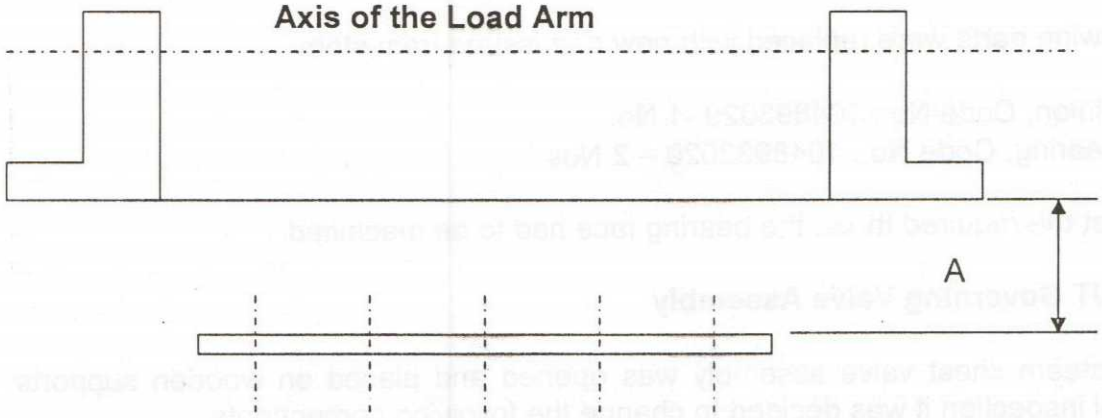
- Lifting bar to steam chest face distance before adjustment
  L=144.09mm, R=144.93mm
- The lifting bar along with the valves was removed and placed inside the steam chest

- With valve no 4 as fulcrum point(C=0) the bar was made parallel to the steam chest by adding shims
- Bar to steam chest face readings was taken again L=6.128", R=6.128".
- In cold condition when lifting lever is horizontal the lifting bar must have traveled half the total lift.
- Total lift=1.20", L=6.128" R=6.128", L'=L - total lift /2, =6.128 – 0.60, = 5.528", R'=5.528"

The lifting bar was assembled and L &R values adjusted to these values

The lifting lever was made parallel to the steam chest by using shims of thickness 4.70mm. & 1.00mm on the governing valve assembly was finally assembled with a new copper gasket 1.00mm

Dimensions of the assembly: (Readings are in mm)



Valve No	Total Lift in mm(Inches)	Total Lift in inches
1	20.32 (0.800")	0.800
2	11.00 (0.433")	0.4330
3	5.40 (0.2126")	0.2126
4	16.05 (0.6319")	0.6319
5	25.23 (0.993")	0.993
A(Before)	L – 144.09 R – 144.93	Offset – 0.84 mm
A(After)	L – 140.40 R – 140.41	Offset – 0.01 mm
Req. value - A	140.40 (5.528")	

101-JLP AIR COMPRESSOR (MAJOR OVERHAULING)

Journal bearings and thrust bearings were inspected and found O.K. Gauss measurement of rotor shaft and bearings carried out. Gauss reading of opposite thrust end journal shaft (7.9 Gauss) and pads (12.2 Gauss) was higher and the same was reduced below 3 Gauss. All the bag filters as well as Roll-O-Matic filters were replaced.

The following activities have been carried out during the overhauling of the LP Case :

- Removing the Coupling guards & coupling spacers on each end of the LP Compressor
- Alignment checking on both ends
- Checking of bearing clearances and axial thrust

- Removal of pipings enable removal of top casing
- Removal of dowel pins of casings & loosening of casing fixing bolts
- Removal of top casing
- Removal of dowel pins of inner casing & loosening of casing fixing bolts(two dowel pins were removed by drilling)
- Removal of Rotor assembly from the casing for cleaning & inspection
- Removal of bearings for cleaning & inspection
- Removal of diaphragms for cleaning & inspection
- Cleaning of components and inspection
- After cleaning has been completed and cleared by IFFCO assembling of diaphragms incasings.
- Assembling of bearings in bottom halves of bearing housings
- Positioning of the Rotor assembly in the casing
- Checking of labyrinth clearances
- Assembling of inner casing
- Assembling of top casing & tightening of casing bolts
- Checking of bearing clearances
- Alignment checking of JT –JLP, JLP-JR and appropriate correction
- Installation of coupling spacers
- Fixing of oil & air pipings
- Fixing of coupling guards
- Leak checking for oil during circulation and rectification if needed.
- During commissioning of the compressor train, equipment tripped due to excessive axial vibration on LP Compressor. Bearings were opened and inspected. No abnormality has been noticed. Bearings were boxed up after inspection.
- Compressor has been put into service and performances are found to be satisfactory.

Labyrinth Clearances (During assembly): (Readings are in mm)

From Non Thrust end	East	West
Oil Guard - G	0.50	0.50
Journal bearing - C	0.19 – 0.24	0.19-0.23
Oil Guard - G	0.15	0.10
Ring - E	0.15	0.10
Balancing Drum - A	0.15	0.10
Wheel	3.05	3.10
Ring - C	0.20	0.30
Bushing - D	0.20	0.30
Wheel	3.05	3.10
Ring - C	0.20	0.30
Bushing - D	0.25	0.25
Wheel	2.90	3.0
Ring - C	0.25	0.20
Bushing - F	0.25	0.20
Wheel	6.15	6.40
Ring	0.20	0.40
Bushing - D	0.30	0.35
Wheel	2.85	3.05
Ring - E	0.10	0.10

Oil guard - G	0.30	0.25
Journal bearing Clearance	0.22	0.19-0.22
Oil guard	0.25	0.25
Thrust end		

Spares replaced:

- Balancing Drum Laby sets
- Dowel pins 4 nos for inner casing
- Both ends seal glands
- Thrust end Active side pads and base ring
- Journal bearings on both ends

Observations:

- The journals of the rotor assembly have severe scoring marks.

101-JR GEARBOX

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 limits.

101-JHP AIR COMPRESSOR (MAJOR OVERHAULING)

Journal bearings as well as thrust bearings were inspected and found O.K. Gauss measurement of rotor shaft and bearings carried out and found within limits.

The following activities have been carried out in the overhauling of the HP Case :

- Removing the Coupling guards & coupling spacers on each end
- Alignment checking and axial thrust checking of the Rotor assembly
- Checking of bearing clearances
- Removal of oil pipings and air lines to enable removal of top casing
- Removal of dowel pins of casings & loosening of casing fixing bolts
- Removal of top casing
- Removal of Rotor assembly from the casing for cleaning & inspection
- Removal of bearings for cleaning & inspection
- Removal of diaphragms for cleaning & inspection
- Cleaning of components and inspection
- One no diaphragm with laby has been replaced by a new one. Dislocation of diffuser blades was observed.
- After cleaning has been completed and cleared by IFFCO assembling has been started.
- Assembling of diaphragms in casings
- Assembling of bearings in bottom halves of bearing housings
- Positioning of the Rotor assembly in the casing
- Checking of labyrinth clearances
- Assembling of top casing
- Checking of bearing clearances
- Alignment checking of JR –JHP and appropriate correction

- Installation of coupling spacer
- Fixing of oil & air pipings
- Fixing of coupling guards
- Leak checking for oil during circulation & rectification if necessary
- During commissioning of the compressor train, train tripped due to excessive axial vibration on LP Compressor. Bearings were opened and inspected. No mechanical abnormality has been noticed. Bearings were boxed up after inspection.
- Compressor train has been put into services and performances are found to be satisfactory.

Labyrinth Clearances (During assembly): (Readings are in mm):

From HP Thrust End	East	West
Oil Guard – A	0.15	0.10
Thrust brg-Oil Guard - F	0.15	0.15
Journal bearing - C - B	0.18	0.18
Oil Guard – E	0.15	0.15
Ring – D	0.10	0.10
Balancing Drum - A	0.10	0.10
Wheel	-	-
Case Ring - B	0.05	0.04
Dia - Bush - C	0.35	0.04
Wheel	-	-
Case Ring - B	0.06	0.05
Dia - Bush - C	0.05	0.04
Case Ring - B	0.00	0.06
Dia - Bush - C	0.30	0.20
Case Ring - B	0.04	0.04
Dia - Bush - C	0.20	0.05
Case Ring - B	0.05	0.05
Dia - Bush - C	0.05	0.05
Case Ring - B	0.05	0.05
Dia - Bush - C	0.05	0.05
Case Ring - B	0.04	0.05
Dia - Bush - C	0.04	0.05
Case Ring - B	0.04	0.04
Ring - D	0.10	0.10
Oil guard - E	0.15	0.15
Journal bearing - C - B	0.15	0.15
Oil Guard – E	0.10	0.15

Spares replaced:

- Balancing Drum Laby sets
- Both ends seal glands
- Thrust end pads set complete
- Diaphragm with new laby – 1 no

Observations:

- One no diaphragm had dislocated diffuser vanes.

The readings taken of 101J train are recorded as under:

Description	Design Clearances (Inch)	Before	After
101 JT			
Thrust end bearing	0.007 - 0.009	0.008 "	0.008"
Opp Thrust end bearing	0.007 - 0.009	0.008"	0.008"
Axial Thrust	0.008 - 0.012	0.009 "	0.010 "
Thrust end Labyrinth		0.018"	0.018"
Opp. Thrust end Labyrinth		0.020"	0.020"
Gov. drive Shaft axial thrust			0.26
Gov drive- Bull gear axial thrust			0.06
Gov drive- Pinion axial thrust			0.08
OST – Trip lever clearance			9.95
DP Check			Yes
Magnetism Check			Yes
Demagnetization			Yes
101 JLP			
Thrust end bearing	0.006 - 0.008	0.008 "	0.008 "
Opp Thrust end bearing	0.006 - 0.008	0.008 "	0.008 "
Axial Thrust	0.011 - 0.015	0.010 "	0.011 "
Thrust end Labyrinth		0.014 "	0.014 "
Opp. Thrust end Labyrinth		0.016 "	0.016 "
DP Check			Yes
Magnetism Check			Yes
Demagnetization			Yes
101 JR			
Drive gear North bearing	0.010 - 0.011	0.011 "	0.011 "
Drive gear South bearing	0.010 - 0.011	0.010 "	0.011 "
Axial Thrust	0.014 "	0.012 "	0.013 "
Pinion North bearing	0.010 - 0.012	0.011 "	0.011 "
Pinion South bearing	0.010 - 0.012	0.010 "	0.010 "
Free float		0.043 "	0.043 "
Backlash		0.0012 "	0.0012 "
101 JHP			
Thrust end bearing	0.004 - 0.007	0.005 "	0.005 "
Opp Thrust end bearing	0.004 - 0.007	0.005 "	0.005 "
Axial Thrust	0.008 - 0.012	0.0010 "	0.010 "
DP Check			Yes
Magnetism Check			Yes
Demagnetization			Yes

101 J Train alignment reading attached
101 JT to JLP

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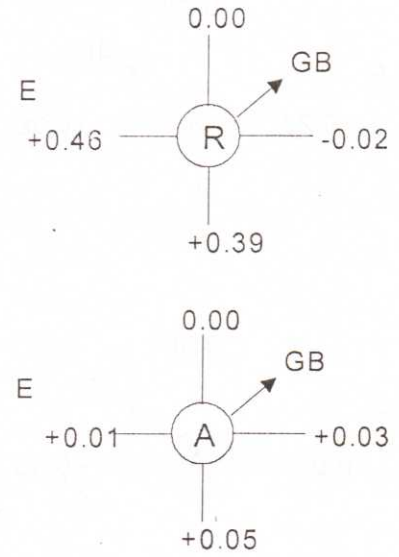
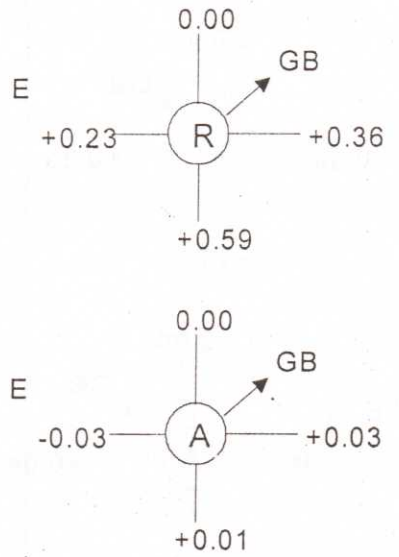
Before PM

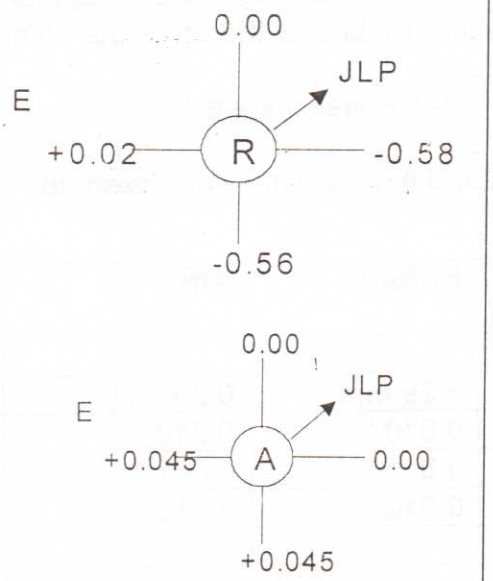


After PM



101 JLP to GB

Before PM



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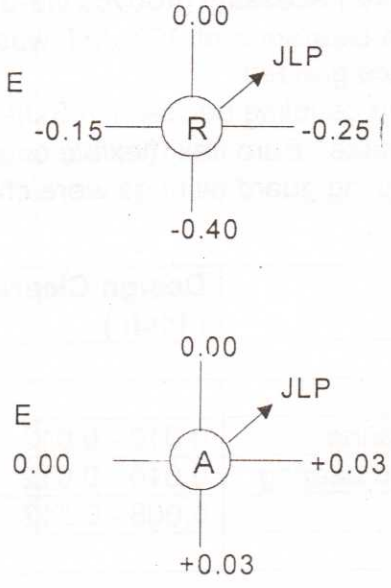
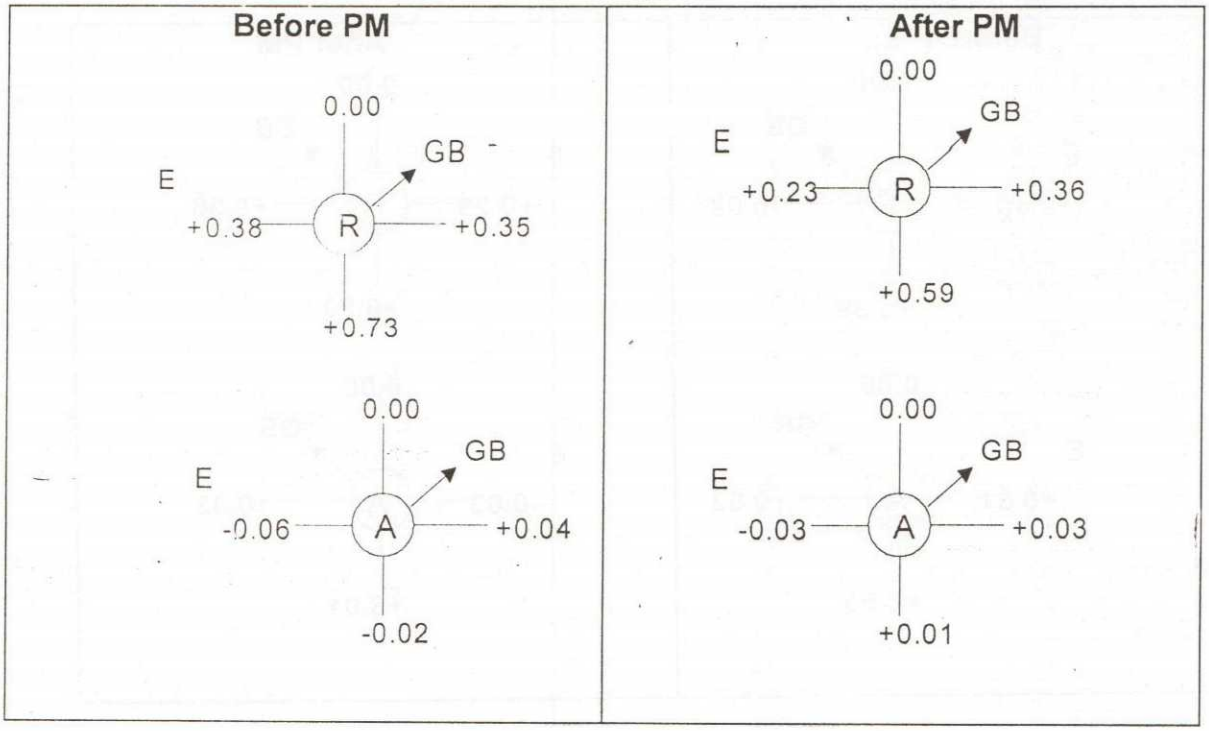


101 JHP to GB



SYNTHESIS GAS COMPRESSOR TRAIN (103 J):

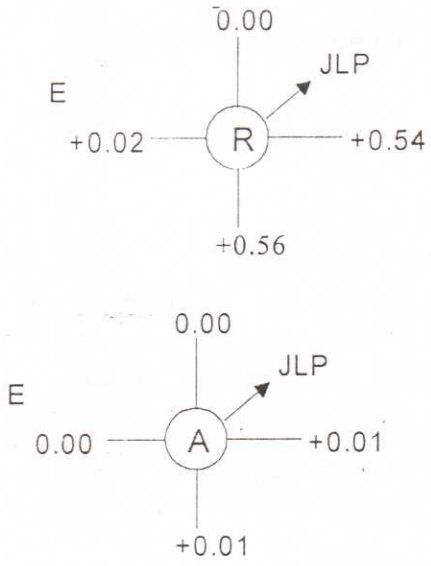
- All the couplings were decoupled and the bearings were opened. all the bearing were inspected and found to be ok.
- New RTD thrust bearings were installed on the governor side of 103-JBT.to take out the RTD wire necessary grooves were made on the coupling guard parting plane.
- The nozzle clearance of 103-JBT was not within limits and therefore the shims had to be surface grinded.
- New flexible coupling between 103-JAT and 103-JLP was installed
- Coupling make : Euro flex (flexible coupling)
- All the coupling guard oil rings were changed and the coupling was boxed up.

Description	Design Clearances (Inch)	Before	After
103JBT			
Coupling float		6.29 mm	6.29 mm
Thrust end bearing	0.010 - 0.012	0.010 "	0.010 "
Opp Thrust end bearing	0.010 - 0.012	0.011 "	0.011 "
Axial Thrust	0.008 - 0.012	0.010 "	0.010 "
103 JAT			
Coupling float		4.03 mm	mm
Thrust end bearing	0.010 - 0.0012	-	0.011"
Opp Thrust end bearing	0.006 - 0.008	0.006 "	0.007 "
Axial Thrust	0.008 - 0.012	0.008 "	0.008"

103 JLP			
Coupling float		4.23mm	4.22 mm
Thrust end bearing	0.11 - 0.19 mm	0.14-0.18mm	0.14-0.18mm
Opp Thrust end bearing	0.11 - 0.19 mm	0.13-0.14mm	0.13-0.14mm
Axial Thrust	0.38 - 0.55 mm	0.40mm	0.40 mm
103 JHP			
Coupling float		5.32	5.32
Thrust end bearing	0.11 - 0.19 mm	0.10-0.13	0.10-0.13 mm
Opp Thrust end bearing	0.11 - 0.19 mm	0.13-0.15	0.13-0.15 mm
Axial Thrust	0.38 - 0.55 mm	0.35 mm	0.35 mm

103 JAT to JLP

Before PM



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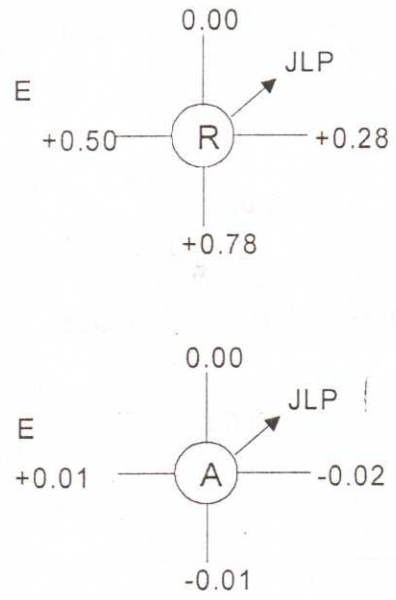
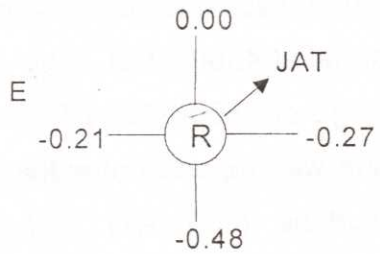


103 JBT to JAT

Before PM



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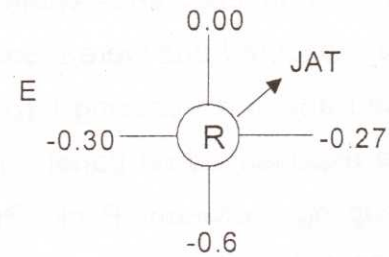
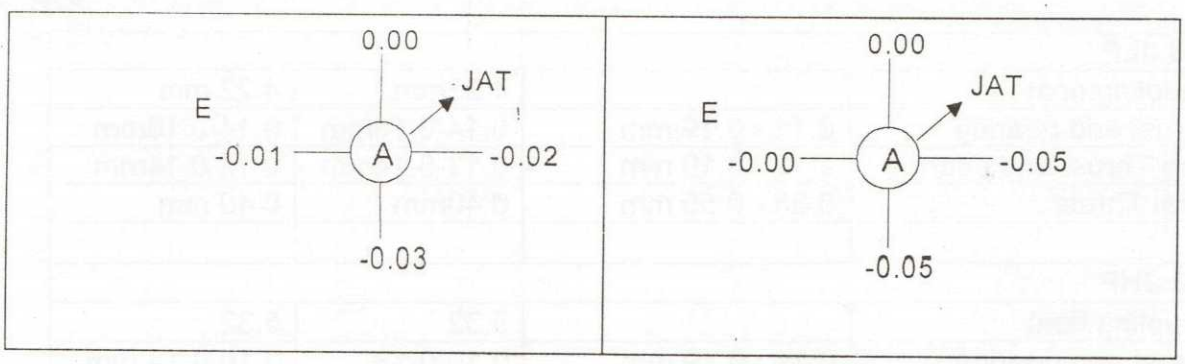
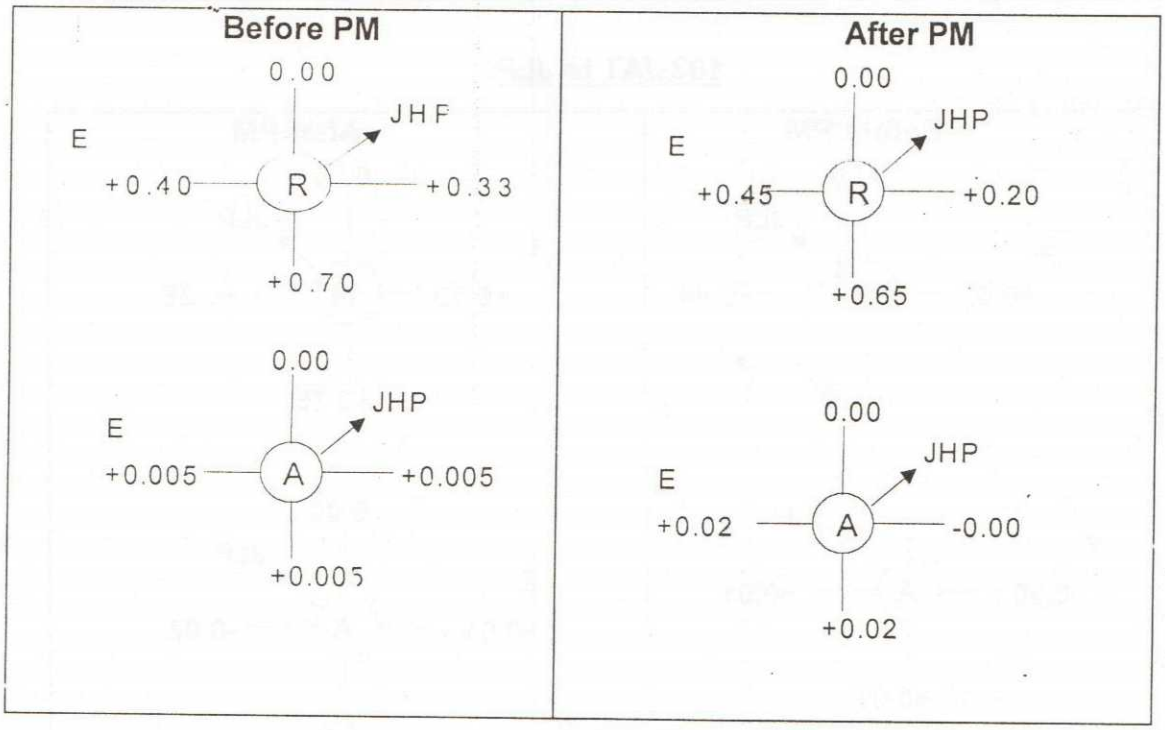




103 JLP to JHP



ROTOR REPLACEMENT OF 103-JAT AFTER PLANT STARTUP:

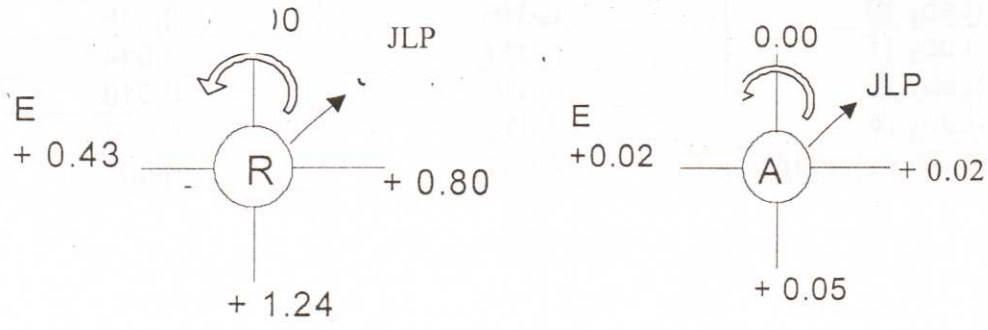
During startup after completion of Annual Turnaround of the plant, 103 J train was started on 25th of June' 2005 and Synthesis Gas Compressor was put on slow roll. The vibrations were measured and were found to be normal at 4000 RPM. The speed was further increased and while passing through the range of 6500-6700 RPM, high shaft vibrations were experienced on panel. The machine was tripped immediately and on inspection, coupling between Back Pressure Turbine (103-JAT) and LP Case compressor (103-JLP) was found to have got slipped and subsequently seized on the shaft of the turbine.

The turbine was assembled with new spare Rotor Assembly and Coupling of the Turbine. The plant was started back and production was lined up on 30th June, 2005.

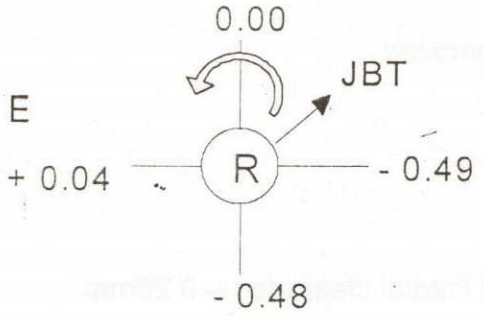
The following job was carried out:

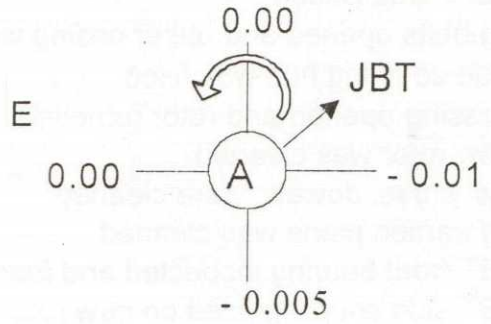
- New rotor was issued
- Casing bolts opened and upper casing was removed
- JLP side coupling hub was fixed
- Inner casing opened and rotor removed
- The new rotor was cleaned
- All nuts, studs, dowels, were cleaned
- Casing partion plane was cleaned
- 103-JBT front bearing inspected and found ok Radial clearance – 0.20mm
- 103-JBT side coupling fixed on new rotor
- Bolts , studs and partition plane of inner casing cleaned
- 103-JBT rear side bearing checked and boxed up
- Repaired top half of inner casing towards JLP side by welding (blade holding rod)
- New rotor kept in position and labyrinth clearance checked
- Top casing placed in position and bolts tightened
- 103-JLP coupling fixed
- Nozzle clearance checked and found to be 2.00m.and to reduce to 1.00mm new shims were used. New shims had to be surface grinded from thickness 10.00mm to8.50mm.
- 103-JBT RTD changed
- Steam chest valve assembly placed in position
- 103-JAT-JBT alignment done and coupling boxed up
- 103-JAT-JLP alignment done and coupling boxed up
- Coupling float taken
- 103-JAT steam inlet flange boxed up
- Exhaust line placed in position and blinded
- Steam chest valve arrangement bolted
- All oil and steam lines fixed
- End float of 103-JAT &103-JBT taken
- Lower portion of both coupling guard boxed up
- Strainer at oil inlet to bearing were put to check foreign matter
- Lube oil flow started and checked and found to be ok.
- both coupling final boxing up completed
- insulation completed

ALIGNMENT READINGS OF 103-JAT-JLP



ALIGNMENT READINGS OF 103-JAT-JBT





End Float of 103-JAT = 0.24 MM
End Float of 103-JBT = 0.22 MM

DBSE of 103-JAT & JBT =335.07mm
DBSE of 103-JAT & JLP = 446.87mm
(Note : both shafts are at extreme ends towards north side)

Coupling float between 103-JAT &103-JLP = 4.03MM
Coupling float between 103-JAT &103-JBT = 3.08MM

Nozzle clearance = 0.037"
Thrust = 0.0095"
Labyrinth clearances, Oil guard clearances and other clearances are as below:

Labyrinth Clearances (During assembly): (Readings are in inch):

From HP Thrust End	East	West
(Brg. Thrust end)C	0.010	0.010
(Laby.)D	0.016	0.016
(Laby.)E	0.016	0.016
(Laby.)F	0.016	0.016
(Laby.)G	0.016	0.016
(Laby.)H	0.012	0.012
(Laby.)I	0.012	0.012
(Laby.)Q	0.020	0.020
(Laby.)R	0.016	0.016
(Laby.)S	0.016	0.016
(Laby.)T	0.014	0.014
(Laby.)U	0.016	0.016
(Laby.)V	0.012	0.012
(Brg. Non Thrust end)W	0.007	0.007

REFRIGERATION COMPRESSOR TRAIN (105 J):

Refrigeration Compressor Drive Turbine 105-JT Preventive Maintenance

Journal & thrust bearings was opened and checked and found normal. Gauss measurement of rotor shaft and bearings was carried out and found normal.

105-JLP Refrigeration Compressor Preventive Maintenance

Thrust bearing was opened and cleaned. Both journal bearing clearances were recorded by dial gauge Gauss measurement of bearings and rotor was carried out.

105-JR Gear Box Preventive Maintenance

All the bearings were inspected and found OK. Both the gear as well as Pinion were inspected and found to be O.K. Gauss measurement of gear shaft and bearings carried out.

105-J HP Refrigeration Compressor Preventive Maintenance

Thrust bearing was opened and cleaned. Both journal bearing clearances were recorded by dial gauge since it is single piece design. Gauss measurement of rotor and bearings was carried out.

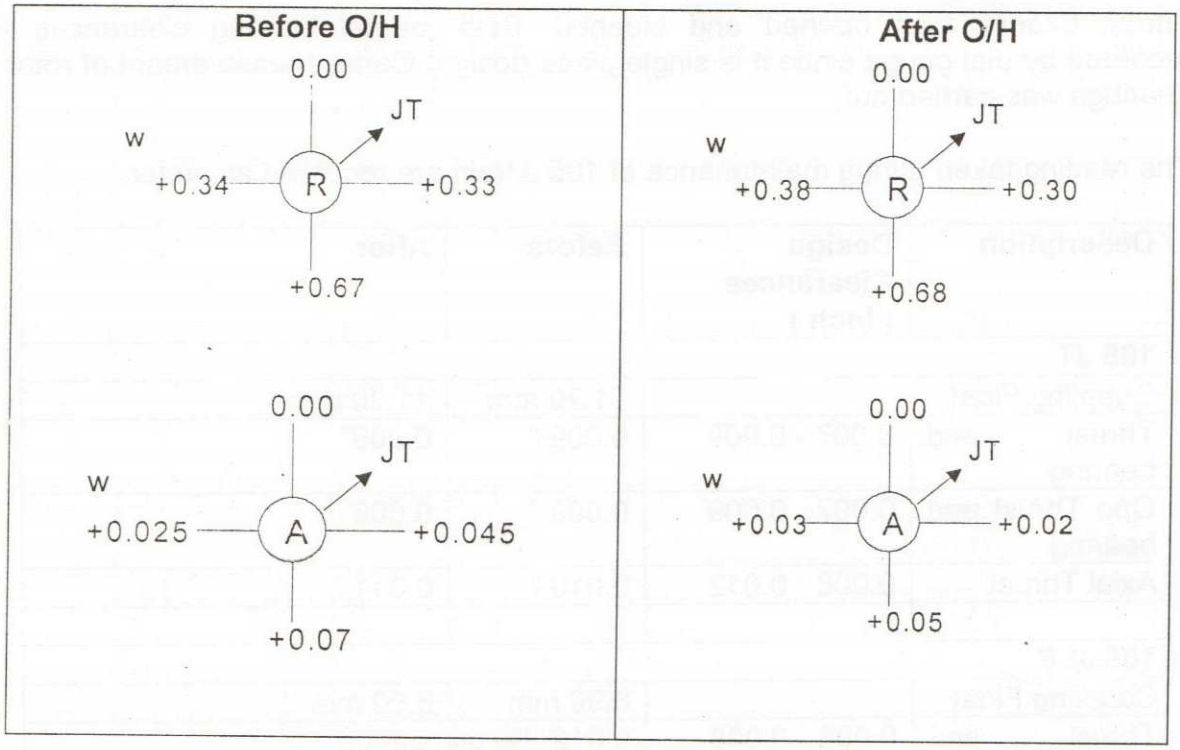
The reading taken during maintenance of 105 J train are recorded as under.

Description	Design Clearances (Inch)	Before	After
105 JT			
Coupling Float		11.20 mm	11.20 mm
Thrust end bearing	0.007 - 0.009	0.009 "	0.009"
Opp Thrust end bearing	0.007 - 0.009	0.009 "	0.009"
Axial Thrust	0.008 - 0.012	0.010 "	0.011 "
105 JLP			
Coupling Float		8.90 mm	8.90 mm
Thrust end bearing	0.006 - 0.008	0.012" By dial gauge	
Opp Thrust end bearing	0.006 - 0.008	0.014" By dial gauge	
Axial Thrust	0.011 - 0.015	0.012 "	0.012 "
105 JR			
Drive gear North bearing	0.010 - 0.011	0.011 "	0.011 "
Drive gear South bearing	0.010 - 0.011	0.011 "	0.011 "

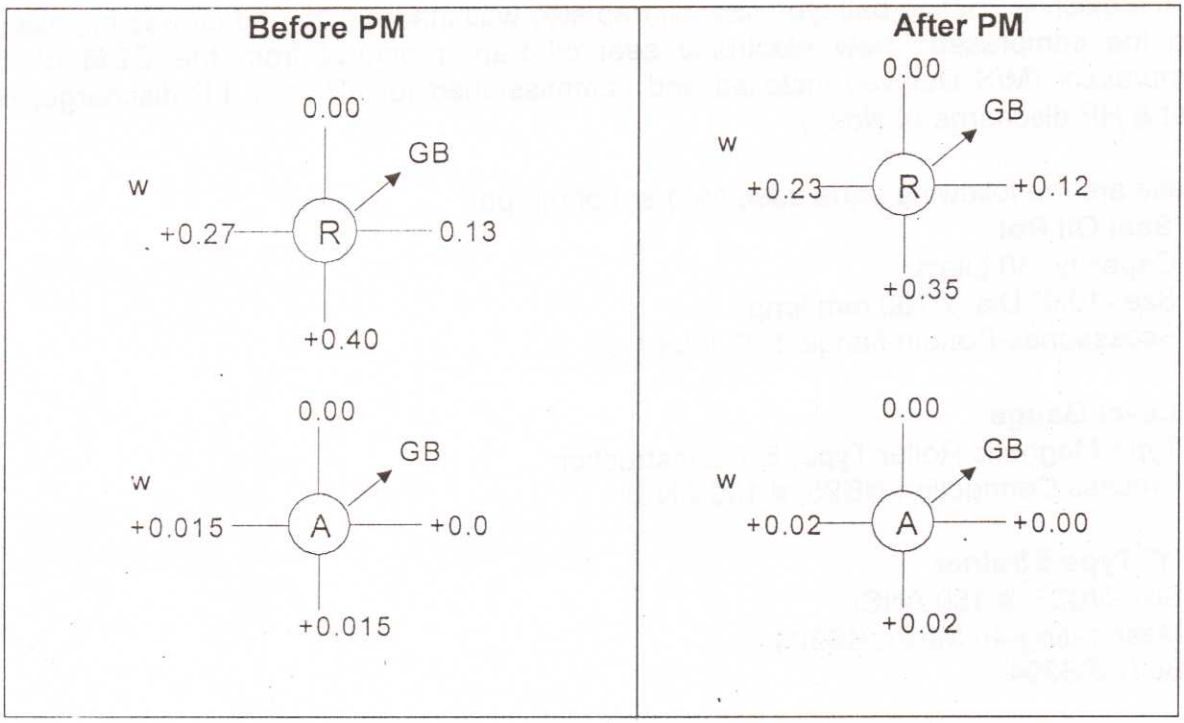
Axial Thrust	0.014 "	0.014 "	0.014 "
Pinion North bearing	0.010 - 0.012	0.011"	0.011 "
PinionSouth bearing	0.010 - 0.012	0.011 "	0.011 "
Free float		0.055 "	0.055 "
Backlash		0.006 "	0.006 "
105 JHP			
Coupling Float		16.50 mm	16.50 mm
Thrust end bearing	0.004 - 0.007	0.005" By dial gauge	
Opp Thrust end bearing	0.004 - 0.007	0.007" By dial gauge	
Axial Thrust	0.008 - 0.012	0.011 "	0.012 "

Train alignment reading:

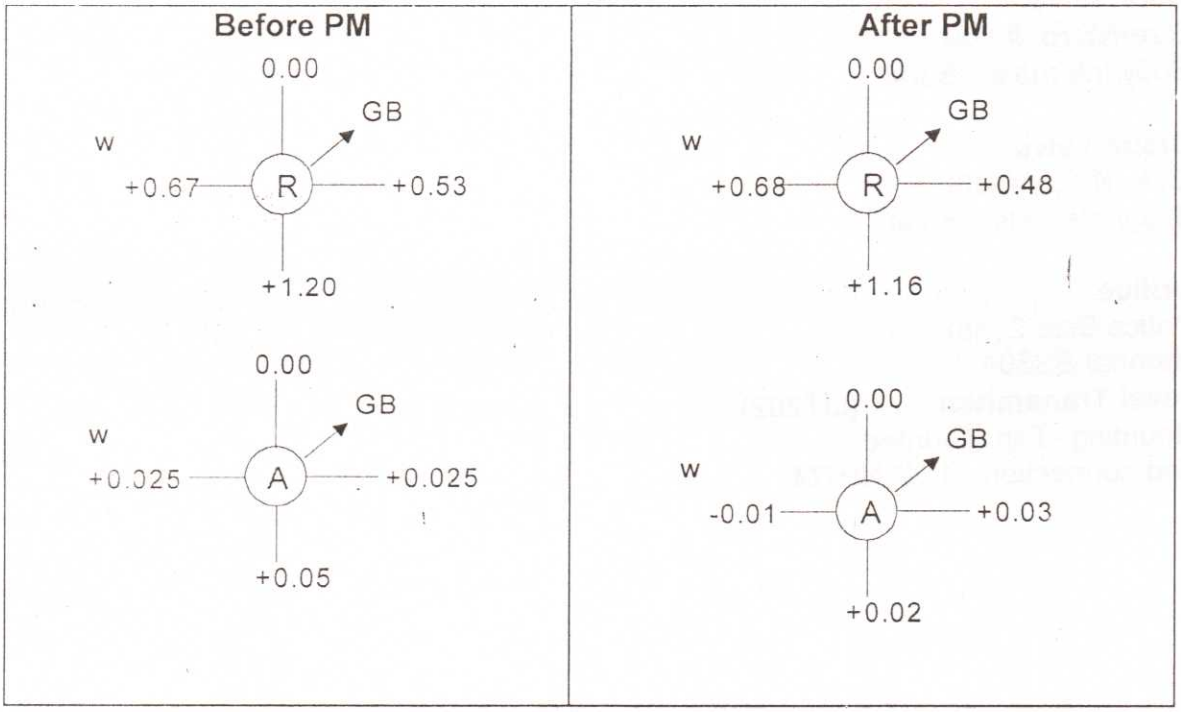
105 JT to JLP



105 JLP to GB



105 JHP to GB



SEAL OIL DRAIN TRAP SYSTEM FOR 105 J LP CASE & HP CASE:

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As the existing floating ball type seal oil trap size was inadequate and oil was ingressing into the compressor, new electronic seal oil trap, procured from the OEM of the compressor (M/S Delaval) installed and commissioned for LP Inlet, LP discharge, HP Inlet & HP discharge (4 Nos..)

These are the following parts used for 1 set of the pot:

- **Seal Oil Pot**
  Capacity- 30 Liters
  Sze -10.0" Dia. x 700 mm long
  Accessories-Bottom flange 4.0", Inlet 1.0"

- **Level Gauge**
  Type-Magnetic Roller Type, SS Construction
  Process Connection-NB25, # 150 ANSI

- **'Y' Type Strainer**
  Size-NB25, # 150 ANSI
  Mesh rating-40 Mesh, SS304
  Body-SS304

- **Control Valve**
  Type-Pneumatic type
  Size-NB25, # 150 ANSI
  Body/Internals-SS304

- **Gate Valve**
  Size-NB25, # 800
  Body/Internals-SS304

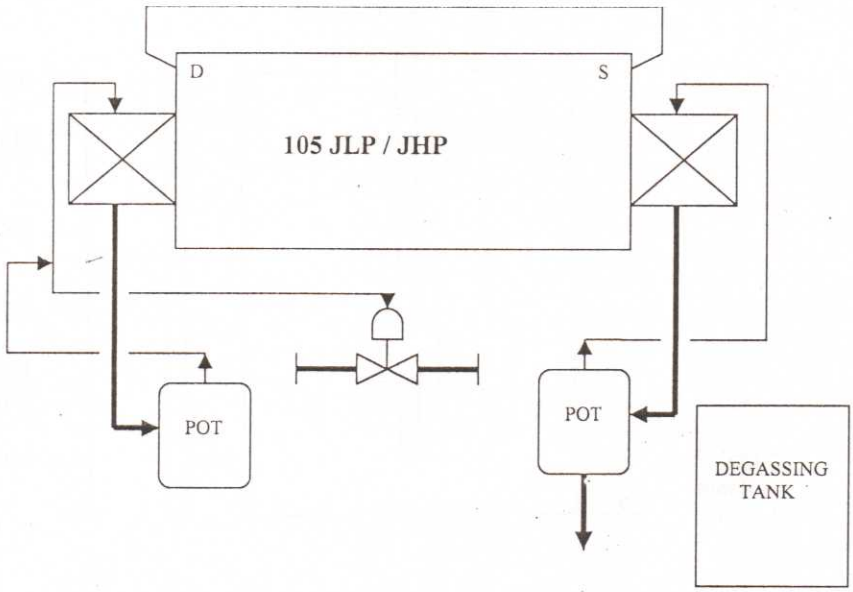
- **Globe Valve**
  Size- NB25, # 800
  Body/Internals-SS304

- **Orifice**
  Orifice Size-2 mm
  Material-SS304
- **Level Transmitter** (LIT202)
  Mounting -Top Mounted
  End connection -1 ½" NPTM

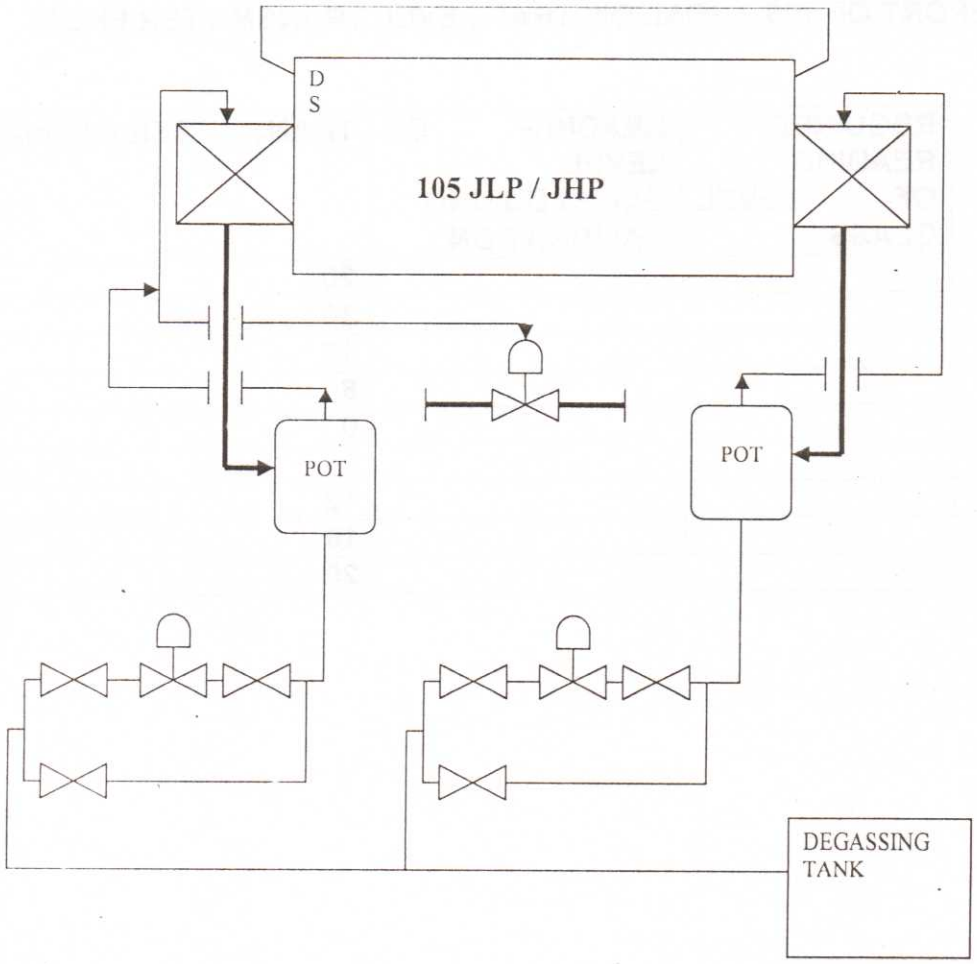
105 JLP/JHP SEAL OIL DRAIN TRAP SYSTEM (OLD):

OIL LINE

GAS LINE

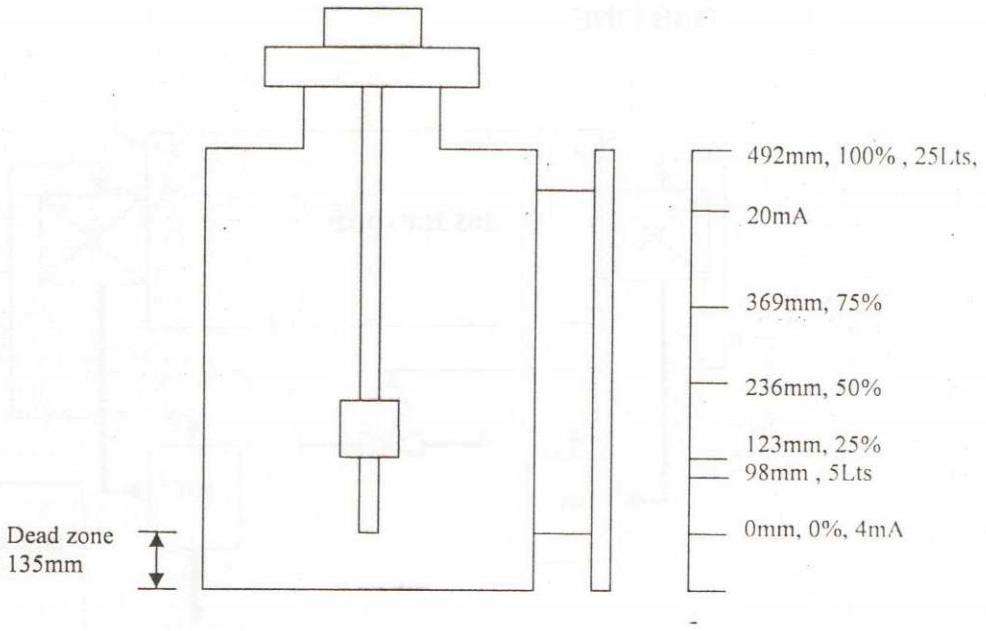


105 JLP/JHP SEAL OIL DRAIN TRAP SYSTEM (NEW):



31

CALIBARATION OF THE LEVEL TRANSMITTER:



CALIBRATION REPORT OF 105 J SEAL OIL TRAP LEVEL TRANSMITTER FROM LIC-31 TO LIC-31:

% LEVEL	REQUIRED READING OF LEVEL GLASS	READING OF LEVEL GLASS DURING CALIBRATION	TRANSMITTER O/P(mA)
100 %			20
75%			16
50%			12
25%			8
0%			0
25%			8
50%			12
75%			16
100%			20

BOILER FEED WATER PUMP & DRIVES TURBINE (104-JA /JAT)

32

104-JAT BFW Pump Drive Turbine (Terry) Overhauling

Turbine was decoupled. The thrust cum journal was opened and the thrust clearances were found to be ok but the journal clearance was on the higher side. The active components were replaced with new ones and the new spacer ring changed to the front of active thrust collar. Shims of thickness 0.20mm added to get the required thrust.

Both ends journal bearings replaced with new one.

The turbines steam glands opened and refitted with graphite tape ring assembly.

104 -JA BFW Pump Preventive Maintenance

Both the journal bearings as well as thrust bearing were inspected clearances found within recommended value. The rear side bearings white metal lining was found to be separated from parent metal .so it was replaced with new bearing to get the oil clearance within limit.

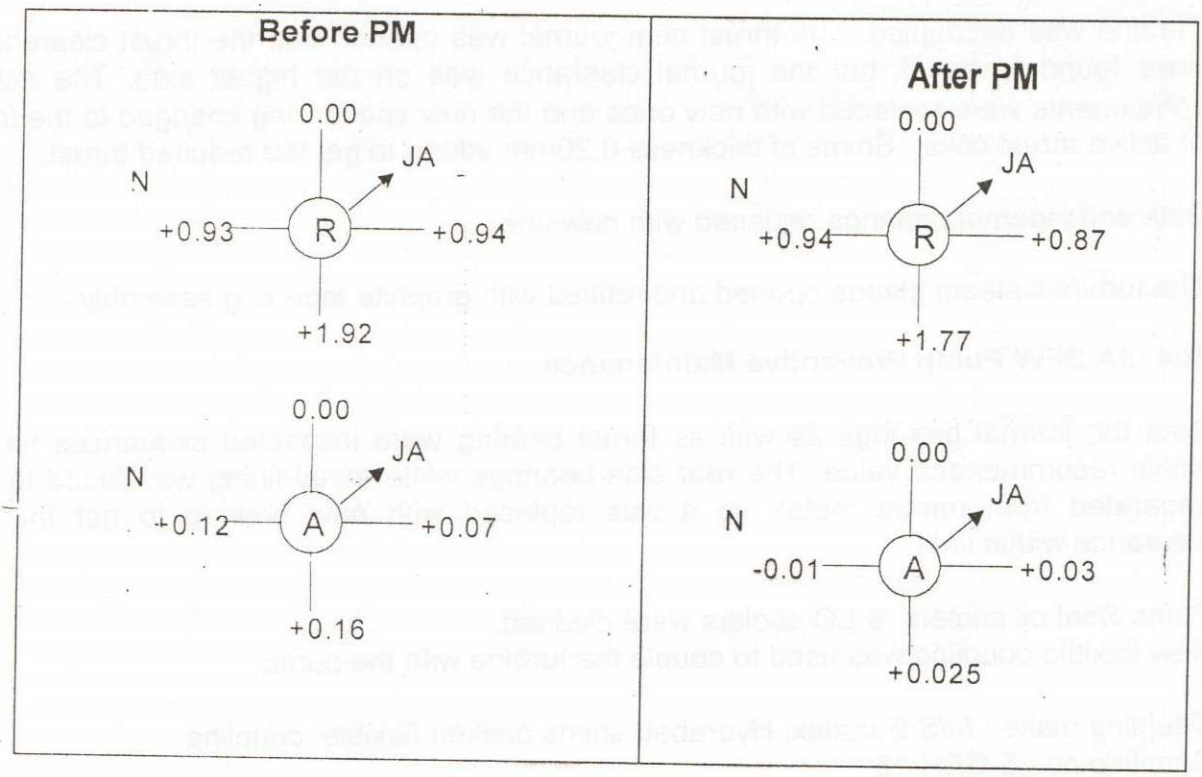
Pump Seal oil coolers & LO coolers were cleaned.
New flexible coupling was used to couple the turbine with the pump.

Coupling make : M/S Euroflex, Hydrabad shims packed flexible coupling.
Coupling no : 6-GBH-16

Description	Design Clearances (Inch)	Before	Actual
104 JAT (Terry)			
Thrust end bearing	0.005 - 0.007	0.009-0.01	0.007"
Opp Thrust end bearing	0.005 - 0.007	0.009-0.01	0.006"
Axial Thrust	0.011 - 0.016	0.013	0.010 "
104 JAT (Terry)			
Thrust end bearing	0.006 - 0.008	0.006	0.006
Opp Thrust end bearing	0.006 - 0.008	---------- ---	0.006
Axial Thrust	0.014 "	0.02	0.01

Alignment reading:

104-JAT TO 104JA



PREVENTIVE MAINTENANCE OF 101-J / 105-J, 102-J, 103-J, LUBE OIL AND SEAL OIL PUMPS AND ITS DRIVE TURBINES :

- Governing valve complete with casted body procured from M/S Coppus, installed on 101-J / 105-J & 103-J turbines.
- 101-J / 105-J lube oil filter six way valve which was passing was replaced by reconditioned one.
- 102-J Suction strainer was cleaned.
- 102-J Lube oil pump suction strainer was cleaned.
- 102-J Seal oil Pump suction strainer to be cleaned.

107-JT AMDEA PUMP DRIVE TURBINE (MURRAY) AND 107 JT (ELLIOT) TURBINE PREVENTIVE MAINTENANCE:

TURBINE

Opened both journal bearings and thrust bearing. The bearing pads were DP tested and found to be ok. Clearances were on the higher side but were brought within limits using shims. LO & GO cooler was cleaned. Lube oil console was cleaned and filled with new oil.

Description	Design Clearances (Inch)	Before	After
107 JT			
Thrust end bearing	0.004 - 0.006	0.008"-0.009	0.008"-0.009
Opp Thrust end bearing	0.004 - 0.006	0.008"-0.009	0.008"-0.009
Axial Thrust	0.007 - 0.013	0.01 "	0.01 "

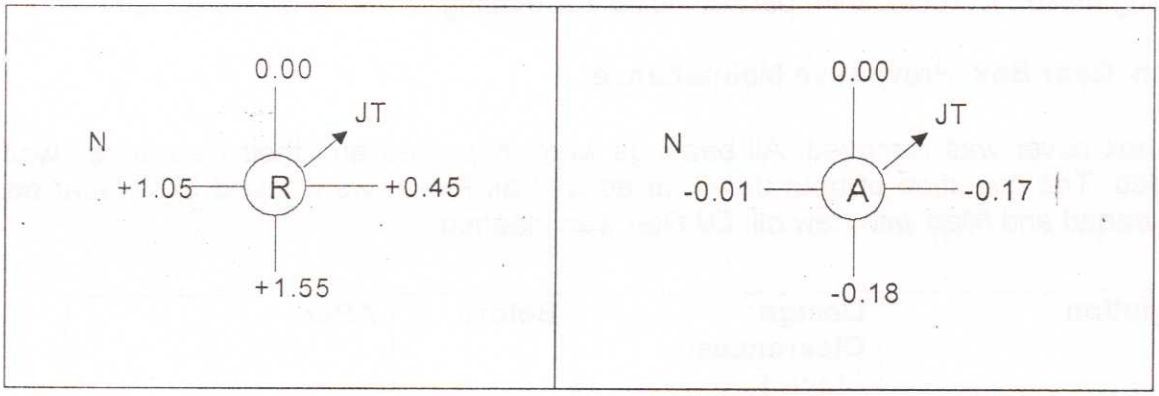
PUMPS

Both the pumps, 107 JA JB and 107 JC JD de coupled. The 107-JB & 107 JD pumps were isolated by cutting the suction & discharge lines and putting blinds. Journal bearings as well as the mechanical seal were replaced with new ones.

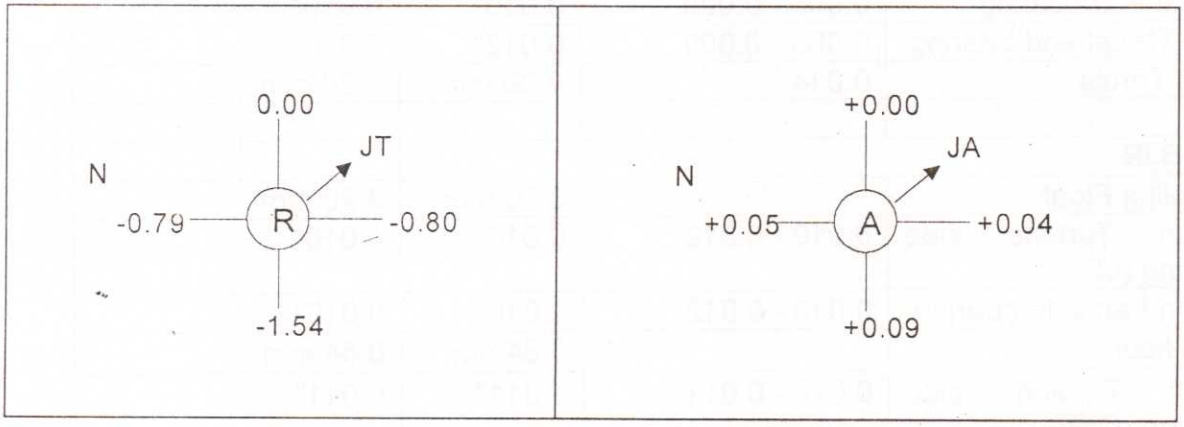
New flexible coupling procured from M/S Euro flex was installed between 107 JT turbine and 107 JA pump.

Coupling make: Euruflex shim packed flexible Coupling
On running the pump the mechanical seal was found to be leaking and was attended.

107 JT to JA (before)



107 JT to JA (after)



PREVENTIVE MAINT. 2004-JT :

- 2004-JT Preventive maintenance done.
- 2004 JT steam leak from gland housing of governor side was attended.

I. D FAN TRAIN (101BJT):

101 BJT I.D Fan Drive Turbine Preventive Maintenance:

Provision for ejector (drilling and tapping) on both the ends made as the turbine was converted from back pressure turbine to vacuum turbine.

During start up, the governor was not responding and hence the old one was tested at governor test bench and it was installed and again found problem with the installed governor, the existing governor tested at test bench and installed then found OK.

Thin shell bearing of turbine was replaced as the white metal had been pilled off from the old one.

New flexible coupling procured from M/S Euro flex, Hydrabad was installed between 101 BJT turbine and 101 BJR G/B.

Coupling make : Euruflex shim packed flexible Coupling

ID Fan Gear Box Preventive Maintenance

Gear box cover was removed. All bearings were inspected and their clearances were recorded. The condition of both the Gear as well as Pinion were found O.K. Gear box was cleaned and filled with new oil. Oil filter was cleaned.

Description	Design Clearances (Inch)	Before	After
101 BJT			
Coupling Float		-	9.50 mm
Thrust end bearing	0.006 - 0.009	0.010"	0.010"
Opp Thrust end bearing	0.006 - 0.009	0.012"	0.010"
Axial Thrust	0.014 "	0.38 mm	0.36 mm
101 BJR			
Coupling Float		3.20 mm	3.20 mm
Pinion Turbine side bearing (I/P)	0.010 - 0.012	0.010"	0.010"
Pinion Fan side bearing	0.010 - 0.012	0.010"	0.010"
Free float		0.84 mm	0.84 mm
Gear Turbine side bearing (O/P)	0.010 - 0.011	0.011"	0.011"
Gear Fan side bearing	0.010 - 0.011	0.010"	0.010"
Gear Thrust		0.48 mm	0.32 mm

Back lash		0.38 mm	0.38 mm
101 BJ			
Thrust end bearing (coupling side)	0.008 - 0.012	0.017 "	0.010 "
Opp Thrust end bearing	0.008 - 0.012	0.012 "	0.012 "
Axial Thrust		0.70 mm	0.90 mm

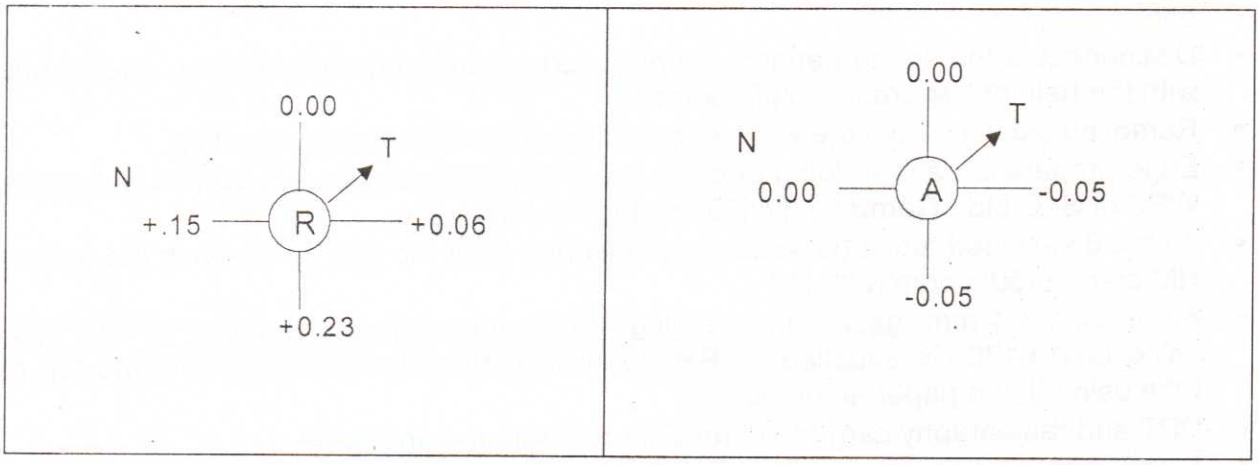
1

01-BJ I.D Fan Preventive Maintenance:

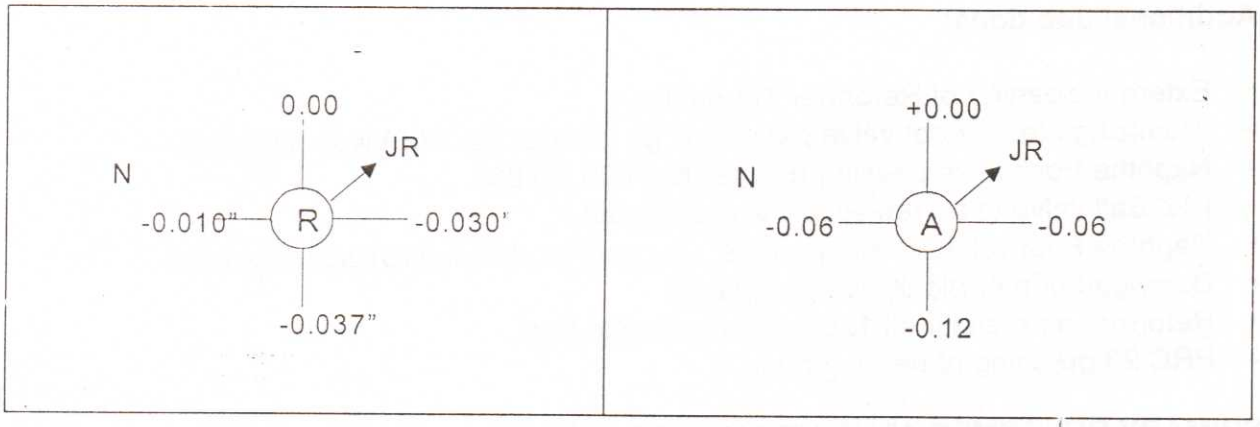
Both the bearings of the I.D. Fan were inspected. Coupling side bearing replaced with new one as the existing one was having clearance was 0.42 mm. The reading taken during overhauling of I.D. Fan train is recorded as under.

Final alignment reading of the train is as under:

101 BJT to 101 BJR (G/B)



101 BJR (G/B) to 101 BJ (Fan)



PRIMARY REFORMER 101-B RADIANT ZONE:

37

After getting permission to enter inside the furnace, arrangement done for Radiography of all the 308 catalyst tubes and 8 risers @ Joint 'C' of the primary reformer. All together 8 catalyst tubes were detected having minor cracks or initiation of cracks from inside of tubes at 'C' joint. It was decided to replace all these 8 cracked tubes.

REPLACEMENT OF CATALYST TUBES:

- The 8 tubes replaced with salvaged tubes are: 225, 306, 407, 432, 708, 714, 811 & 829. The replacement job carried out departmentally.
- The procedure for replacement of catalyst tubes is as follows:
- Locked the spring hangers and removed the top plug.
- Removed the catalyst from the tubes.
- Made approach in the tunnel by removing tunnel cover tiles and tunnel wall bricks to facilitate cutting and welding.
- Cut out the tube (G4852 mod.) from the weldolet joint by grinding at outlet manifold end.
- Disconnected the spring hanger and removed the tube from the furnace one by one with the help of HM crane (120ft. boom).
- Removed old weld from the weldolets (Incolloy 800 HT) edge by grinding.
- Edge preparation and welding of catalyst tubes with weldolets was carried out as per WPS of S+C Ltd., Germany. (WPS is attached here with):
- All the 8 salvaged tubes (G 4852 mod.) inserted from top one by one with the help of HM crane (150' boom with Jib).
- Fit up with 3-4 mm. gapes and welding of new tube with the weldolet by filler wire using UTP 6170 Co supplied by S+C Germany. Purging was done from the top of tube using damp paper at the bottom.
- DPT and radiography carried out for both root run and final weld.
- Finally pigtail tubes were welded with T-11 top piece (welding rod E-8018- B2L) with preheating 150-180 deg. C.

Additional Job done:

- External cleaning of Reformer Tubes done.
- Atomizing steam Foot valve passing & g/l (Burner No. 205) was attended.
- Naphtha Foot valve passing (Burner No. 806 & 709)
- (½" Ball valve to be replaced.) was attended.
- Naphtha Foot valve is not operable. (Burner No. 412 & 413) was attended.
- Damaged burner blocks were replaced.
- Reformer air resister all 126 nos. were make free.
- PRC 23 greasing of bearing done.

PRIMARY REFORMER 101-B HT AND LT ZONE:

- External cleaning of LT zone coils by using fire Hydrojetting.
- External cleaning of HT zone coils by air jet.
- Replacement of ceramic fibre insulation of East / West Panels of HT convection section.

Schmidt + Clemens GmbH + Co
Edelstahlwerk Kaiserau
Postfach 1140
D-5253 Lindlar

QW-482 Welding Procedure Specification (WPS)

No. 1795

W 14

G 4852 - SB-564
catalyst tube - weldolet
item SP-1 - item SF-1

designation see drawing KA 15320-03-2
KA 15320-05-1
KA 15320-06-1
and KA 15320-00-1

WELDING PROCEDURE SPECIFICATION NO. 1795 DATE 13.11.91 SUPPORTING PQR NO(S) P 124

REVISIONS ____ DATE ____

WELDING PROCESS(ES) GTAW TYPES manual

JOINTS (QW-402)

Groove design: V-groove 70° with gap

Backing: without strip or ring, back gas Argon

Other: ---

BASE METALS (QW-403)

P No. similar 45* to P No. 45

Thickness range: 5 to 19 mm

Other: ---

FILLER METALS (QW-404)

	root pass	filler passes	final pass
F No.	NA	NA	NA
A No.	NA	NA	NA
Spec. No. (SFA, SFA)	NA	NA	NA
AWS No. (Class)	NA	NA	NA
Other	manufacturer: Thyssen / UTP type: Thermanit 2133 / A2133Mn		
Size of Electrode	rods 2,4 mm	rods 2,4 + 3,2 mm	rods 2,4 + 3,2 mm

Flux Composition: ---

Particle Size: ---

Electrode Flux Composition: ---

Consumable Insert: ---

Other: ---

POSITION (QW-405)

Position of Groove: 5 G

Welding progression: overhead, uphill and flat

Other: ---

PREHEAT (QW-406)

Preheat Temp.: none

Interpass Temp.: max. 200°C

Preheat Maintenance: ---

Other: ---

POSTWELD HEAT TREATMENT (QW-407)

Temperature: none

Time Range: ---

Other: ---

Bearbeiter: Bernhof
Rev. 243

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QW-482 Welding Procedure Specification (WPS) (Cont'd)

No 1795

GAS (QW-408)

Shielding Gas(es) Argon

Percent Composition 99,999% (mixtures)

Flow Rate 8 to 10 liter/min.

Gas Backing Argon

Trailing Shielding Gas Composition 99,999%

Other ---

ELECTRICAL CHARACTERISTICS (QW-409)

	root pass	filler passes	final pass
Current (AC or DC)	DC	DC	DC
Polarity	- GTAW	- GTAW	- GTAW
Amps (Range)	60 - 100	90 - 140	90 - 130
Volts (Range)	--	--	--
Travel Speed (Range)	4-6cm/min.	5-8cm/min.	5-8cm/min.

Other ---

TECHNIQUE (QW-410)

String or Weave Bead string and weave beads

Orifice or Gas Cup Size GTAW 3/8"

Initial & Interpass Cleaning (Brushing, Grinding, etc.) grinding

Method of Back Gouging ---

Oscillation 3 to 6 mm

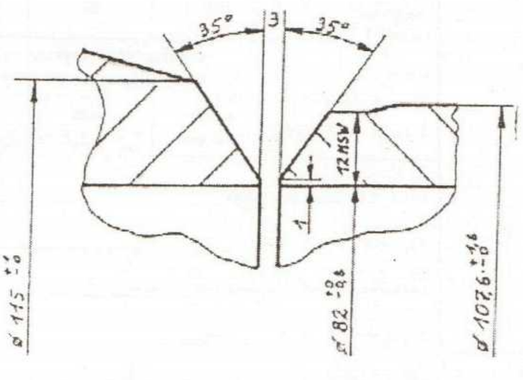
Contact Tube to Work Distance ---

Multipass or Single Pass (per side) multipasses from one side

Single or Multiple Electrodes single rods

Other SCHMIDT + CLEMENS GmbH + Co
Edelstahlwerk Kaiserau
Schweißtechnik [signature]
D-5253 Lindlar 15.11.91

SKETCH



2

AUXILIARY BOILER & ITS BURNERS JOB:

AUXILIARY BOILER

After continuous operation for the 30 years, a deflection of 30 mm to 100 mm was observed in some of water tubes in Coil A, B & C during the last inspection in April 2004. It was decided to Prefabricate and Replace Coil C and In-situ Replacement of 60 tubes each of the Coil A & B. Work contract awarded to M/S Skywin Erectors, Ahmedabad for the same. Prefabrication of Coil C was completed before the Shut-Down. Only replacement of Coil C and 60 tubes (30 tubes each) of the coil A & B was done during the Shut –Down period.

Drgs. And sketches of rigging arrangement, brick, brick hangers, headers showing the welding detail and tube showing the area at which insitu welding done.

Replacement of Coil C and Tubes of Coil A:

Only 60 tubes of Coil A & B replaced during the shut-down period out of 120 tubes (including 30 tubes of Coil B). It was decided after opening of furnace because of difficulty of welding position and duration of shut-down.

Procedure for replacement of Coil A, B & C:

- Hydro test of new Coil C completed at 175 kg.
- Removed all 5 burners.
- Removed top cover of Outlet Header of Coil C, D & E and six bolted panel of west side of Coil C, D & E.
- Removed four bolted panel of east and west side of Coil A, three bolted panel of north side Coil C and two bolted panel of east side of inlet header of Coil C.
- Locked all spring hangers and supports.
- 6 blind was needed for isolate the Coil A, B, & C. it was required for Hydro test of 102 C.
- Cut welded joints of inlet and outlet header of Coil A , B & C with riser pipes for the isolation.
- Removed the 5 nos of inconnel tie rod from stiffeners of Coil C.
- Crane testing completed by Inspection Department of weight 75 Ton at Boom length 150 feet at 29 m radius.
- Removed the Coil C from that position by the Crane.
- Repair and patch up of refractory work behind the Coil C completed.
- Inserted the insulation inside the header box of new Coil C and after that covered it by inconnel sheet and inconnel bolt ant nut.
- Cracked the refractory of west side and east side wall of coil A and removed from the site.
- Bending of all 60 tubes completed from bending machine.
- Cut and Grinded the first six tubes (tube no.1, 2, 3, 4, 5, 6) of west side of coil A but stub length were kept different at bottom side because of getting grinding space.
- First DP of bevel edge of cut stubs (bottom and top) , after that root run and DP of root run then final weld of first two tubes (tube no. 1 & 2 of west side) of Coil A completed.
- Radiography test (RT) completed, one weld layer needed for tube 2 of west side. RT of tube 1 was ok. Now remaining all the tubes of east and west side cut except last two tubes of Coil A (both side).

- Edge preparation and DP of all cut stubs completed.
- Level of inlet header of coil A & B checked. There was 10 mm and 30 mm level difference in east side and west side inlet header.
- Welding of tube no 3 of west side completed without DP of root run. Radiography of final weld was ok. Later DP of root run dropped for saving the time.
- Final welding of tube no 4, 5 of west side and tube no 1, 2 of east side completed.
- Radiography of all tube except tube no 1 of east was not ok, there was repair above the root needed.
- Final weld of tune no. 6, 7 of west side and tube no 3, 4 of east side completed. Radiography of all these tubes was ok.
- Final weld of tune no. 7, 8 of west side and tube no 5, 6 of east side completed. Radiography of all these tubes was ok.
- Final weld of tune no. 9, 10 of west side and tube no 7, 8 of east side completed. Weld a layer needed in top joint of tube no. 8 of east side, except this joint Radiography of other joints was ok.
- Final weld of tune no. 11, 12 of west side and tube no 9, 10 of east side completed. Weld a layer at up joint and weld above the root at bottom joint of tube no 10 of east side needed. Except this tube Radiography of other joints was ok.
- Final weld of tune no. 13, 14, 15 & 16 of west side and tube no 11, 12,13 & 14 of east side completed. Repair above the root at bottom weld joint of tube no 14 & 15 and weld a layer for tube no 16 in west side needed. And weld a layer at the up joint for tube 10 and repair above the root at the bottom joint of 11 of east side needed. Except this weld joints tube Radiography of other joints was ok.
- Final weld of tune no. 17 of west side and tube no. 15, 16 and 17 of east side completed. Repair above the root at the bottom joint of tube no. 17 of west side needed. Weld a layer at bottom joint of tube no. 17 of east side needed. Except this tube Radiography of other joints was ok.
- Final weld of tube no, 18, 19 20, 21 22, 23, 24, 25, 26, 27 & 28 of west side and tube no. 18, 19 , 20, 21 ,22, 23, 24, 25, 26, 27 & 28 of east side completed.
- Cut the tube no 29 & 30 of east & west side and grinded the stubs.
- Final weld of tube no 29 & 30 of east & west side completed. Repair the root at bottom joint of tube no 28 in east side needed. Repair above the root at top joint and repair the root at bottom joint of tube no 28 of east side needed.
- Welding of all tubes of Coil A with all repairs completed.
- Manufacturing of 5 nos of inconnel tie rod completed.
- Inserted the new coil C in that position.
- Inserted the 5 nos. of inconnel tie rod in the stiffeners of Coil- C.
- Two burner block work completed.
- Completed root run of inlet header of Coil C with down comer pipe and outlet header of Coil C with the riser pipes. Radiography of these joint...after that final weld completed. Radiography of final weld joint was ok.
- Completed root run of inlet header of Coil A & B with down comer pipe and outlet header of Coil A & B with the riser pipes. Radiography of these joint was ok, after that final weld completed. Radiography of final weld joint was ok.
- Stress relieving of the all the weld joint was completed.
- Stress Relieving Procedure:
- Loading temp: 300 °C
- Heating rate: 90 °C/ hr
- Soaking rate: 1 and ½ hr
- Cooling rate: 60 °C/ hr
- Natural cooling after 300 °C

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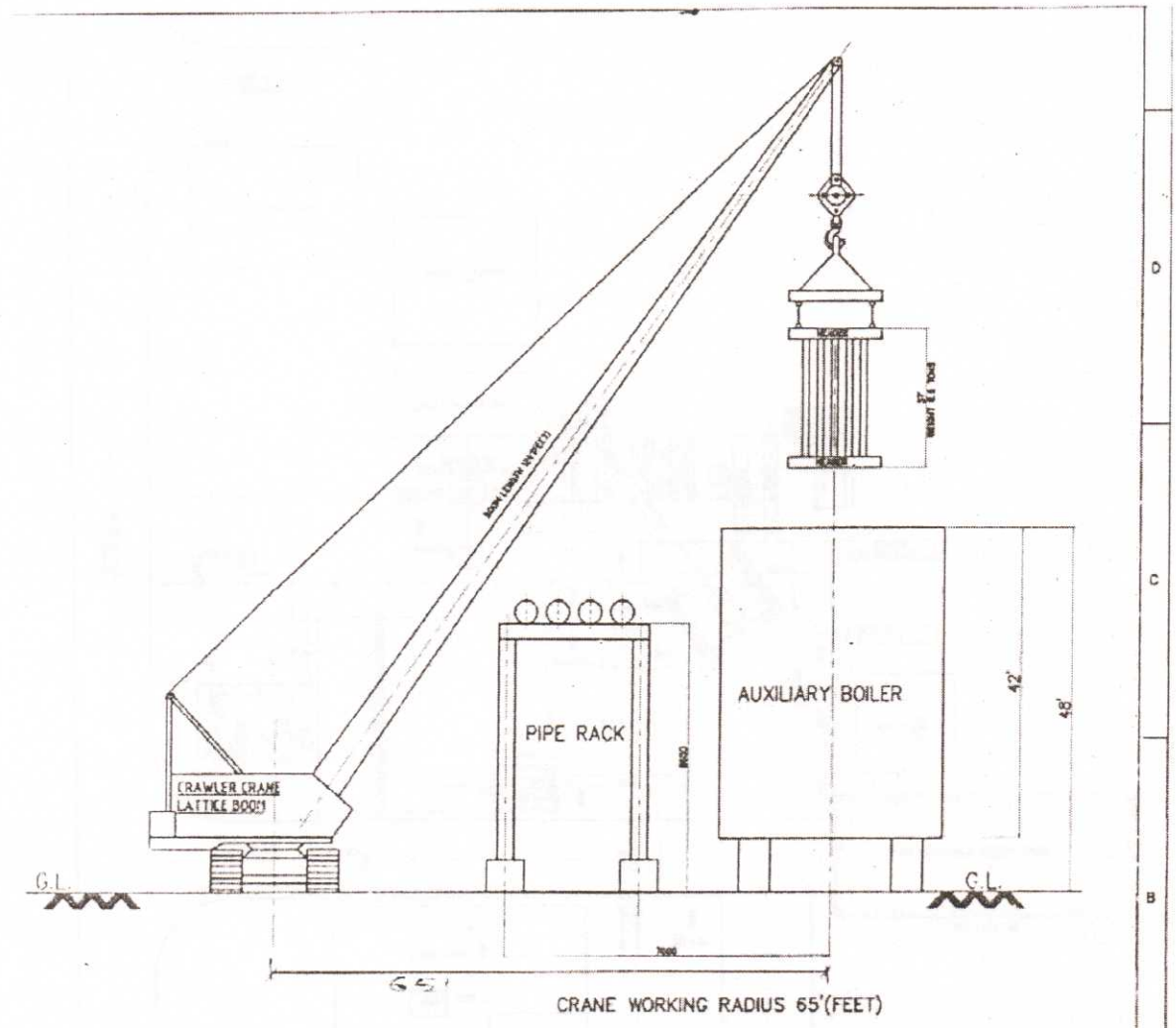
- Manufacturing of six new bolted panels completed, in two bolted panel Cerawool and in four bolted panel insulate11 filled.
- Refractory was damaged in four old bolted panel, insulate 11 was filled after the cracking the refractory.
- Refractory work at the roof completed (hanging bricks)
- All five burner installed at their position



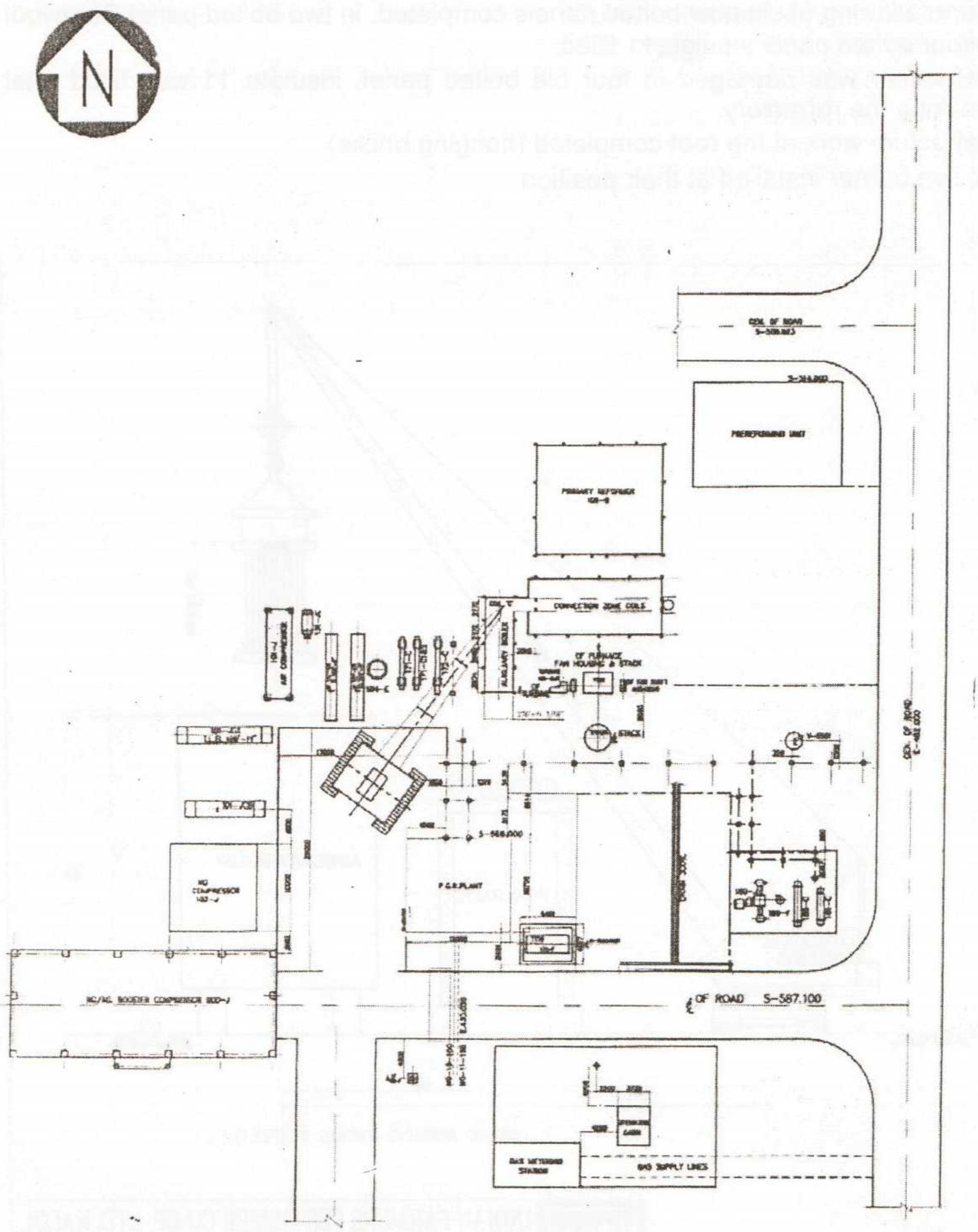
IFFCO INDIAN FARMERS FERTILISER CO-OP. LTD. KALOL

	NAME	DATE	PLANT : AMMONIA	EWR No.
DRN	कुमारी	16.01.2004	SCHEMATIC RIGGING ARRANGEMENT FOR AUXILIARY BOILER COIL 'C'	
CHD				
APD				
SCALE	N. T. S.			

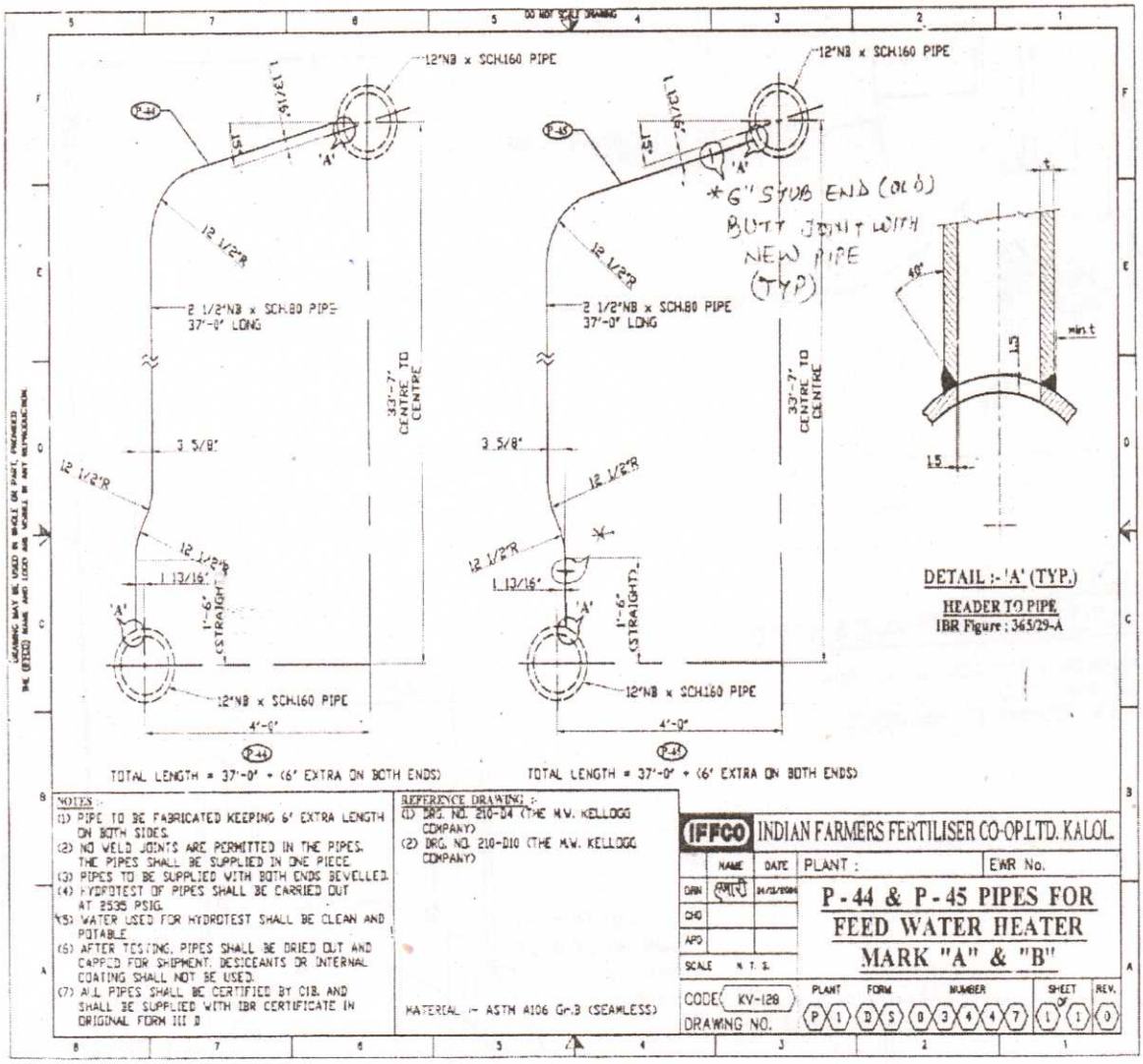
CODE KV-097 DRAWING NO.

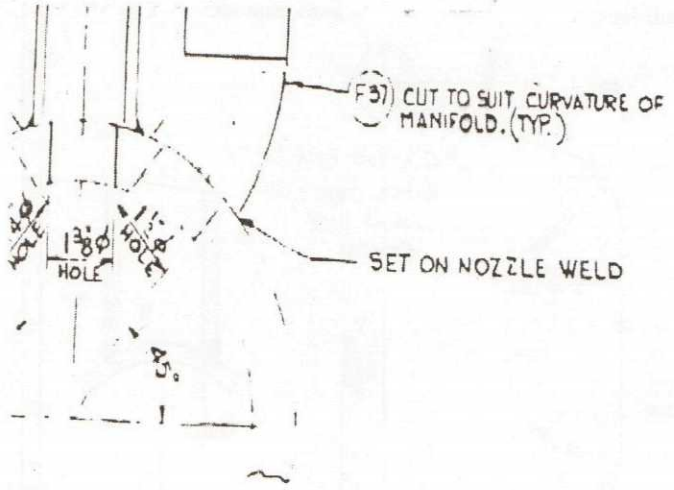
PLANT	FORM	NUMBER	SHEET OF	REV.
P1	CS	03440	1 OF 1	0

243



Schematic Pegging arrangement for Aux Blr. Coil C, Plan

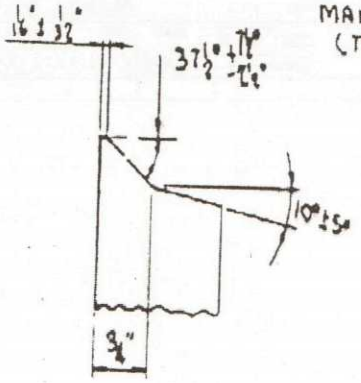

12"NB x SCH.160 PIPE
P-44
P-45
12 1/2"R
2 1/2"NB x SCH.80 PIPE
37'-0" LONG
33'-7" CENTRE TO CENTRE
3 5/8"
1 13/16"
1'-6" (STRAIGHT)
4'-0"
*6" STUB END (OLD) BUTT JOINT WITH NEW PIPE (TYP)
DETAIL :- 'A' (TYP.)
HEADER TO PIPE
IBR Figure : 365/29-A
TOTAL LENGTH = 37'-0" + (6" EXTRA ON BOTH ENDS)
NOTES :-
(1) PIPE TO BE FABRICATED KEEPING 6" EXTRA LENGTH ON BOTH SIDES.
(2) NO WELD JOINTS ARE PERMITTED IN THE PIPES. THE PIPES SHALL BE SUPPLIED IN ONE PIECE.
(3) PIPES TO BE SUPPLIED WITH BOTH ENDS BEVELLED.
(4) HYDROTEST OF PIPES SHALL BE CARRIED OUT AT 2535 PSIG.
(5) WATER USED FOR HYDROTEST SHALL BE CLEAN AND POTABLE.
(6) AFTER TESTING, PIPES SHALL BE DRIED OUT AND CAPPED FOR SHIPMENT. DESICCANTS OR INTERNAL COATING SHALL NOT BE USED.
(7) ALL PIPES SHALL BE CERTIFIED BY CIB. AND SHALL BE SUPPLIED WITH IBR CERTIFICATE IN ORIGINAL FORM III D
REFERENCE DRAWING :-
(1) DRG. NO. 210-04 (THE M.W. KELLOGG COMPANY)
(2) DRG. NO. 210-010 (THE M.W. KELLOGG COMPANY)
MATERIAL :- ASTM A106 Gr.B (SEAMLESS)
IFFCO INDIAN FARMERS FERTILISER CO-OP.LTD. KALOL.
PLANT :
EWR No.
DRN
CHD
APD
SCALE N. T. S.
P-44 & P-45 PIPES FOR FEED WATER HEATER MARK "A" & "B"
CODE KV-128
DRAWING NO.
PLANT FORM NUMBER SHEET REV.
P 1 D 5 0 3 4 4 7 1 1 0



TION 3K-3K.

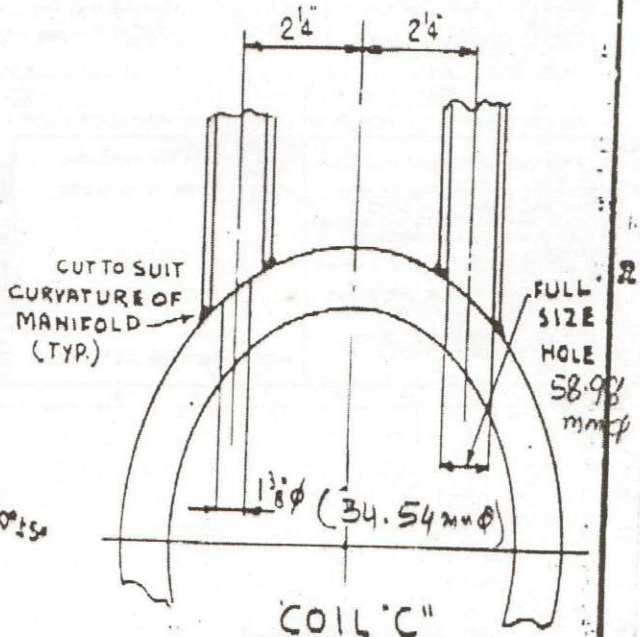
U OUTLET MANIF. OPP. HAND & NOTED.

AS SHOWN TYP. FOR ENTIRE ROW
NLET MANIFOLD.
HOLES AT OUTLET MANIFOLD.



DETAIL 3W

FLUE GAS



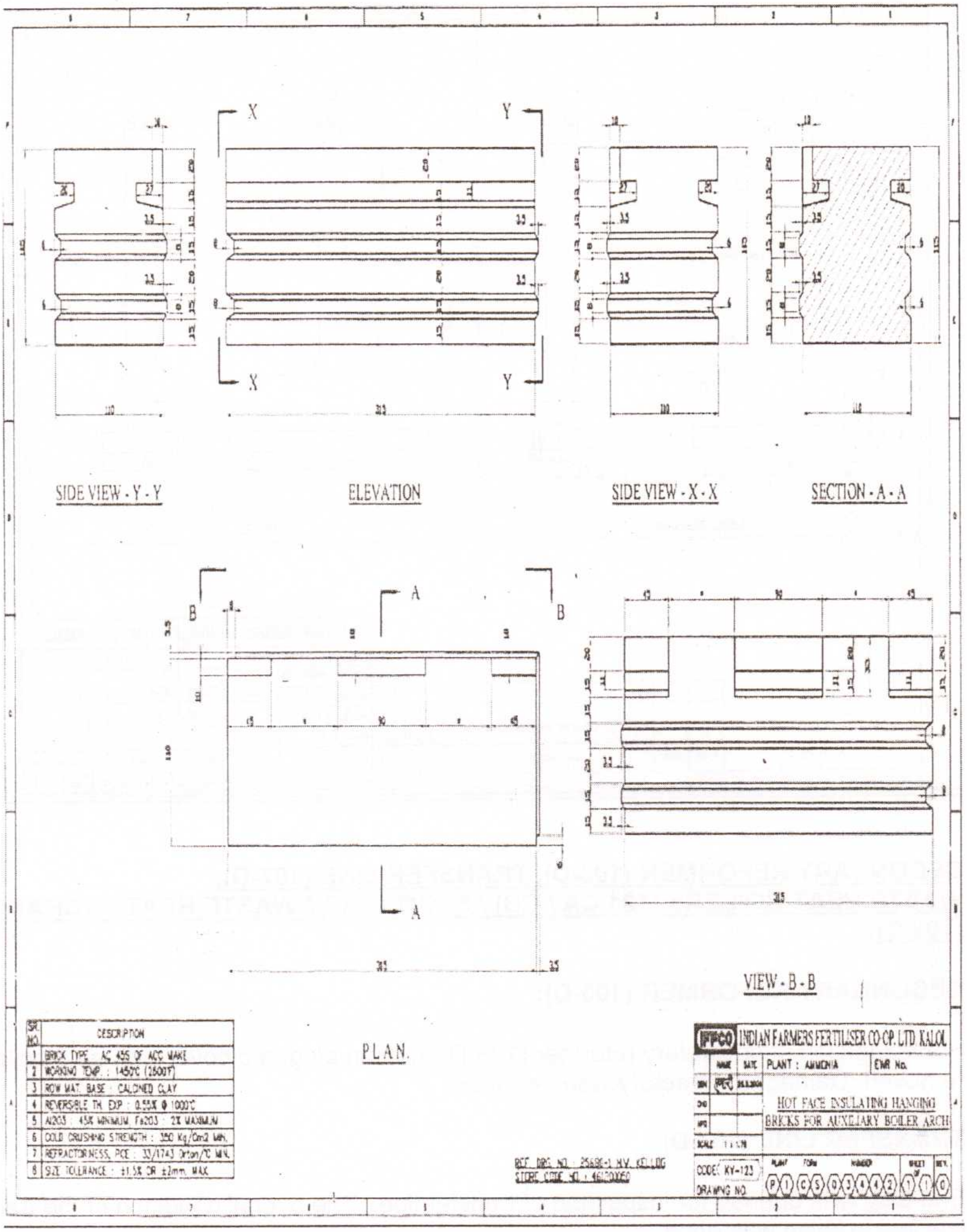
COIL "C"

SECTION 3H-3H-INLET

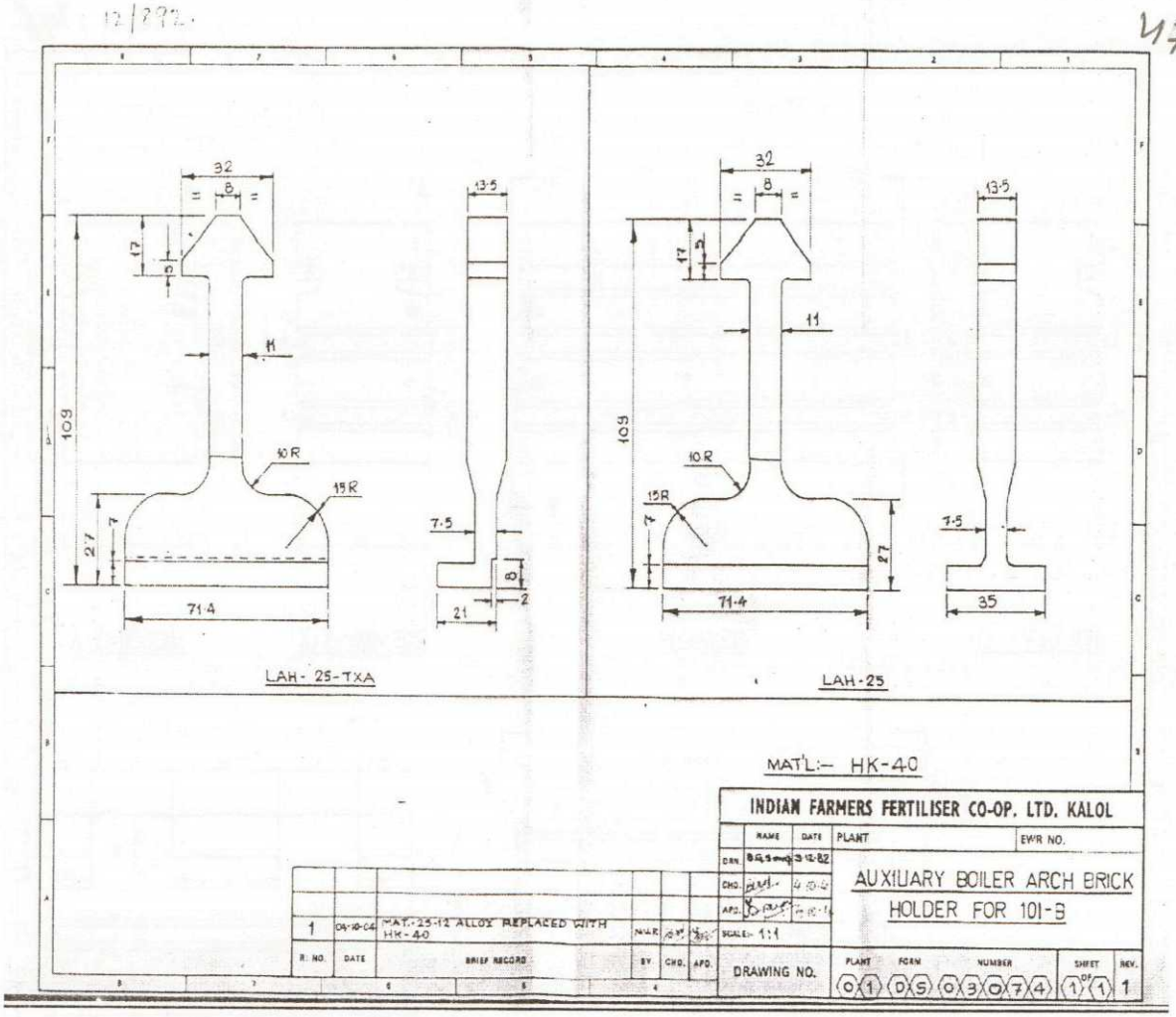
SECTION THRU OUTLET MAN. OPP. HAND & NOTED.

HOLE DRILLING AS SHOWN TYP FOR ENTIRE ROW OF TUBES IN INLET MANIFOLD.

FULL SIZE HOLES IN OUTLET MANIF.



SR. NO.	DESCRIPTION
1	BRICK TYPE : AC 455 OF ACC MAKE
2	WORKING TEMP. : 1450°C (2500°F)
3	ROW MAT. BASE : CALCINED CLAY
4	REVERSIBLE TH. EXP : 0.55% @ 1000°C
5	Al2O3 : 45% MINIMUM, Fe2O3 : 2% MAXIMUM
6	COLD CRUSHING STRENGTH : 350 Kg/Cm2 MIN.
7	REFRACTORINESS, PCE : 33/1743 Orton/°C MIN.
8	SIZE TOLERANCE : ±1.5% OR ±2mm. MAX.



SECONDARY REFORMER (103-D), TRANSFER LINE (107-D), WASTE HEAT BOILERS (101 CA / CB) / SECONDARY WASTE HEAT EXCHANGER (102 C):

SECONDARY REFORMER (103-D):

For Inspection of secondary reformer (103-D), bottom plug, top cover with air nozzle removed. Damaged refractory work repaired.

TRANSFER LINE (107-D):

End plug was opened for inspection of transfer line. The overall condition of the transfer line inside lining was good.

WASTE HEAT BOILERS (101 CA / CB)

Furmanite filling done @ BFW & steam flanges in 101-CA / B at the time of departmental hydrotest..

SECONDARY WASTE HEAT EXCHANGER (102 C) TUBE LEAK: 48

At the time of opening bottom plug of 103 D, Secondary Reformer, water was coming out from the bottom. After thorough checking, it was confirmed that the tubes of Secondary Waste Heat Exchanger (102 C) was leaking. Both the end covers were opened. DM water was filled, after taking pressure by running 123 J Pump, tubes leaking observed. In total 34 Tubes were plugged out of 750 tubes. In bottom tube sheet seal weld, 100% old seal weld removed and new seal welding done by using Inconel 82 filler wire.

Secondary Waste Heat Exchanger (102 C) detail:

- Type of the Exchanger : Vertical Fixed tube sheet exchanger (under the perview of CIB Gujarat & registered under Boiler No. GT-1632)
- Drawing No. : P1-BS-04108 sheet 1 of 1 Rev. 0 GA drawing & P1-BS-04109 sheet 1 of 1 Rev. 0 Bundle assembly
- Total No. of Tubes in the exchanger : 750
- No. of exchanger : 01
- Tube material : SA-213 Gr.T11 Seamless
- Size : 1" O.D. x 8 BWG x 13'-0" length
- Tube sheet material : A-182 F.11
- Tube to tube sheet joint: Grooved holes welded and expanded.
- Service, Shell side : Steam / BFW at 1500 PSIG.
- Tube side : Process gas at 436 PSIG.
- Hydro-test Shell side : 2515 PSIG.
- Hydro-test Tube side : 730 PSIG.

Before welding, dehydrogenation of both the tube sheets done as below:

Loading temp : 120 degree centigrade
Heating temp : 60 degree centigrade/Hr. upto 350 degree centigrade
Saoking temp : 24 Hrs.
Cooling temp : 60 degree centigrade/Hr. upto 120 degree centigrade
Unloading temp : 120 degree centigrade

Plug Detail: 18 mm dia at center, 1" long with 1 degree taper, SS 304 material,

After welding, stress relieving of both the tube sheets done as below:

Loading temp : 350 degree centigrade
Heating temp : 35 degree centigrade/Hr. upto 675 degree centigrade

(actual achieved, Top tube sheet – 655 degree centigrade, Bottom tube sheet – 585 degree centigrade, it was a rainy season)
Saoking temp.: 1 Hr.
Cooling temp.: 35 degree centigrade/Hr. upto 300 degree centigrade
Unloading temp.: 300 degree centigrade

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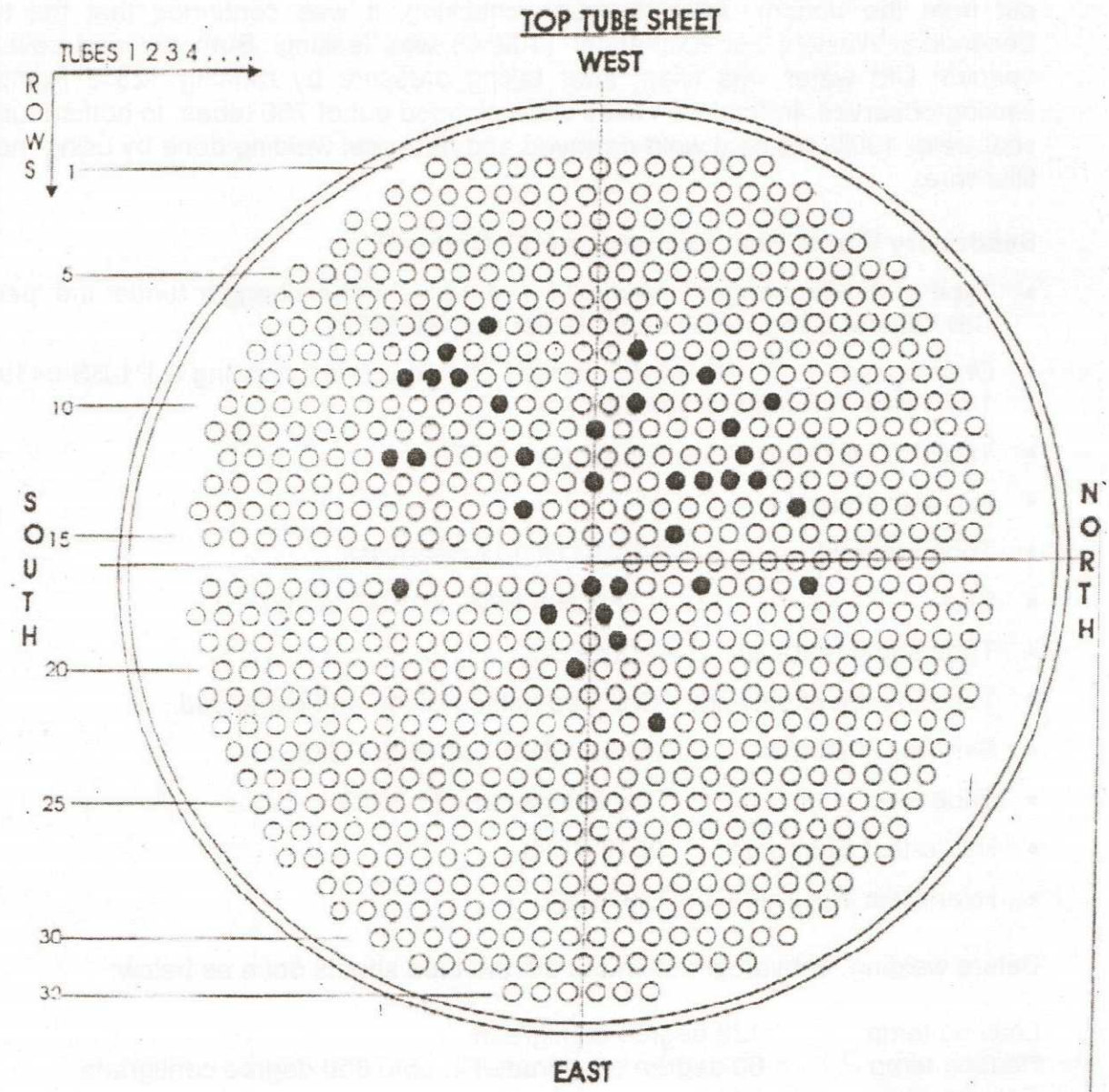
102 - C
WASTE HEAT EXCHANGER



● Plugged Tubes

Total 34 nos. of tubes plugged during Annual Plant Turnaround, May - June 2005

HEAT EXCHANGERS & COOLERS CLEANING BY HYDROJETTING : 50

(I) Following heat exchangers were opened, pulled out the tube bundle for hydro jetting of shell / tubes .Tube bundle and channel covers were boxed up. Hydro test was carried out as mentioned below:

Sr. No.	Equip.	Qty. Nos.	No. Of Tubes	Tube side		Shell side		REMARKS
				Design Hydrotest		Design Hydrotest		
				kg/cm2	kg/cm2	kg/cm2	kg/cm2	
1	115 C	1	649 U	29.9	-	10.6	15.8	
2	124 C	1	775 U	158	-	17.6	26.5	
3	129JC	1	290	2.3		5.29		
4	130JC	1	264	5.82	-	5.27		
5	131JC	1	348	11.90	-	5.27		

(II) Following heat exchangers were opened for hydro jetting of shell / tubes . Hydro test was carried out as mentioned below:

Sr. No.	Equip.	Qty. Nos.	No. Of Tubes	Tube side		Shell side		REMARKS
				Design	Hydrotest	Design	Hydrotest	
				kg/cm2	kg/cm2	kg/cm2	kg/cm2	
1	105 CA	1	2790	05.27	Static	30.9	46.50	
2	105 CB	1	2790	05.27	Static	30.9	46.50	
3	108 C1A	1	1415	05.27	08.5	8.00	08.5	
4	108 C1B	1	1415	05.27	08.5	8.00	08.5	
5	109 C1A	1	1150	30.58	45.50	5.29	8.5	
6	109 C2A	1	1150	30.58	45.50	5.29	8.5	
7	109 C1B	1	1150	30.58	45.50	5.29	8.5	
8	109 C2B	1	1150	30.58	45.50	5.29	8.5	
9	110-CA	1	763	05.60	-	5.27	8.10	
10	110-CB	1	2790	05.27		5.27	8.10	
11	127 CA	1	3516	05.60	-	21.10	31.50	
12	127 CB	1	3516	05.60	-	21.10	31.50	
13	128 C	1	1200	05.60	-	8.09	-	
14	173 C	1	294	010.60	-	5.27	-	

(III) Hydro jetting in shell / tube side done on the following Lube Oil Coolers:

Sr. No.	Equipment	Quantity (Nos.)	Description	Remarks
1	101-JLC / 1,2,3	3	Lube oil cooler for 101 - J	
2	103-JLC/ 1 & 2	2	Lube oil cooler for 103 - J	

(IV) Following Lube Oil Ccoolers were opened, cleaned by rod poking and boxed up:

Sr. No.	Equipment	Quantity (Nos.)	Description	Remarks
1	101-BJ Lube oil coole	3	Lube oil cooler for 101 - BJ	
2	104-J / JA Lube oil cooler	5	Lube oil cooler for 104–J /JA	
3	107-J / JA Lube oil cooler	2	Lube oil cooler for 107-J/JA	

(V) Following Gland Condensers & Surface Condensers were opened, cleaned by Hydrojetting and boxed up:

Sr. No.	Equipment	Quantity (No.)	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	1	Gland Condenser	
5	103-JBT	1	Gland Condenser	
6	105-JT	1	Gland Condenser	

(VI) Following seal coolers were opened, cleaned and boxed up:

Sr. No.	Equipment	Quantity (Nos.)	Description	Remarks
1	104-J	2	Seal Cooler	
2	104-JA	2	Seal Cooler	
3	170 J/JA	2	Seal Cooler	

STEAM LEAK JOBS :

Steam leak job was attended as per Production List given at the time of Plant Shutdown:

- PICV-14 passing
- SP 4 by pass line isolation valve gland leak. .(2"X1500#)
- 3.5 kg to 104-E isolation valve gland leak to be attended
- 126-C Drain line isolation valve D/S union leak. (¾" size Union)
- LCV-26 by pass isolation valve gland leak(2"x8#)
- LC-26 by pass valve gland leak
- 101F steam outlet block valve gland leak(This job will be done by valve gland leak group 01-17-02- job no 18)
- 101JT steam inlet main I/V G/L(6"X 300#)(This job will be done by valve gland leak group 01-17-02- job no 19)
- SP -70 U/S recycle pilot R.V. union leak. (furmanited. Post-C)
- V-15 u/s line trap is leaking. (post-C)

FLANGE LEAK JOBS:

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The following flange leak job was attended:

- 156-F Blow down drum RV upstream flange leak.(3"x150#)
- FIC-13 orifice flange leak.
- 103JAT steam inlet strainer flange leak4.
- 110-CA/CB outlet flange leak.
- 102 c inspection hole flange and 102C intermittent blow down line.
- MIC -61 U/S flange leak. (¾ " studs issued & kept in amm.maint)
- 38 kg Steam to 181 c isolation valve passing (4"x300# valve)
- 101CA/CB both riser & down comer flange Gkt to be replaced(spiral wound Gkt with inner ring-NEW TYPE) (14"x1500# , 18"x1500#)
- 102JT 3.5 Kg steam to 102JT PIC 202 D/S flange and strainer U/S flange leak(6"X 300# &8"X 300#)14 4ata steam Urea side I/V G/L(6"X150#) .
- 107 JT Murray turbine stem inlet I/V bonnet leak (6"x 400# Pacific make G/V
- 11 KG steam to LTS isolation valve U/S flange leak on rack(6"X 150#)
- V-15 U/S flange leak.(2"x300#)
- 14. 157F inlet flange leak.(18"x300#)
- LTS outlet on rack above 103C F/L .(16"x300#).
- 112JB Dis/V passing badly.(6"x150#)
- TI-1018 Thermowell (H-111) flange leak.
- 101 F north L.G. leak
- SP-3 to be attended as it is not operatable. (10"x300#)
- 107 JAT steam inlet block valve attended for passing.
- Steam+Hydrogen gear valve inlet to H111 line check valve
- 104 J disch ARV/NRV d/s flange leak. (6"x900#)
- 38 KG steam to 800 JT inlet vent valve u/s flange leak.(2"x 300#)
- 38 KG Steam to 800 JT thermocouple flange is leaking.(11/2"X300# POST-A)
- MS to 800 J steam inlet line TI flange leak.(post A)
- MS to 800 JT steam inlet line vent i/v u/s flange leak.(1"x800#)
- 101 CA south side risetr drain flange leak.(1"x1500#)
- 101 F south side LG bottom port is leak. And its i/v passing.
- PRC -25 u/s flange is leaking.(4"x400#)
- IBD root flange of 102 c(11/2"x 1500#)
- Chemical doz. Flange leak of 101 CB BFW O/L (102 C side 4"x1500#)
- 109 F 1st i/v not operatable.(2"x800#)
- MDEA filter 101L, 103L,104L interchangeability check and modify it for same.

OIL LEAK JOBS:

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The following job related to oil leak was carried out:

- 101-J / 105-J L.O.Cooler 6 way valve gland.
- 101-JT governor assembly oil leak, M-seal is provided.
- 105-JT governor assembly oil leak, M-seal is provided.
- 103-JAT LPC coupling drain, M-seal is provided.
- 103-J North bearing outlet.

IBR INSPECTION OF STEAM DRUM (101-F) :

101 F North LG isolation valve was replaced with new one procured from M/S Tyco, Halol.

WASTE HEAT BOILER (GT-1632 – 101F) INSPECTION BY IBR:

Waste Heat Boiler was inspected by Boiler Inspector in open test condition on 03.06.2005. Hydrotest at 150 Kg/cm2 pressure was done and witnessed by Boiler Inspector on 18.06.2005.

All the 4 relief safety valves of steam drum 101-F was steam tested/floated on 23.06.2005 and their readings are as follows:

	R.V. (North)	R.V. (Middle)	R.V. (South)	R.V. (Super Heater)
Popping Pr. Kg/cm2g.	114.6	117.5	119.4	112.5
Reset Pr. Kg/cm2g.	108.5	109.0	112.0	104.3

RELIEF VALVES OVERHAULING AS PER LIST :

Following relief valves were reconditioned and tested:

SR. NO.	RELIEF VALVE NO.	SET PR. KG/CM2	TEMP. DEG.F	CAPACITY LBS/HR.	RELIEF VALVE SIZE INCH.	DESCRIPTION	MAKE
1	RV-101-F 1	118.8	600	19576	2.5 X 6(2.545)	Steam Drum RV	CrossBy
2	RV-101-F 2	117	600	19576	2.5 X 6(2.545)	Steam Drum RV	CrossBy
3	RV-101-F 3	115.3	600	19576	2.5 X 6(2.545)	Steam Drum RV	CrossBy
4	RV-101-B	111.8	865	222182	3 X (3.6) X 6	Super heater RV	CrossBy
5	RV-MS-9	42.2	740	182928	4 P 6	38 K Steam header	CrossBy
6	RV-S-7	14.8	540	72884	4 P 6	11 K Steam Header	CrossBy
7	RV-LS-1	12.7	380	46634	4 N 6	3.5 K Steam header	CrossBy
8	RV-123-C A (2 Nos.)	122	275 Deg. C		3 J 6		CrossBy

9	RV-BFW-1	92		542.74 VSGPM	1 1/2 G 2 1/2	Offsite coil RV	CrossBy
10	RV-S-26	14.06		15100 PPH	2 1/2 J 4	Atomising steam to Aux boiler	CrossBy
11	RV-103-JAT (2 Nos.)	660 Psig	610		4 P 6	103 JAT exhaust	CrossBy
12	RV-103-JAT	660 Psig	680	2057	3/4 X (110) X1	103 JAT cover Sentinel RV	CrossBy
13	RV-104-JAT	5.3	300		6 Q 8		CrossBy
14	RV-111-C	5.3	300	5341	1 D 2	3.5 k steam to 111 C	CrossBy
15	RV-112-CA	10.5	298	5980	1 1/2 H 3	3.5 k steam to 112 C	CrossBy
16	RV-112-CB	10.5	298	5980	1 1/2 H 3	3.5 k steam to 112 C	CrossBy
17	RV-101-BJ	5.3	300	53680	6 Q 8	101 BJT exhaust	CrossBy
18	RV-109-F	19	270	61309 CFM air	6 Q 8	105 J Discharge	CrossBy
19	RV-110-F (N&S)	7	56	6332 CFM air	3 L 4	Ammonia vapour	CrossBy
20	RV-111-F	6.3	19	12912 CFM air	4 P 6	Ammonia vapour	CrossBy
21	RV-112-F	6.3	--- 28	929 GPM water	4 M 6	Liquid Ammonia	CrossBy
22	RV-175-J	7		18596 Kg/hr	1 1/2 XF 2		CrossBy
23	RV-104-D 1	35 reset 33	700	104796 CFM air	6 Q 8	HTS inlet	CrossBy
24	RV-104-D2	34.1		2996 CFM	1 1/2 F 2	LTS inlet	CrossBy
25	RV-101D	43.9	100	23073 CFM	3 K 4 -		CrossBy
26	RV-102-D	43.9	100	23073 CFM	3 K 4		CrossBy
27	PSV 2201	6.3	43	8000	4 M 6	Syn. Gas tube rupture	Audco
28	RV 101-J	36.9		37948		Air	CrossBy
29	RV-102-JLJT/1	4		1381 Kg/hr	1 1/2 X 3 630 mm3	102 J SO Turbine Outlet	Samual Birket
30	RV-105-JLO	5.3	300	6252 Lbs/hr	2 J 3	LO Turbine Exhaust	CrossBy
31	101 JT Sealing steam RV	10		885 Lbs/hr	1 1/2 --	101 JT Sealing steam RV	JE Lonergan
32	RV-102-F	29.5 Kg	146	110313 SCFM	6 X R X 8	PG, Raw gas sep o/l	Tyco
33	RV-103-J	2260 Psig	115	65120	3 X K X 4		Anderson
34	RV-147C	49.2	30	1536 CFM Air	J-0-35-A ID2	Ammonia from 147-C	CrossBy
35	RV-129C	8.4	34 Deg.C		1 E 2	103J inter stage cooler	CrossBy
36	PSV 1201	7	150	4700 Kg/hr	1 1/2 H 3	F- 101 Naphtha gas	Audco
37	PSV 1202	7	30	1200 m3/hr	1 1/2 F 2	F 101 NG	Audco

38	PSV 1203	48	37	9000	1 E 2	P-110 O/L Naphtha liquid	CrossBy
39	PSV 1204	48	150	3800	1 1/2 F 2	Recycle H2 from header	CrossBy
40	PSV 1205 (2 Nos.)	7	102		3 K 4	B-110, Naphtha liquid & vapour	CrossBy
41	PSV 1206	48	380	8400	1 1/2 G 2 1/2	H-110 Naphtha gas	Audco
42	PSV 1209	42	150	915 m3/hr	1 D 2	H2 gas from header	CrossBy
43	PSV 1210	48	535	5000	1 1/2 G 2 1/2	R-112 Process gas	CrossBy
44	PSV 1212	7	65	8400	3 L 4	B-218 Vent gas	Audco
45	PSV 301	10	70 Deg. C	5500 Kg/hr	1 1/2 H 3	Naphtha drain tank	Audco

VALVE JOBS:

The following job related to correction of valves was carried out:

- 173-C by pass valve gland leak. (4" x 150 #)
- 101-F steam outlet block valve gland leak.
- 101-JT steam inlet main I/V gland leak. (6" x 300 # valve)
- HCV-12 gland leak.
- 104-E condensate to 103-D jacket block valve gland leak.
- Atomizing steam to Auxiliary Boiler Br.No.1,2 & 5 B/V g/l. (11/2x800)
- FIC-16 U/S and D/S gland leak.
- Rich MDEA outlet corrosion test coupon line first I/V g/l (3"x300#)
- ata steam Urea side isolation valve gland leak. (6" x 150 #)
- SP-4 by pass valve gland leak.(2"x1500#)
- 101-D / 102-D Inlet line by pass valve passing. (2" x 600 # CS. G/v)
- 102-C chemical cleaning flange and intermittent b/d line flange leak.
- 101 –J lube oil turbine steam I/L line drain 1st I/V G/L(3/4"X800#)
- 127 –C Gas O/L I/V G/L (6"X300)
- LC-26 by pass valve G/L (2"X800#)
- 104 JT steam inlet bypass line i/v gland leak.(3/4"#1500#)
- ATA Steam to 104 E I/V G/L.(8"X150#)
- 38 kg steam to800 jt c.v. d/s pi i/v g/l (2"x300# post A1)

VALVE BONNET LEAKAGE:

Leak jobs were attended as per Production List given at the time of Plant Shutdown.

STRAINERS / FILTERS JOBS:

Following Cooling water Strainers were cleaned.

- 104-J / JA
- 107-J / JA
- 101-BJ
- 102-J L.O.Pump

102-EB STRIPPER JOB:

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As per inspection report, welding / repair job carried out.

VESSEL INSPECTION / REPAIR JOBS:

As per inspection report, welding/ repair job carried out in:

- Inspection of 101-E
- Inspection of 102-EA / EB
- Inspection of 102-F
- Inspection of 103-F
- Inspection of 104-F
- Inspection of 106-F
- Inspection of 107-F
- Inspection of 109-F
- Inspection of 110-F
- Inspection of 111-F
- Inspection of 112-F
- Inspection of 172-F

FABRICATION JOBS:

The following fabrication was carried out:

- PI-104 isolation valve gland leak(1''-800# cs g/v)
- PIC –7 Control valve by pass valve wheel broken.(1*800cs g/v)
- Gland leak of BBD sample line first isolation valve.(¾"x1500#)
- 103-JAT steam inlet strainer d/s drain valve g/l (3/4X1500)
- PIC -4 gland leak on rack near 105-CA/CB (1''X 800#)
- TRC-11 U/S drain valve gland leak (3/4''x 800 #)
- 101F HP steam sample first I/V gland leak.(1/2''x 1500#)
- 101 F level troll top isolation valve gland leak. (1''x1500)
- 101-BJT Exhaust line drain valve gland leak((1/2''X 800#)
- FRCV-2 block valve D/S bleed valve gland leak(3/4''X 800#)
- 101F B/D S/V near 103D at ground level g/l(3/4X1500)
- Steam line trap I/V Passing near 156F(1/2''X 800#)
- MIS22 Jumover valve gland leak(3/4''X 1500#)
- 38 Kg to ID Fan PI LP tapping root valve g/l(1/2X 800#)
- 3.5 Kg S/T I/V not operable at flare stack area road(1/2''X 800#)
- 101F LAL Switch west side top I/V G/L(1''X 1500#)
- HCV 12 sealing steam line valve bonnet leak
- 38 kg steam to pre reformer battery limit block valve D/S tarp I/V G/L(1/2''X 800#).
- Offsite BFW outlet line PI Ist I/V G/L(1/2''X 800#)
- Offsite BFW outlet line drain 2nd I/V & Drain line to RV D/S I/V G/L(1''X 800#)
- FRC2 HP tapping 1st I/V G/L & its tee thread leak(1/2''X 1500#)
- 104E from Urea B/V U/S DRAIN 1ST I/V and its trap by passvalve g/l (1/2''x800)
- MIC 22 Jump over valve(MS Side) G/L(3/4''X 1500#- 5 NO.)

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- 101J/105J LOT S/I B/V U/S 1ST drain valve passing (1/2''X 800#)
- 101 –F high level switch to I/V valve G/L (1''X1500)
- R -112 top & middle bed sample I/V G/L and bonnet leak.(1/2''x800#)
- Steam inlet line transmitter route I/V G/L
- M.S steam nr. Aux. Blr. Trap I/V bush broken (½''x 800#)
- FT 1017 LP Tapping R/V G/L.(1/2''x800#)
- 801 steam foot valve not getting close.(1/2''x800# ball valve)
- 109C D/L 1st I/V not operatable.(3/4''x800#)
- FIC 13 RO U/S D/Line corroded.(1''xcs pipe, 120 sch.)
- Auxiliary Boiler Burner No.1 Naphtha / steam valve is passing.
- 101-CB Shell side bottom drain valve gland leak.
- 101-CA shell side second drain valve gland leak 3.5kg to 104-E isolation valve gland leak to be attended (3/4''x800#)
- 104 E condensate to 103 D jacket block valve G/L (Nr LCV-20)
- FIC -16 U/S and D/S G/L.
- 38 KG steam line I/V near 101 B step ladder G/L (3/4''X800)
- SR2801 disch to be connected to F 101 instead of feed fuel pump suction line.(as per production requirement)
- 101 C steam o/l sample point 1st i/v g/l (furmanited –post A)
- HV 800 by pass valve g/l(1/2''x800# -furmanited)
- MS to 800jt steam inlet local pi u/s i/v g/l (1/2x 800#)
- Agitator separator drain valve g/l.(3/4''x800#)

PGR RELATED JOBS :

Cold box top manhole was opened for inspection of perlite and related job were carried out.

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CO_2 COMPRESSOR TRAIN (K-1801)

MAJOR OVERHAULING OF CO_2 COMPRESSOR DRIVE TURBINE (Q-1801-1)

Specification of the Turbine

Equipment Name	:	Drive Turbine for Hitachi Make CO_2 Compressor
Tag No	:	Q-1801
Make	:	M/s. Siemens Germany
Type	:	ENK 32 / 45 / 8 / 20 – 7
DOR	:	Clockwise
Output	:	7679 KW
Output rated	:	9660 KW
Speed (Normal)	:	7160
Minimum Governor Speed	:	6375 RPM
Maximum Continuous Speed	:	7875 RPM
Trip speed	:	8663 RPM
Main Steam inlet pressure	:	60 ata
Main steam temperature	:	395 °C
Extraction steam Pressure	:	23.8 ata
Exhaust pressure	:	0.12 ata
Induction Steam Pressure	:	4.91 ata

The following activities have been carried out during overhauling of the Steam turbine.

Dismantling:

- Removing the Coupling spacer on LP casing side.
- Turbine rotor assembly Alignment and axial thrust checking.
- Removal of necessary oil and steam piping to enable machine dismantling.
- Removal of extraction valves actuating cylinders.
- Checking of bearing clearances.
- Inspection of bearings and removal of their top halves.
- Checking of rotor assembly position with respect to casings and bearings.
- Locking of bottom half of the turbine casing & supporting the bottom casing at front end.
- Loosening of casing fixing bolts.
- Removal of top casing.
- Removal of nozzle box & Guide Blade Carrier (GBC) top halves.
- GBC and Labyrinth clearance checking.
- Removal of Rotor assembly from the casing.
- Removal of bearing bottom halves.
- Removal of Guide Blade Carrier bottom halves.

VISUAL OBSERVATIONS

- Scale deposits in the casings, GBCs, guide blades & rotor blades were found to be normal. Slight erosion was noticed on LP Stage blades.
- The labyrinths on Balance piston showed considerable wear.

CLEANING

- Cleaning of all sub-assembly components was carried out.
- Cleaning of Casing drains, oil pipings etc was attended.
- Cleaning of Turbine blades, Guide blades, Nozzles in nozzle block and carriers was carried out by hydrojetting followed by air drying.

NDT INSPECTION

DPT was carried out on the following components and no significant defects were noticed.

- Rotor LP stage blades.
- All Journals.
- Thrust Collar.
- All Bearings.
- All Thrust pads.
- Nozzles in the nozzle Block.

Guass measurement on bearings – Demagnetizing was carried out.

Run out checking of Rotor assembly on bearings – Run out readings were well within permissible limits. (Please refer report).

ASSEMBLY

Assembly of the components in the casing was started only after thorough cleaning followed by detailed joint inspection by IFFCO & M/s SPIC-SMO.

- Assembling of bottom halves of bearings in bearing housings.
- Front bearing oil labyrinth was found worn out and hence replaced by a new one.
- GBC II & III centering pins were machined to set side clearance as per protocol readings.
- Front and rear glands were assembled and clearances were checked.
- Rotor assembly was positioned in the bearings bottom halves.
- Rotor assembly was centered in the casings / bearings.
- Assembling of Guide Blade Carriers one by one in bottom casing, starting from exhaust end to suction end.
- With each GBC in position, Rotor assembly was positioned in bearing bottom halves.
- Similarly all GBCs were centered in the casing with respect to rotor assembly.
- Thrust bearing was properly assembled.
- Rotor assembly was axially located and nozzle clearances were checked.
- Balancing drum and inter stage labyrinth clearances were checked.
- Top halves of the GBCs were assembled and centering of the GBCs was completed.
- GBCs fixing nuts were tightened and secured positively by TIG welding to bottom casings.
- Chest valve assembled.

- Top casing was positioned on the bottom casing with sealant in position.
- Casing bolts were tightened.
- Rotor free float was checked.
- Centering position of the rotor assembly in the casings was checked.
- Rotation of the rotor assembly was checked and found to be satisfactory.
- Fixing of oil piping & steam piping was carried out.
- Lift checking of chest valves & Servo Motor was verified.
- Turbine float was measured and recorded.

SPECIAL REMARKS

- The side clearance in guide blade carrier-II & III was found high i.e. 0.25 mm at one side indicating rotor shifting to one side. This required shifting of the rotor assembly side wise. Proper positioning was achieved by adjusting the height of centering pin of the bottom guide blade carrier. A new step was machined at opposite face of the centering pin (Part no. 502 Drawing No. 0-0006-0450-50/51) keeping width of 32 mm (same as per the original dimensions).

  Turbine float : 0.20mm
  (Net float = Total float minus Housing play = 0.35 - 0.15)

- Free end bearing was opened and cleaned, polished and the dimensions were recorded.

Pad Thickness	:	**17.48 mm/17.49 mm**
Journal diameter	:	**124.80 mm**
Bearing housing ID	:	**159.93 mm**
Clearance was found to be	:	**0.17 mm**

- Thrust bearing was removed and cleaned, polished and reassembled back. The measured rotor float was as per design values.
- Free end bearing cover was boxed up after cleaning.
- Turbine coupling end bearing was removed, cleaned, polished and re-assembled back. Bearing dimensions were recorded as follows.

Bearing Pad Thickness	: **22.47mm**
Journal dia is measured and found	: **159.71mm/159.72mm**
Bearing housing ID	: **204.94m**
Clearance was found to be	: **0.34mm**

- Turbine free end and coupling end top covers were boxed up by applying Hylomer compound to the split face.
- Alignment readings were recorded for LP case to Turbine coupling.

FINAL READINGS OF TURBINE :

62

Sr. No.	Description	Design Value (mm)	Actual Value BPM (mm)	Actual Value APM (mm)
1	Axial Float	0.25 ~ 0.35	0.31	0.20 (0.35 ~0.15)
2	Free End Bearing Clearance	0.18 ~ 0.31	0.23	0.23
3	Coupling End Bearing Clearance	0.24 ~ 0.36	0.28	0.28

Sr. No.		1		
Ref Page No.		9+		
Part Name & Position		Axial displacement of rotor at the casing		
Parameter		Lower part	Lower part & upper Part	Lower part & upper Part with all internals
+ Direction	Nominal	2.2 - 2.8	2.2 - 2.8	2.2 - 2.8
	Actual	2.20	2.20	2.20
Measured Value	Before overhauling	2.20	2.20	2.20
	After overhauling	2.15	2.15	2.15
- Direction	Nominal	1.7 - 2.3	1.7 - 2.3	1.7 - 2.3
	Actual	1.80	1.80	1.80
Measured Value	Before overhauling	1.76	1.76	1.76
	After overhauling	1.87	1.87	1.87
Sum	Nominal	3.90	3.90	3.90
	Actual	4.00	4.00	4.00
Measured Value	Before overhauling	4.06	4.06	4.06
	After overhauling	4.00	4.00	4.00
Remarks				

Guide blade carrier (4) :

63

Measurement Method		1											
Pos.	Version	SRLE						SRLA					
		Ref. Value	Actual Value	Measured Value				Ref. Value	Actual Value	Measured Value			
				Before O/H		After O/H				Before O/H		After O/H	
				R	L	R	L			R	L	R	L
2	A - Rad			0.35	0.35	0.40	0.45	0.80 to 1.00	0.80	0.40	0.40	0.45	0.45
3	A	0.35 to 0.60	0.4	0.40	0.38	0.40	0.45	0.35 to 0.60	0.40	0.40	0.35	0.45	0.45
4	A			0.40	0.35	0.40	0.45		0.40	0.40	0.35	0.45	0.45
5	A			0.40	0.35	0.40	0.45		0.40	0.40	0.40	0.45	0.45
6	A			0.40	0.35	0.40	0.45		0.40	0.35	0.35	0.45	0.45
7	A			0.40	0.35	0.40	0.45		0.40	0.40	0.40	0.45	0.45
8	A			0.35	0.35	0.40	0.45		0.40	0.50	0.50	0.45	0.45

Measurement Method		1											
Pos.	Version	SRLE						SRLA					
		Ref. Value	Actual Value	Measured Value				Ref. Value	Actual Value	Measured Value			
				Before O/H		After O/H				Before O/H		After O/H	
				R	L	R	L			R	L	R	L
2	A -Rad	>4.5 =4.5	5.20	5.20	5.20	5.20	5.20						
3	A	>2.0 =2.0	2.10	2.25	2.50	2.25	2.25	>3.0 =3.0	4.00	4.20	4.30	4.20	4.20
4	A	>2.10 =2.10	2.20	2.30	2.30	2.30	2.40	>3.1 =3.1	4.10	4.00	4.20	4.20	4.20
5	A	>2.2 =2.2	2.40	2.45	2.50	2.50	2.55	>3.3 =3.3	4.10	4.20	4.30	4.30	4.30
6	A	>2.3 =2.3	2.60	2.80	2.70	2.80	2.90	>3.4 =3.4	4.40	4.20	4.00	4.30	4.30
7	A	>2.4 =2.4	2.80	2.80	2.80	2.90	3.00	>3.6 =3.6	4.60	4.60	4.60	4.55	4.50
8	A	>2.5 =2.5	2.90	2.90	2.70	2.90	2.90						
3			E						4.50				

Guide blade carrier (4) :

64

Measurement Method		1											
Pos.	Version	SRLE						SRLA					
		Ref. Value	Actual Value	Measured Value				Ref. Value	Actual Value	Measured Value			
				Before O/H		After O/H				Before O/H		After O/H	
				R	L	R	L			R	L	R	L
9	A	0.35 to 0.61	0.40	0.40	0.45	0.40	0.45	0.35 to 0.61	0.40	0.40	0.40	0.40	0.45
10	A			0.40	0.45	0.40	0.45			0.40	0.40	0.40	0.50
11	A			0.40	0.45	0.40	0.45			0.40	0.45	0.40	0.45
12	A			0.35	0.30	0.40	0.45			0.40	0.40	0.45	0.50
13	A			0.35	0.30	0.40	0.45			0.40	0.40	0.45	0.50
14	A			0.35	0.30	0.40	0.45			0.40	0.40	0.45	0.50
15	A			0.35	0.30	0.40	0.45			0.40	0.40	0.45	0.50
16	A			0.35	0.30	0.40	0.45			0.40	0.40	0.45	0.50
17	A			0.40	0.40	0.40	0.50			0.40	0.40	0.45	0.50
18	A			0.35	0.35	0.45	0.50			0.40	0.40	0.50	0.50
19	A			0.40	0.40	0.45	0.50			0.40	0.40	0.50	0.50
20	A			0.40	0.45	0.45	0.50			0.40	0.40	0.50	0.50

Guide blade carrier (4) :

Measurement Method		1											
Pos.	Version	SRLE						SRLA					
		Ref. Value	Actual Value	Measured Value				Ref. Value	Actual Value	Measured Value			
				Before C/H		After O/H				Before O/H		After O/H	
				R	L	R	L			R	L	R	L
9	A	>3.0 =3.0	3	2.9	3	2.9	3	> 4.4 =4.4		5.40	5.90	5.40	5.40
10	A	>3.1 =3.1	3.1	3.4	3.6	3.1	3.15	>4.5 =4.5	4.00	5.60	5.55	5.50	5.50
11	A	>3.2 =3.2	3.4	3.4	3.5	3.3	3.35	>4.7 =4.7	4.10	5.20	5.30	5.80	5.80
12	A	>3.2 =3.2	3.3	3.3	3.35	3.4	3.3	>4.8 =4.8	4.10	5.30	5.60	5.90	5.90
13	A	>3.3 =3.3	3.5	3.5	3.5	3.5	3.55	>4.9 =4.9	4.40	5.60	5.40	5.70	5.70
14	A	>3.4	3.5	3.4	3.4	3.5	3.5	>5.1	4.60	5.60	6.10	6.30	6.30

		=3.4						=5.1					
15	A	>3.5 =3.5	3.6	3.4	3.3	3.6	3.7	>5.2 =5.2		6.10	6.20	6.60	6.20
16	A	>3.6 =3.6	3.8	3.5	3.2	3.8	3.65	>5.4 =5.4		6.30	6.80	6.80	6.80
17	A	>3.7 =3.7	3.7	3.5	3.2	3.75	3.8	>5.5 =5.5	4.00	6.70	6.70	6.90	6.90
18	A	>3.7 =3.7	3.7	3.4	3.14	3.7	3.8	>5.6 =5.6	4.10			7.00	7.00
19	A	>3.8 =3.8	3.8	3.7	3.3	3.9	3.9	>5.8 =5.8	4.10			7.10	7.10
20	A	>3.9 =3.9	4.1	4.2	3.9	4.2	4.2						

Guide blade carrier (4) :

Measurement Method		1											
Pos.	Version	SRLE						SRLA					
		Ref. Value	Actual Value	Measured Value				Ref. Value	Actual Value	Measured Value			
				Before O/H		After O/H				Before O/H		After O/H	
				R	L	R	L			R	L	R	L
21	A	0.35 to 0.61	0.40	0.45	0.50	0.55	0.65	0.35 to 0.61	0.45	0.45	0.45	0.45	0.45
22	A	0.35 to 0.61	0.40	0.45	0.40	0.50	0.60	0.40 to 0.67	0.45	0.45	0.40	0.45	0.55
23	B	0.40 to 0.67	0.40	0.45	0.45	0.50	0.60	0.40 to 0.67	0.45	0.40	0.40	0.45	0.55
24	C	0.40 to 0.67	0.40	0.45	0.40	0.55	0.60	2.55 to 3.25	2.90	2.95	2.95	2.90	2.90
25	C	0.40 to 0.67	0.40	0.45	0.45	0.55	0.65	3.65 to 4.55	4.00	3.90	4.10	4.15	4.15

Sr No.	Ref Page No	Part Name & Position	Parameter	Ref Value	Actual Value	Measured Value		Measm. method
						Before O/H	After O/H	
2	9+	Rotor axial Position(1)	E1		98.80	98.80	98.90	2
			E2		132.20	132.20	132.10	2
			E3		304.50	303.70	303.70	2
3	10+	Journal Bearing; Tilting pad Front(1)	Journal Dia D		124.81			3
			Bearing Housing inner Dia D2		200.02			
			B1		20.00			
			B2		17.50			
			D2-D2xB1-2XB2=S	0.188 to 0.307	0.214		0.24	11
		Journal Bearing; Tilting pad Rear(5)	Journal Dia D		159.74			3
			Bearing Housing inner Dia D2		250.07			
			B1		22.51			
			B2		22.49			
			D2-D2xB1-2XB2=S	0.240 to 0.363	0.33		0.29	11
		Thrust Bearing (1)	SA	0.30 to 0.43	0.36	0.32 E0.12	0.32 E0.12	4
			SR1	0.70 to 1.00	0.70			1
			SR2	0.70 to 1.00	0.70	1.00	1.00	1
			SA1	0.01 to 0.055	0.03			4
4	11+	Bearing Housing front(1)	S1 Front Left	>1.3 =1.3	>3.0			1
			S1 front Right		>3.0			1
			S1 rear lkeft		>3.0			1
			S1 rear right		>3.0			1
			S2 Front Left	>16.4 =16.4	>17.0			1
			S2 front Right		>17.0			1
			S2 rear left		>17.0			1
			S2 rear right		>17.0			1
5	11+	Bearing Housing front(1)	S3 front left	0.02 to 0.03	0.03	0.03	0.03	1

OVERHAULING OF PERIPHERALS

67

- Oil seals replaced in following assemblies as a preventive measure.

  Actuating cylinders of the extraction valves.

  Emergency shut off Valve.

  LP Control valve

  HP Servo Motor

  Pilot Piston

- Governing Control Valves

  No# 2 valve seat was replaced by a new one as the old one was found in damaged condition.

  No 2 valve stem was been replaced by a new one as old one was found bent & having severe scoring marks.

  No 2 valve stem packing washer was replaced.

  LP governing valve packing was replaced by a new one.

- LP governing valve stem was replaced.

The Final reading of governing valves lift w.r.t. secondary oil pressure

Sr. No	WW-505 DCS out-put In %	H.P.Servo-motor		L.P.Valve (4-Ata)		23 –Ata Valve	
		Secondary oil pressure	Valve Lift (Div)	Secondary oil Pressure	Valve Lift Div)	Secondary oil pressure	Valve Lift (Div)
1	0	1.5	0	1.65	1.0	0	1.5
2	10	1.9	1.0	1.85	5.0	1.73	1.5
3	20	2.12	7.0	2.12	11.5	2.0	2.7
4	30	2.40	10.50	2.40	19.0	2.3	4.0
5	40	2.70	14.0	2.70	27.0	2.58	5.8
6	50	3.00	18.0	2.98	33.0	2.88	7.5
7	60	3.32	21.50	3.30	38.0	3.2	9.2
8	70	3.70	25.26	3.60	43.0	3.52	11.0
9	80	4.02	30.00	3.95	49.50	3.87	13.2
10	90	4.40	35.00	4.38	55.0	4.25	15.8
11	100	4.75	39.00	4.65	65.0	4.60	31.5

All of the above readings were matched with protocol readings. The fine adjustment is done in the L.P. valve (23 ata) links to adjust readings.

Over Speed Trip

68

Following procedure was followed during over speed test (OST) carried out on the turbine on 13/06/2005.

- Hydraulic function of over speed trip and Emergency stop valve checked three times.
- Each protection device like over speed, solenoid valve for remote tripping, and manual tripping device were checked thrice.
- Heating up the turbine with Live steam at 15 bar & 300 ^{0}C condition for 4 hours.
- Dial indicator put on front casing for seeing thermal expansion of turbine.
- Put turbine on slow roll of 2000 RPM for two hours.
- Increase speed up to 6375 RPM and hold for 30 minutes.
- Increased Turbine speed up to 7875 RPM (Maximum continuous speed) and hold for 30 minutes.
- During OST oil pressure ,temperature and shaft vibration was checked at each speed.
- Further speed was increased through Woodward–DCS governor in the control room.
- Turbine was tripped at 8749 RPM (Nominal trip speed 8663 +/- 1% ; min 8576 RPM , maximum 8749 RPM).

Remark

- The turbine speed was not increasing after 7875 RPM due to Woodword -DCS interlock at this speed. The interlock was removed from local panel with providing jump-over to the over speed key i.e. over speed key was released.
- During OST of the turbine, metal temperature of the one pad of rear journal bearing went up to 85 deg C. However oil outlet temperature and vibrations were normal. After OST rear bearing housing was dismantled and overall condition of bearing was checked. it was found in good except impression marks on the bottom pads. The clearance and blue match was taken and the same was found satisfactory & acceptable. In one pad the instrument RTD probe was found in loose condition and the same was replaced.
- The weight of trip bolt was measured as **2.9136 gm.** M.O.C. was confirmed as EN.19

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 coupling end were opened for inspection. Replaced by new one as the same were found damaged.
- Journal bearing on free end was opened for inspection and found OK.
- Thrust bearing was opened for inspection. DP testing on all the thrust pads was carried out & was found OK. Thickness of the thrust pads was checked and found within acceptable limits.
- Thrust bearing pads were thoroughly cleaned, polished and reassembled.
- The journal bearings were cleaned, polished and then reassembled back. Bearing clearances checked with lead wire.
- Gauss measurement was done by Inspection section and the readings were recorded. Found within acceptable limits.
- Final alignment readings were taken and recorded. Alignment between HP casing & gearbox was checked and corrected as per OEM reference values.

The Coupling spacer between HP casing & gearbox was assembled.

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

- Coupling guard between HP case and Gear box was removed and Decoupled from Gear Box after match marking.
- Alignment readings were taken and recorded.
- Journal bearing pads on coupling end were opened for inspection. Replaced by new one as the same were found damaged.
- Journal bearing on free end was opened for inspection and found OK.
- Thrust bearing was opened for inspection. DP testing on all the thrust pads was carried out & was found OK. Thickness of the thrust pads was checked and found within acceptable limits.
- Thrust bearing pads were thoroughly cleaned, polished and reassembled.
- The journal bearings were cleaned, polished and then reassembled back. Bearing clearances checked with lead wire.
- Gauss measurement was done by Inspection section and the readings were recorded. Found within acceptable limits.

- Final alignment readings were taken and recorded. Alignment between HP casing & gearbox was checked and corrected as per OEM reference values.
- The Coupling spacer between HP casing & gearbox was assembled.

PREVENTIVE MAINTENANCE OF GEAR BOX M-1801

Since last one year, the Temperature of high speed pinion bearing of gear unit was remaining higher than permissible value of 80 ° C. Once, it even went up to 105^0 C and then it came down.

Observations: High speed Pinion Shaft and Bearings

- Both Pinion shaft bearings were inspected. Brownish discoloration and mild impressions were observed on the white metal surface of both the halves.

The Bearing white metal surface was thoroughly cleaned and polished.

Observations: Low speed Gear Shaft and Bearings

- Both bearings were found in good condition.
- Bearing clearances were measured and recorded. Found within design limit.
- Backlash measurement was carried out and found ok.

FINAL CLEARANCE READINGS OF HP COMPRESSOR

LP Compressor

Before	Description	After
0.17	Thrust end Brg. Clearance	0.18
0.14	Non Thrust end Brg. Clearance	0.145
0.32	Axial Thrust	0.32
0.2	Thrust End oil Laby clearance –Right	0.2
0.1	Left	0.1
	DP Check	Yes
	Magnetism Check	Yes
	Demagnetization : Done	Yes
Spares replaced :		
1	Thrust Bearings Pads - 1 set	
2	Journal Bearing Pads - 1 set	
Observations :		
1	Bearing pads had scoring marks.	

HP Compressor

Before	Description	After
0.15	Thrust end Brg. Clearance	0.18
0.14	Non Thrust end Brg. Clearance	0.13
0.32	Axial Thrust	0.32
0.3	Thrust End oil Laby clearance	0.3
	DP Check	Yes
	Magnetism Check	Yes
	Demagnetization : Done	Yes
Spares replaced :		
1	Thrust Bearings Pads - 1 set	
2	Journal Bearing Pads 1 set	
Observations :		
1	Bearing pads had scoring marks.	

Hitachi Compressor Gearbox

Tag No.1101

Before	Description	After
0.14	Input shaft - LP side	0.14
0.16	Input shaft - HP side	0.16
0.18	Output shaft - LP side	0.18
0.17	Input shaft - HP side	0.17
1.54	Axial Thrust - Output Shaft	1.54
0.46	Axial Thrust - Input Shaft	0.46
0.46	Gears backlash	0.47
	DP Check	Yes
	Magnetism Check	Yes
	Demagnetization : Done	Yes
Spares replaced : Nil		
Observations:	-	

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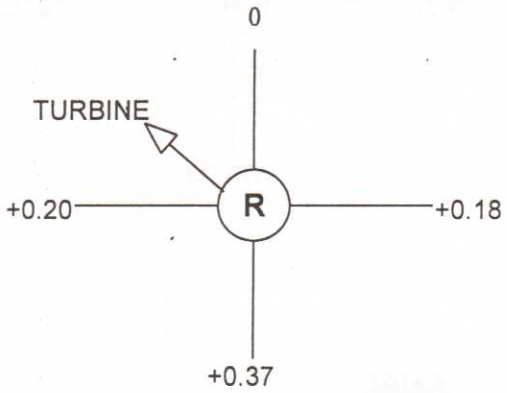
ALIGNMENT DATA FOR HITACHI COMPRESSOR TRAIN :

LP Compressor to Turbine :

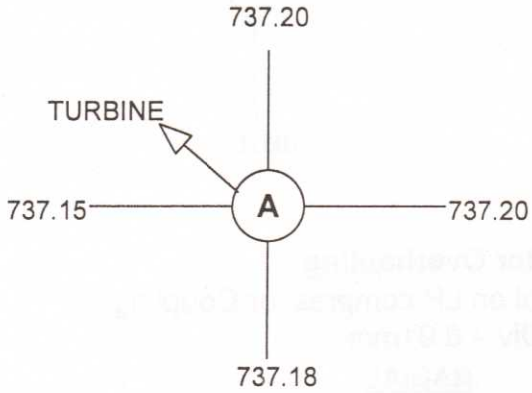
Before Overhauling

Dial on Turbine Coupling
1 Div = 0.01mm

RADIAL



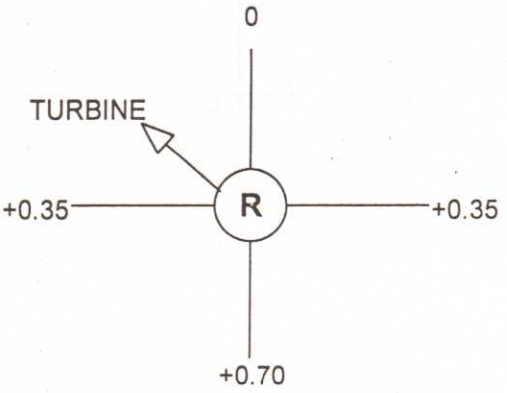
AXIAL



After Overhauling

Dial on Turbine Coupling
1 Div = 0.01mm

RADIAL



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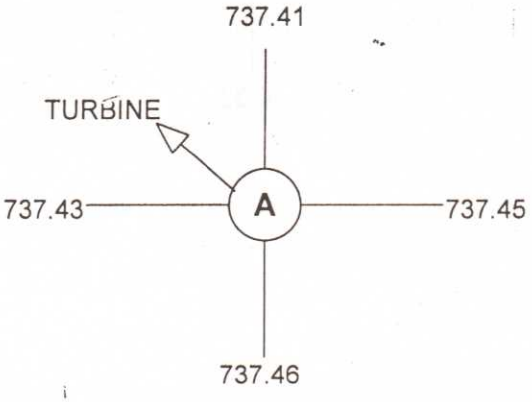
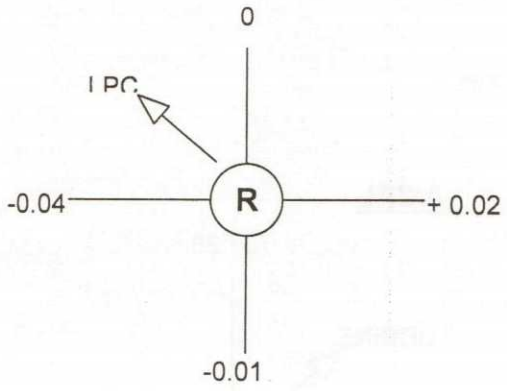


Gear box to LP Compressor:

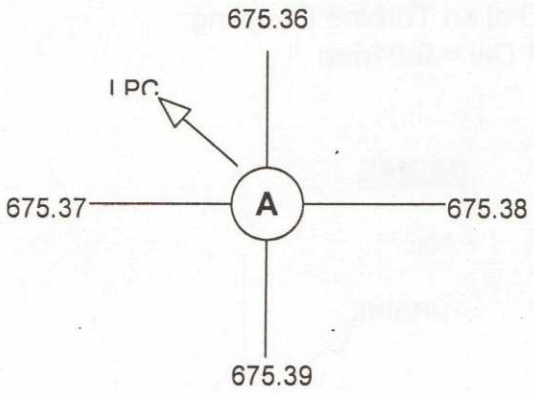
73

Before Overhauling
Dial on LP Compressor Coupling
1 Div = 0.01mm

RADIAL

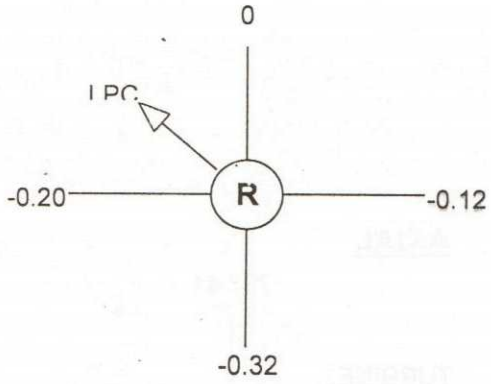


AXIAL



After Overhauling
Dial on LP compressor Coupling
1 Div = 0.01mm

RADIAL



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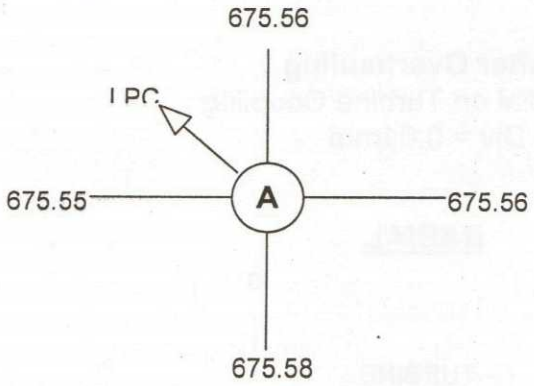
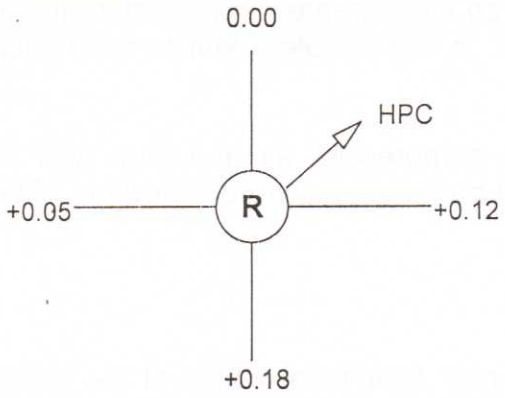


Gear box to HP Compressor :

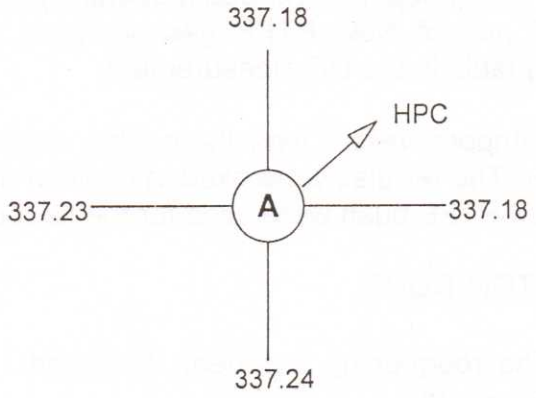
74

Before Overhauling
Dial on HP Compressor Coupling
1 Div = 0.01mm

RADIAL

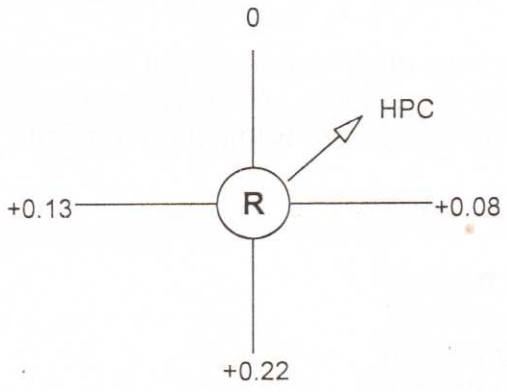


AXIAL

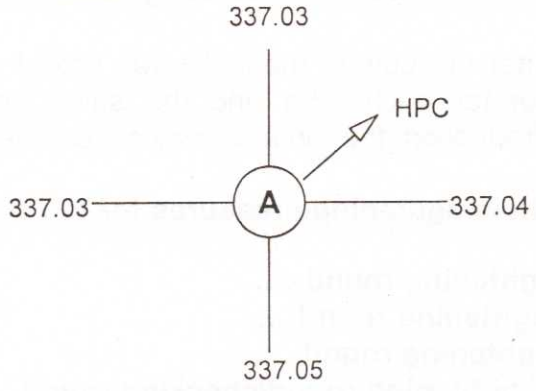


After Overhauling
Dial on HP Compressor Coupling
1 Div = 0.01mm

RADIAL



AXIAL



H.P. VESSEL JOBS

HP STRIPPER (H-1201)

The top and bottom covers of the HP Stripper (H-1201) were opened using "Hydra Tight Sweeny" make bolt tensioner at hydraulic pressure of 1000 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. Some oil deposits and scaling was observed between the tube ends, on the top tube sheet. 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 2700 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. 72 no of new PTFE bush were used for the tie rods.

BOTTOM DOME

- The roughening has been observed in two nos. liner petal plates of the bottom dome area.
- Two Nos of bolt of urea solution outlet flange were observed blackish compared to the rest and these were replaced by new ones.
- The small cavity on overlay welding of manway was observed and the same was repaired using TIG welding method with 25-22-2 L Mn filler wires. The weld repaired areas were passivated and washed with DM water.

- After inspection by production department and getting clearance, the bottom manhole was boxed up using new "Kempchen" gasket.

- 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.

Manhole tightening pressures for top and bottom covers

1st tightening round.....	**400kg per /cm^2**
2nd tightening round.....	**700kg per/cm^2**
3rd tightening round.....	**1000kg per/cm^2**
Final tightening round/checking round	**1000kg per/cm^2**

H.P. CONDENSER (H -1202)

The top flange of H-1202 (off gas line) was opened. Then the top cover was opened with bolt tensioner at 500 kg/cm2 hydraulic pressure and shifted from position. The partition plates, basket, segments and rasching rings were removed.

At the bottom end, the Liquid outlet line (H-1202 to V-1201) was opened. The bottom cover was opened using bolt tensioner at 500 kg/cm2 hydraulic pressure.

During visual inspection of the bottom dome small cavity (size : 2mm deep x 3mm width) observed at two location of circumferential weld seam .The same was repaired by

TIG welding method with 25-22-2 L Mn filler wires. The weld repaired areas were passivated and washed with DM water.

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..... 250 kg/cm²
2nd tightening round..... 350 kg/cm²
3rd tightening round..... 450 kg/cm²
4th/final checking round... 450 kg/cm²

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..... 250 kg/cm²
2nd tightening round..... 350 kg/cm²
3rd tightening round..... 450 kg/cm²
4th/final checking round..... 450 kg/cm²

Connected liquid outlet line and tightened it.

AUTOCLAVE (V-1201)

All the nozzles at the bottom and off gas line at the top were opened including all the steam tracing lines. The top man way over was opened using hydraulic bolt tensioner at 500 kg/cm2 pressure. The over 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 : s

Compartment No.1 (Top Compartment):

- Minor Roughening /corrosion of dome liner was observed and also grayish oxide layer was observed on dome and man way surface.

- 3 Nos. Spot-welds observed to have corroded in northwest direction just below the circumferential seam and 1 no. Undercut was observed on long seam in North East direction. All these spots 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.
- Brownish oxide layer was observed on bottom side of trays.

Compartment No.2:

- Minor roughening of tray holding clits and brownish oxide layer was observed on bottom side of trays.

Compartment No.3:

- Very minor roughening was observed on insert liner.
- 2 nos. of spot welds observed to have corroded the same 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.
- Few 'J' bolts were found loose and the same were tightened

Compartment No.4:

- Slight roughening of insert liner plate and tray holding clits was observed.
- Approx. 30 mm below circumferential weld a depression of approx. 100 mm dia. and 3 mm depth observed at west side liner. Same was observed during last inspection also.
- Convex bulging of liner plate observed just above circumferential weld by approx. Less than 4 mm height from North to West side.

Compartment No.5:

- Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 3 to 9 mm height starting from north to south direction. The same was observed during last inspection also.
- Concave depression of max. 4 to 5 mm was observed at approx. 500 mm below circumferential length. The same was observed during last inspection also.
- One crevice cavity of 1.5 feet long was observed on North west long seam and one no. Spot-weld cavity observed on shell liner. These 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.

Compartment No.6:

- Convex bulging of liner plate was observed above the circumferential weld joint by approx. 3 to 10 mm height, which starts from north-west to south-east direction in approx. Length of 4500 mm. The same was observed during last inspection also.
- Concave depression of less than 5 mm depth was observed at approx. One meter below circumferential weld in area of approx. 750 X 70 mm at east side of shell. The same was observed during last inspection also.

Compartment No.7:

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- Convex bulging of liner plate was observed above the circumferential weld joint by approx. less than 6 mm height in approx. 2 mtr. Circumference from South-East to West side. The same was observed during last inspection also.

Compartment No.8:

- Two nos. cavities were observed and the same 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.

Compartment No.9:

- One no. Cavity was observed which was repaired using TIG welding method and 25-22-2 L Mn filler wires. The weld repaired areas were passivated and washed with DM water.

Compartment No.10:

- Four nos. Old clit welding marks were found corroded and the same 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 .

Compartment No.11:

- Just below circumferential weld concave depression of approx. 4 to 6 inch drain north west direction was observed. The same was observed during last inspection also.
- 10 to 12 mm gap was observed between tray & sheil 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 stich welds (approx. 125 mm long).
- 2 nos. of undercuts were marked for repair in long seam in north direction.

Compartment No.12 (Bottom Compartment.):

- Weld joints of all nozzles, petal plates, crown plates and the circumferential weld of the bottom dished end liner DP tested. 11 nos. of minor welding defect repaired using TIG welding method and 25-22-2 L Mn filler wires. The weld repaired areas were passivatied and washed with DM water.
- All marked defects were repaired, DP tested followed by ferrite content checking and found 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.

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1st tightening round..... 250 kg/cm^2
2nd tightening round..... 350 kg/cm^2
3rd tightening round..... 450 kg/cm^2
4th/final checking round..... 450 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#).

EXTERNAL SHELL SURFACE INSPECTION (V-1201)

External shell inspection was planned as a preventive measure to verify corrosion attack severity on the vessel shell surface as it has put in approx. 30 years service. This job was taken up in the light of case study presented in the Urea STAMI CARBON symposium-2004, which highlighted accelerated Nitrate attack on the shell surface leading to cracking due to corrosion. The job required proper co-ordination of multiple activities like scaffolding, shot blasting, NDT inspection, painting and re-insulation in addition to weep hole checking by Production & drain connections by Instrument sections. During actual job execution, NDT inspection was carried out after applying primer coat for proper co-ordination.

In this connection, the following NDT inspection activities were carried out.

(a) 100% MPI of all circumferential and longitudinal butt weld joints.
(b) 100% DPT of all fillet welds / branch welds of connected nozzles.
(c) UFD of all T-Joints.
(d) Thickness measurement of shell.
(e) In-situ metallography on selected spots.

External condition of vessel was found satisfactory with respect to all the above-mentioned NDT testing.

SHELL SURFACE SHOT BLASTING AND PAINTING (V-1201)

Shot blasting and Painting contract was awarded to M/s Evershine Corrosion control Pvt. Ltd, Mumbai, vide WO No. 13/00671/9916837 dated 31/03/2005. The shell surface was thoroughly cleaned by shot blasting with Sa-2-1/2 grade minimum of Swedish specification SIS –05-05900-1967 having surface profile upto 30 micron. After shot blasting one coat of Zinc silicate primer was applied. After one coat of primer, heat resisting HT 400 Silicon Aluminum paint of two coats each of 20 micron thick was applied.

The details of Primer and paint are as follows.

Primer :
Make : Shalimar
Type : Zinc dust-56/12
Batch no.:LN:4596 ; 1/2005
Quantity : 12.5x3=37.5 Kg

Binder – Zilicate based binder
Thinner- Zilicate based thinner

Paint
Make : Shalimar
Type : TUFFKOTE , LUSTROTHERM HT-400
Batch No. : NL/5083
Quantity : 20x3 = 60 Litre

Scaffolding , Removal of old Insulation , Cleaning and Re-insulation Job

The above job was awarded to M/s Balaji Insulation India Pvt. Ltd, Mumbai vide W.O.No. 13/00654/9916852 dated 15/02/05. To save time, the scaffolding job was taken up as pre-shutdown activity well before the start of shutdown.

The details of Insulation material (Mineral wool and Aluminum sheet) used for the job are as follow.

Density : 150 Kg/m^3
Thermal Conductivity :0.52 MW/CM ^{0}C
(At 100 deg mean temp)
Nitrate content : < 10 ppm
Aluminum sheet : 22 gauge

The details of insulation for various sections of the vessel is as shown in the following table.

Sr No	Vessel zone / Pipeline No	Diameter MM	Length MM	Insulation thickness
1	Shell Top hemisphere - Gas phase From the top man way flange to the insulation ring at elevation EL24350 (For details refer drawings No 02-AS-05067 sheet 1 of 1 Rev 0)	Hemi- sphere from 2856 mm to 800 mm	3000 mm	5 Inch
2	Cylindrical shell portion and bottom hemisphere (For details refer drawings No 02-AS-05067 sheet 1 of 1 Rev 0)	2856 mm	27,000 mm	3 Inch
3	A-1 Man way top cover and top flange	1125 OD	300 mm	5 Inch
4	C1A - Carbamate inlet nozzle & pipe	8" NB	2000 mm	4 Inch
5	C1B - Carbamate inlet nozzle and pipe	8" NB	2000 mm	4 Inch
6	C2 - Gas outlet nozzle and pipe	4" NB	2000 mm	4 Inch
7	C3 - Ammonia inlet nozzle & pipe	3" NB	2000 mm	2 Inch
8	C4 - Urea / Carbamate solution outlet nozzle and pipe	8" NB	2000 mm	5 Inch

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9	C5 - Carbamate from HP Scrubber nozzle and pipe	4" NB	2000 mm	3 Inch
10	R2 - Level Indicator	500 OD	300 mm	5 Inch
11	R3- Level Float Connection	4" NB	400 mm	4 Inch
12	Upper trunnions - 2 Nos	300 OD	425 mm	5 Inch
13	Bottom trunnions - 2 Nos	300 OD	507 mm	3 Inch

Aluminium tie strips of 1" width were provided at every circumferential joint for further strengthening of aluminum sheet.

LOW PRESSURE (LP) VESSELS

All LP vessels were opened and offered for visual & NDT examination by Inspection section. The repair activities were performed based on already planned maintenance jobs and also as per observations made during visual & NDT inspection.

CO_2 SPRAY COOLER (H-1104)

The bottom portion of the vessel was found badly corroded during Annual Turnaround of F.Y. 2004-05 and 5 mm thick SS liner was provided during that period. After June-2004, some leakages were observed just above the top weld of these patches. Initially, Pipe box with valve were provided at two locations. But, afterwards these leakages became very frequent and therefore, a circumferential patch of approx. 12 Inch wide was welded all around the leaky shell. Furmaniting was also done to avoid any leakage during service. With this set up plant ran without trouble from August 2004 to May 2005.

In-situ replacement of leaky bottom shell was planned for the annual turnaround. For this, necessary rolling of 10 mm thick MS plates (Approx. 2000 Kg) was carried out before hand. This repair job was carried out by M/S. J& J Engineering, Shertha.

After opening the bottom side manhole, suitable scaffolding was erected from the base of the vessel. The Nylon Pall rings were completely removed, followed by the ring supporting trays. Exhaust fan arrangement was provided at the top end of the vessel. Visual inspection of the vessel indicated preferential corrosion on the Carbon steel shell. The metal was completely eaten away at dissimilar joints of SS and CS. Also, severe depression marks measuring approx. 5-6 mm deep and 20 – 25 mm dia were observed in the top zone. The areas having concentrated population of such depressions was provided 5 mm thick MS liner.

The badly corroded bottom portion was then removed by gas cutting / grinding into three pieces, alternately. Each corroded segment was replaced with a new segment and was tack welded before proceeding to the next one. In this fashion all pre-fabricated CS plates were put into position in three pieces(size: 1.5 mtr. Width x 10 mm thick), to suit the curvature of shell. CO_2 Inlet nozzle pipe was also found corroded and hence, replaced with a new one.

Demister pad was found intact in position. Wood & paint debris were found collected on the liquid distributor.

Epoxy paint was found peeled off at a few locations. All debris were cleaned. One coat of epoxy primer was applied in the top compartment.

The structural members of the permanent scaffolding around the vessel towards water seal pipe was replaced with new ones and protective epoxy painting was done.

The joint of seal pot pipe with the concrete tank was repaired by Civil section using Araldite compound.

CO_2 KNOCKOUT DRUM (V-1101)

Demister pad was found intact in position but at some locations it was found choked with yellow coloured debris.

At some locations the epoxy paint had peeled off and indicated blisters.

Brownish colour patches were observed at scattered locations on the shell surface.

The inside surface of the shell was thoroughly cleaned by power tool cleaning method and one coat of epoxy primer & two coats epoxy paint were applied.

AMMONIA SUCTION FILTER (V-1102)

The condition of the filter was found good. The same was boxed up after cleaning.

AMMONIA SUCTION VESSEL (V-1103)

The inside surface colour was brownish & black.

The condition of the welding joints was found satisfactory.

Oil layer was found in the bottom dished end. It was cleaned before box up.

RECTIFYING COLUMN (V-1202)

Opened top and side manhole and visual inspection carried out by inspection deptt . The bed limiter supports & mesh was found damaged. The damaged structural members were repaired and proper mesh fixing was carried out.

Production (Urea) removed all Pall rings and loaded the same after thorough cleaning & inspection.

After getting clearance from production department the vessel manhole and all connected pipe lines were boxed up using new gaskets.

LP ABSORBER (V-1203)

Top and side manholes were opened. The distributor plate was badly damaged due to explosion in the vessel. It was very difficult to repair or replace the distributor plate in-situ, due to smaller diameter of the vessel. Hence, it was decided to cut the vessel after providing side support at distributor area. The new spare distributor plate was fixed in the position. The cut portion was re-welded and the side manhole was boxed up after loading the rasching rings.

LP VENT SCRUBBER (V-1206)

The side manhole was opened for visual inspection.

Demister pads were found intact in position. All fasteners were found intact. grayish black coloration was observed inside the vessel.

Over all the condition was satisfactory

After getting clearance from production department the vessel side manhole and all pipelines were boxed up using new gaskets.

LP SCRUBBER (V-1207)

Top and side manholes were opened. The distributor plate was badly damaged due to explosion in the vessel. It was very difficult to repair or replace the distributor plate in-situ, due smaller diameter of the vessel. Hence, it was decided to cut vessel after providing side support from bottom at distributor area. The flow distributor plate was repaired and then fixed in position. The cut portion was re-welded and the side manhole was boxed up after loading the rasching rings.

Bottom supporting grill of pall ring bed found slightly bend on one side.

The pipeline from V-1203 to V-1207 was found cracked due to explosion and the same was replaced with new.

The top manhole was boxed up with new gasket, after getting clearance from Production.

SECOND DESORBER V-1301

Top and bottom manholes were opened for visual inspection.

Top portion:

Brownish coloration was observed inside the vessel.
All fasteners and tray were intact in position.
Top nozzle was found satisfactory.

Bottom portion:

Brownish coloration was observed inside the vessel. One clamp was found missing. New clamp provided.

Nozzle condition was satisfactory.

Top and bottom manholes boxed up after getting clearance from production.

HYDROLYSER (V–1351)

The top and bottom man holes were opened for inspection. The overall condition of the vessel was found to be satisfactory.

The steam tracing line at top dome area was suspected to have leakage. This line was blocked at topmost concrete floor of Hydrolyser section.

FIRST DESORBER (V-1352)

Top and bottom manholes were opened for visual inspection. The gasket area of the top cover was machined in workshop. The machined cover was boxed up with a new gasket.

Top portion:

Brownish coloration was observed inside the vessel

All fasteners were found intact.

Condition of welding joints was found satisfactory.

Bottom portion:

Brownish coloration was observed inside the vessel.

One bolt of the tray was found missing. New one was provided.

Overall condition of the vessel was satisfactory.

The top and bottom manholes were boxed up after getting clearance production.

FLASH TANK SCRUBBER (V-1421)

The side manhole was opened for the visual inspection.

Shell inside was found brownish in color.

Demister pads were found in intact condition.

Wire mesh of demister pads was found satisfactory.

Condition of all the welds joints was found satisfactory.

The side manhole was boxed up after getting clearance of production.

FIRST EVAPORATOR SCRUBBER (V-1423)

The manhole was opened for visual inspection.

Vessel inside coloration was found brownish.

Demister pads were lifted upwards by approx. 50mm at some locations.

The condition of wire mesh of the demister pads was found satisfactory.

Demister pads were found intact in position and the condition of the same was found satisfactory. 85

INTER STAGE SEPARATORS OF HITACHI COMPRESSOR K-1801

(**V-1811 / V-1812 / V-1813** - 1st, 2nd and 3rd stage separators)

Leaking bottom drain line (1" NB x Sch 40 SS-304L) of V-1811 was replaced.

Demister pads were found intact position.

Vortex breaker was found intact in position.

Coloration of shell had assumed shining.

Overall condition was found satisfactory.

Manholes boxed up after getting clearance from Production.

1ST STAGE EVAPORATOR HEATER / SEPARATOR (H-1422)

Visual inspection was carried out. Impingement cone to support welding found in broken condition. Repaired by welding.

The vessel manhole was boxed up after necessary repairs.

2nd STAGE EVAPORATOR HEATER (H-1424)

Visual inspection was carried out. Found satisfactory.

PRE-EVAPORATOR, HOT WATER PORT (V-1418)

Visual inspection was carried out. Found satisfactory.

SEPARATOR, PRE-EVAPORATOR (H-1418)

Visual inspection was carried out. Found satisfactory.

4 ATA STEAM DRUM (V-1501)

Both manholes were opened and thorough cleaning of the shell was carried out. No abnormal findings were recorded during visual inspection. NDT inspection of the shell was carried out.

Open inspection was offered to CIB on 04-06-2005.

Popping of both RVs of the drum was witnessed by CIB on 04-06-2005 at 7.12 Kg/cm^2 (g).

Hydro- test was witnessed by CIB on 07-06-2005 at 10.8 Kg/cm^2 (g).

23 ATA STEAM DRUM (V-1502)

Opened both manholes and visual inspection was carried out.

All fittings were found good condition.

Welded joints condition and over all condition were found satisfactory.

9 ATA STEAM DRUM (V-1503)

Opened side manhole and visual inspection was carried out Scattered scales were observed of dished end. All other internal fittings were found satisfactory. Overall conditions of the vessel were found satisfactory. Scales were removed and cleaning was carried out.

CLEANING AND HYDROJETTING OF HEAT EXCHANGERS:

Following heat exchanger were opened for cleaning by hydro jetting. After cleaning boxed up with new gaskets.

- Surface condenser (H-1815)
- Main lube oil coolers (H-1814-A/B)
- 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.
- LO Coolers of P-1102-A/C & LO.Coolers of P-1201-A/B/C
- CCS - II cooler (H-1207)
- Reflux condenser (H-1352)
- Pre-evaporator condenser (H-1419)
- H-1301 A/B/C Heat Exchangers (Tube side)
- H-1351 A/B/C Heat Exchangers (Tube side)
- H-1303 Effluent cooler.
- H1113 A/B Main lube oil cooler.
- H-1123 C.C. LUBE OIL COOLER.

PLATE TYPE HEAT EXCHANGER (H-1206) PLATE REPLACEMENT

The plate type heat exchanger was reported to have inefficient cooling and therefore, WO No : 9917342 dtd 13-05-2005 was placed on M/s Alfa Laval (I) Ltd, Vadodara,for carrying out cleaning, NDT inspection & regasketting of 185 Nos of channel plates, before shutdown.

Earlier, 113 No of available plates were sent and afterwards, balance 72 Nos removed from the exchanger (during shutdown) were sent at party's Thane works. 182 Nos of cleaned, inspected & regasketted channel plates were replaced in the PHE. The total width of the plates was kept 809.9 mm , using formula for AX-30 PHE

A = (G+T) N

Where A= Plate pack length , G=Gap between two plates , T= Thickness of plates

A= (3.85+0.6) X182

A=809.9 MM

Hydrotest of the cooler was carried out on both CW & condensate sides at 7 Kg/cm^2. The whole job was carried out under expert supervision of M/s Alfa Laval Engineer.

The PHE CW lines were provided with 2" size tapping for carrying out in-situ cleaning of the plates using Sulphamic acid. This process has been suggested by M/s Alpha Laval for cleaning of the plates during short shutdown of the plant. Necessary equipment for cleaning has been developed in-house.

HEAT EXCHANGER TUBE BUNDLE PULL-OUT:

Following Heat Exchanger's Tube Bundles were Pulled out.

(1) H-1209 (2) H-1351/B

Tube bundles and shell were cleaned thoroughly by hydrojetting.

RELIEF VALVE OVERHAULING AND TESTING:

Following RV's were removed, overhauled and tested on valve test bench by M/S.Dembla Valves Pvt. Ltd. Mumbai vide W.O.No.9917161 dated 25/04/2005.

Sr. No.	RV No	Location	Set Pressure Kg/cm^2	Reset Pressure Kg/cm^2
1	RV-1202-A	V-1202 Off gas line	6	5.4
2	RV-1202-B	- do -	6	5.4
3	RV-1202-C	- do -	6	5.4
4	RV-1916	23 Ata Exhaust	28	26
5	RV-1301	V-1301 Exhaust	6	5.4
6	RV-1129-A	4 Ata steam header	6	5.4
7	RV-1129	- do -	6	5.4
8	RV1130	23 Ata steam header	26	22
9	RV-1504	V-1503 9 Ata steam drum	12	11
10	RV-1901	First stage discharge of Hitachi compressor	8	7.2
11	RV-1902	2ND Stage discharge of Hitachi compressor	28	25.2
13	RV-1204	P-1201-B suction	8.5	7.5
14	RV-1102	Ammonia suction vessel	31	28
15	RV-1203	P-1201-A suction	8.5	7.5
16	RV-1351	MP steam inlet to V-1351	24	22
17	RV-1503	23Ata steam drum (V-1502)	24	22.5
18	PSV-1201-C	P-1201-C suction	8.5	7.5
19	RV-1209	V-1203 vapour inlet	10	8.1
20	RV-1205	P-1201-A discharge	172	154.8
21	RV-1181	Final discharge of Hitachi compressor K-1801	177	159
22	RV-1206	P-1201-B discharge	172	154
23	RV-1130	24 Ata steam exhaust of Q-1101-2	26	22
24	RV-1205	P-1201 C	172	154.8
25	RV-1206	P-1201 B	172	154.8
26	RV-1201-A	V-1201 off gas line	165	148.0

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27	RV-1201-B	V-1201 off gas line	165	148.0
28	RV-1201-C	V-1201 off gas line	165	148.0
29	RV-1101 A	Liquid ammonia Line	31	28
30	RV-1101 B	Liquid ammonia Line from Lt. 1102 to V-1102	31	27
31	RV-1102/1	Ammonia suction V-1103	31	28
32	RV-1102/2	Ammonia suction V-1103	31	28
33	RV-1102 B	Ammonia suction V-1103	31	28
34	RV-1108	Liquid Ammonia line from Ammonia storage tank to H-1102	31	28
35	RV-1106-1	Liquid Ammonia line from Ammonia plant to Ammonia filter	31	28
36	RV-1106-2	- do -	31	28
37	RV-1107-1	Liquid Ammonia (Hot) before Ammonia filter	31	28
38	RV-1107-2	- do -	31	28
39	RV-1110-A	Liquid Ammonia line from Ammonia storage tank to H-1102	31	28
40	RV-1110-B	- do -	31	28
41	RV-1112	HP Ammonia P-1102-A discharge line	150	135
42	RV-1112	HP Ammonia P-1102-B discharge line	150	135
43	RV-1112	HP Ammonia P-1102-C discharge line	150	135
44	RV-1184	H-1102 NH-3 Outlet CCS-1	6	6.4
45	RV-1910	H-1811 L.O. P1814	6	5.4
46	RV-1123	K-1101-2 First stage for cooler	34.5	31.5
47	RV-1124	K-1101-2 Second stage for cooler	73.5	66
48	RV-1127	K-1101-2 Third stage for cooler	159.5	146
49	RV-1224	CW from Utility	6	5.4
50	RV-1224	CW from utilities	6	5.4
51	RV-1904	H-1811	8.0	7.2

52	RV-1905	H-1812	8.0	7.2
53	RV-1906	H-1813	8.0	6.5
54	RV-1181	Hitachi compr. IV Stage Discharge	177	159
55	RV-1573	Discharge of P-1502 FINAL	180	162
56	RV-1501	Steam Drum 8"x10"	7.5	6.8
57	RV-1502	Steam Drum 8"x10"	7.5	6.8
58	RV-1916	23 Ata exhaust	24	22.5
59	RV-1504	9 Ata drum	12	11
60	RV-1301	V-1301 Off gas	6.0	5.4
61	RV 1917	4-Ata exhaust	4.0	3.6

INSPECTION OF TANKS

AMMONIA WATER TANK (T-1301 & T-1301-A)

The tank manholes were opened for visual inspection. The overall condition of all the welding joints, shell surface and nozzles was found satisfactory.

Necessary fabrication work was carried out for providing a Level measurement instrument in T-1301A.

Manholes of both the tanks were boxed up with new gaskets after getting clearance fro production (urea).

UNDER GROUND WASTE WATER TANK (T-1302)

The top manhole was opened. Production department carried out cleaning of the tank from inside. The manhole was boxed up with new gasket after getting clearance from production department.

UREA SOLUTION TANK (T-1401 / T-1401-A)

The tank manholes were opened for visual inspection. The overall condition of all the welding joints, shell surface and nozzles was found satisfactory. Manholes were boxed up with new gaskets after getting clearance production.

STEAM CONDENSATE TANK (T-1501)

The tank manholes were opened for visual inspection. As per inspection report the condition of shell, welding joints and nozzles was found satisfactory. The manhole was boxed up with new gasket.

PRILL TOWER ID FANS (K-1401 / 1, 2, 3 & 4)

The scaffolding was provided in the fan cell. All blade locking bolts were loosened and blade angle was set at 10^0 with the help of protractor spirit level. The bladed were tightened.

Both the fan bearings were opened and inspected. Found OK. Fresh grease provided and boxed.

Alignment of fan motor w.r.t. fan was carried out and the V belts were fully tensioned.

Scaffolding was removed.

All internal and external surfaces were cleaned by power tool and painting was carried with 1 coat of epoxy primer and 2 coats of epoxy paint.

PRILL COOLING SYSTEM

SILO REPLACEMENT:

All three silos were badly corroded due to urea dust atmosphere and by loosened inside UHMW polymer liner. All three silos were replaced with new one. The job of manufacturing, supply, pre-fabrication, Polymer UHMW lining, related structural work and commissioning at site was carried out by M/s E & C Projects Pvt Ltd, Ghaziabad vide W.O.No. 13/00596/KLL/9915577 dated 14.07.04. The silos were manufactured as per the following IFFCO drawings :

- P2-BS –17024 Sheet 1/1 Rev. 0 (Urea Silo V-1703 /1&2) : Qty : 2 Nos.
- P2-BS –17025 Sheet 1/1 Rev. 0 (Urea Silo V-1703 /3) : Qty : 1 Nos.
- P2-ES –17026 Sheet 1/1 Rev. 0 (polymer lining details).

INLET AIR FAN (K-1701) & EXHAUST AIR FAN (K-1702)

The following preventive maintenance jobs were carried out.

- Both bearing were opened, Cleaned and checked. Found in good condition and hence boxed up.
- Fresh lube oil charged.
- Damper made operational and provided fresh grease.
- Rotor and casing of fan were cleaned.
- V belts replaced with new ones and aligned with motor.
- Alignment of fan belt checked and corrected.
- Painting of external surfaces of casing carried out.

FLUIDIZED BED COOLER (H-1701)

Fluidized bed cooler, Silos and cyclone separators were opened for inspection. After inspection and cleaning the same were boxed up.

CONVEYOR SYSTEM

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UREA PRODUCT CONVEYOR (M-1403)

- Belt was replaced by new one made of 4 ply Nylon, Grade **HR–T1** 800 mm width.
- Gear box checked & found OK.
- Flushed gear box oil.
- Skirt rubber replaced wherever found damaged.
- Aligned motor with gear box and after checking direction coupled with gear box by new bushes

LINK CONVEYOR (M-1419)

- Belt was replaced by new one made of 4 ply Nylon,Grade **HR–T1 &** 800 mm width.
- Checked gear box found OK.
- Flushed gear box oil.
- Skirt rubber replaced wherever found damaged.
- Aligned motor with gear box and after checking direction coupled with gear box by new bushes

PRILL COOLING LINK CONVEYOR (M-1421)

- Belt was replaced by new one made of 4 ply Nylon, Grade **HR–T1 &** width 800 MM
- Replaced bearings of head pulley (NTN – 75mm dia).
- The base plate of the gear box was modified to make equal level of motor and gear box.
- Aligned motor (reconditioned) with gear box. New bushes provided in the coupling.
- Provided new sprocket and aligned.

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

Following preventive maintenance jobs were carried out.

- Bucket change over mechanism was cleaned.
- As required by Production, the direction of locking plate was modified to have complete rotation of the unit.
- Pulley of the mechanism checked and found OK.
- Greasing of the bearings and chain was carried out.
- V Belts were replaced and alignment was carried out.

SCRAPPER (M-1402 -1/2):

Following preventive maintenance jobs were carried out.

- Scraper arms were inspected for tightness of nuts.
- Checked scraper floor slit plates
- Cleaned scraper surface by power tool and applied one coat of epoxy primer and two coats of epoxy paint.
- Covered the scraper surface with aluminum sheets to prevent corrosion.
- Fluid Couplings of scrapper arm was checked and found OK.
- Fluid coupling oil flushed.
- Checked condition of V belts (B 69- 4no.) and tightened the belts.

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- V- belts of M-1402/1 replaced with new ones.
- Alignment checked and tightened belts.
- Checked oil level of gear box and topped up.

INSPECTION OF CHECK VALVES (NRV)

Following non-return valve (check valves) were checked and overhauled.

- CO2 to H-1201
- NH3 to H-1202
- NH3 to V-1201
- Carbamate to H-1202
- Carbamate to H-1203
- CO2 to H-1203
- 4ATA steam to V-1352
- 23ATA steam to V-1351
- 4ATA steam to V-1301
- Condensate to Melt Return line.
- P-1201 A/B steam injection to discharge Relief valve.
- 9ATA steam injection to off gas line of V-1203/V-1207
- 9ATA steam injection to off gas line of V-1205
- NH3 water to V-1352
- P-1204 A/B discharge Non-return valve.
- P-1501/6 discharge Non-return valve.
- P-1351 A/B discharge line.

Note:-
H-1201 modified sample point BEL valve body was badly corroded. The same was replaced with new one (Size: ½").

PROCESS JOBS

COMPRESSOR FLOOR

Sr. No	DESCRIPTION
1	Q-1801: Turbine casing drain valves all flanges gasket replaced.(ejector Floor)
2	P-1815 A/B suction line flange gaskets replaced.
3	Q-1801: Turbine casing drain valves glands were replaced.(eject. Floor)
4	Q-1814: 23 ata steam inlet bvpass of first I/v g/l. repacked
5	Q-1801: 23 ATA extraction L.P.valve gland repacked
6	Q-1101-1: 60 ata flow orifice flange gasket replaced.
7	Q-1101-2: 60 ata steam inlet first i/v was attended for passing
8	60 ata header vent i/v was re[placed
9	K-1801 G/B high speed shaft bearing oil leakage was tried to arrest by providing OKS compound but still oil speage.

SYNTHESIS PROCESS JOBS

Sr. No	DESCRIPTION
1	V-1201: Sample point both i/v were replaced
2	NH3 suction vessel vent first i/v was replaced
3	NH3 suction vessel vent line height was increased (app.1 foot) Due to fouling over head.
4	H-1201: new sample point both i/v were replaced.
5	H-1203: I st drain i/v was replaced .
6	P-1201 C: Suction i/v was replaced by overhauled
7	H-1207 (CCS_II cooler): Plug on c.w O/L line was removed & drain/ vent line was provided (for vapour removal)
8	P-1211A/B dis.line rotameter d/s i/v made operatable .
9	P-1211A suc.i/v made opera table.
10	P-1211A dis.i/v made operatable
11	H-1205/ H-1102 Hydrotest was carried to check leakage.
12	P-1202 B : mechanical seal & oil seal leak was atteded
13	P-1302D : broken bush of was replaced recycle line i/v.
14	V-1201 drain line first i/v was replaced (third floor)
15	Carbamate/water ratio meter line final drain i/v was replaced (on V-1200 top)
16	Direct NH3/H2O to H-1205 i/v made operatable.
17	CO2 to H-1203 FI-1202 u/s i/v and d/s i/v and its bypass i/v made operatable.

EVAPORATION AND PRILLING AND PCS SECTION PROCESS JOB

SR NO	DESCRIPTION
18	H-1419 C.W.outlet First i/v and second i/v indicator showing wrong.
19	V-14 09B-UREA sol. Filter suction i/v bonnet leak.
20	H- 1419 off gas line To H-1423 line is tobe lifted by 1 foot due to fouling O/Head.
21	Prill bucket (both) coupler to be repair for its threds and coupler is deformed.
22	NH3 plant NH3/H2O to v-1418 S.S.line to be provided with both side drain i/vs and pressure gauge.
23	Bucket rotary mechanism to be attended for safe direction.
24	V-1418 liquid o/l line both flanges are leaks on T-1401.(both flanges gaskets are to be replaced)
25	V-1418 off gas line is to be opened for inspection (PRCV-1481 u/s and d/s line).
26	V-1418 off gas line to H-1419 spool piece is to be removed for amm/water inlet nozzel inspection.

27	V-1418 liquid o/l to T-1401 small spool piece between two flanges on T-1401 is to be remove for inspection & repair.(suspected leakage.)
28	C.W. To H-1425 pressure guage i/v to be provided.
29	H-1425 C.W. O/l vent i/v hard to operate.
30	H-1423 C.W. O/L vent i/v both hard to operate and line to be relocated.
31	V-1421 Pinhole leak at support side nr.Booster ejector (last s/d attended -bolt provided
32	bucket inlet melt line and spool piece allignment to be checked, P-1408 dis. Line clamp broken and line comedoun to 6 inch.
33	H-1425//H-1426 Berometric leg drain i/vs hard to operate.
34	To provide common i/v on conde. Line to V-1418 offgas flushing (nr. pre-evapo.top).
35	H-1420 Berometric leg drain to be provided for flushing purpose (on plug point).
36	H-1419 Berometric leg drain point with i/v and cond. Flushing to be provided for remove chocking (on bottom of H-1419).
37	P-1701A/B to be replaced for high capacity
38	K-1701/K-1702 dampner operating device stem thereds to be checked / serviced
39	Dust belt conveyor roller to be provided.
40	P-1701A/B recycle line to be relocated for chocking problem.
41	Dust dissolving hopper size to be increased.
42	H-1423 berometric leg drain i/v replace as its spindle bend and its d/s line extend up to floor level for flushing conveincy.
43	H-1421 berometric leg drain i/v hard to operate and its d/s line extend up to floor level for flushing conveincy.
44	V-1409A discharge open drain i/v wheel free to be attended.
45	P-1102 /A Suction open drain I/V Wheel Free

HYDOLYSER JOB

46	LIC-1353 u/s I/V g/l. repacked
47	NH3/H2O to V-1352 NRV gasket replaced).

STEAM / CONDENSATE JOB LIST

GROUND FLOOR & HYDROLYSER :

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SR NO	DESCRIPTION
1	LRCV-1201 d/s tracing line portion replaced.
2	P-1505A suction drain first i/v replaced.
3	V-1351 top steam tracing / steam injection both lines are to be separated. (23-ata steam-HYDROLYSER)
4	MICV-1351 u/s of third bend,pin hole leak is to be attended nearH-1351 A/B/C (M-seal is provided)-job over
5	V-1409 A Steam tracing main i/v G/L upper side.
6	P-1408 suction line steam jacket flange leak & pin hole leak (above 23 ata-drum).
7	DMW service station Ist I/V is passing & IInd valve is hardto operate. (Near P-1201-C)
8	23 ata steam tracing at V-1351 top to be attended for leak.
9	Nr. V-1353 top floor service station i/v wheel missing and hard to operate.
10	Dust Dissolving Hopper o/l line cond.flushing point to be provided.
11	P.C.S. All floor air/cond./steam/raw water service station i/vs hard to operate and Wheel missing. (tag provide in ground floor).
12	Hydroliser top tracing cond. O/l trap and its bypass i/v is to be replaced by new one (not operatable-02 bush broken).
13	Cond. Flushing to PICV-1353 u/s i/v is passing.

FIRST FLOOR

14	V-1202 bottom steam tracing line pinhole leak (two points).
15	V-1201 liq -□ H-1201 steam tracing trap o/l pin hole leak and d/s header is to be Replaced.
16	H-1201 B/D is to be attended for leakage.
17	H-1201 B/D tail pipe is to be inclined 70 degree upwards.(stamicarbon suggestion).
18	C/Room side steam and cond. Service station i/vs hard to operate.
19	P.Tower side steam/cond./air/raw water service station i/vs hard to operate.

SECOND FLOOR

20	H-1422 steam tracing i/vs are to be attended for G/L. (2nd & 3 rd & 5 th from top)
21	CCS-II 9ata jacket drain pipe is to be rerouted towards pillar side as it is fouling with H-1207 o/l bpv.
22	H-1207 C/W out let line plug is to be removed and drain line with i/v is to be provided.
23	H-1422 Steam tracing I/V are to be attended for G/L. (H-1422 bottom --last time fermanite done).
24	V-1418 Steam tracing I/V are to be attended for G/L. (H-1418 bottom)
25	H-1424 Condensate pot vent I/V gland is to be repack.
26	H-1424 Condensate pot O/L to H-1424 & to T-1501 both I/V's gland is to be repack.
27	FI-1502 23 ATA to 9 ATA steam line orifice L.P tapping plug is to be attended for heavy leakage.
28	P.Tower side cond. And steam service station i/v hard to operate.
29	Steam tracing line i/v wheel missing nr.FRCV-1421.
30	V-1418 dom cond. Flushing 1st i/v is passing nr.PRCV-1481.
31	H-1424 offgas line steam tracing d/s line is to be connected to trap header.
32	H-1422 top side steam tracing coil pinhole leak nr. V-1202 side.
33	H-1422 top side steam tracing flange leak and pinhole leak at c/r side.
34	H-1424 off gas line steam tracing trap d/s line is to be connected to trap header.
35	Cond. Flushing to v-1418/H-1419 common header line i/v to be provided
36	Conde. To H-1424 dom side i/v hard to operate.
37	Between 2rd to 3.5th floor melt line jacket pinhole leak (two pts).
38	4 ata steam tracing line pressure guage i/v not operated(fermanite done) nr.lift door-bush broken.
39	H-1425 gas o/l line conde. Flushing i/v not operated.
40	9 ata to H-1424 local pressure guage i/v hard to operate.
41	V-1418 top side steam tracing lines and cond.line to be rerouted nr. H-1418 side.
42	H-1418A shell side vent (both two point) to be rerouted nr. H-1419.
43	**H-1424 top side steam tracing lines to be rerouted in safe location.**
44	Flash tank ejector to be opened for inspection.(poor efficiency)
45	9ata to ccs-2 jacket i/v g/l at 9 ata drum top.
46	9 ata drum local pressure guage i/v g/l and its line plug leak at 9 ata drum top.

FICV-1204 FLOOR

47	Cond. Flushing to H-1424 offgases line first i/v wheel broken and hard to operate and second flushing first i/v hard to operate (small i/v).
48	TO attend bracket support of steam risers line from H-1202 to V-1501. (NO TAG).
49	Nr. V-1421 steam and air line to be relocated for easy walking.(unsafe-Condition).
50	H-1202 gas Inlet line tracing I/V G/L (On H P condenser top)
51	H-1202 top steam tracing line i/vs (three nos.) G/l.
52	H-1202 top shell side sample point first i/v is not operatable.

H-1203 BOTTOM AREA.

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54	H-1203 bottom side BFW service station I/V is passing & hard to evaporate.

P.T. TOP /PRCV-1201 & PICV-1202 AREA

55	Nr.H-1203 middle area BFW service station i/v to be relocated for easy operation and this valve is hard to operate at p.t.top.
56	H-1203 Top area steam traps header corroded line is to be replaced and trap header is to be connected to trap header.
57	9 ata stem to RV-1201 A/B/C injection line at P.T. top, trap is to be provided near stair case to drain out condensate of vertical line.
58	4 ata steam tracing line to P.T top trap is to be provided near stair case to drain out cond.
59	9 Ata steam to pr-1421 jacket first i/v not operatble (bush free) (3rd floor).
60	4 ata steam to v-1421 bottom sensing line flushing first i/v g/l (3.5 floor).
61	Steam cond. Trap o/L line of (4 ata steam to 2nd stage ejector pot) to be rerouted towards bottom side (3rd floor , nr.H-1425).

HPF JOB

62	HPF to NH3 to V-1201 first and second i/v is passing.
63	H-1203 Un-loading line i/v is passing.
64	Old HPF pump (P-1502) First dis. I/v hard to operate and its open/close indicator not showing.

SR. NO.	MODIFICATIONS CARRIED OUT	REMARKS
1	L.P.Steam line (4-Ata) and control valve (TICV-1201) for recirulation heater (H-1204) size has been increased from 8" to 10" as per IFFCO Isometric Drawing no. 02-CL-13443 Sht. 1/1 Rev. 0 .The size and rating of Pipe : 250 NB x Sch. 30 (M.O.C. 106 Gr. B)	ERW Scheme no. TM/02/1309
2	Re-routing of the urea solution filter (V-1409) liquid outlet line was carried out as per IFFCO Isometric drawing no. 01-DL-13439 Sht. 1/1 Rev.0. Also Control valve (FRCV-1421) was replaced with bigger size	ERW Scheme no. TM/02/1307
3	Low DP flow orifice for LP steam flow indicator (FR-1504) was provided.	

FABRICATION JOBS

Following major fabrication jobs were carried out Departmently

- Replacement of Header Flanges RV –1201 A/B/C

  All three RV header flange RTJ grooves were damaged and hence all these flanges were replaced by new one (Size : 3" x 1500 # WNRTJ , M.O.C. SS 316 L). All three RVs were at the same level and this hampered bolt tightening in case of emergency. Therefore, height of the middle RV inlet flange was raised by 8". DP & radiography of the root & final pass welding was carried out and was found O.K.

- New "Tyco" make RV bearing following specification was installed in the final discharge (RV-1205C) of Peroni make HP Carbamate Pump P-1201 C.

  Inlet Size & Rating : 1-1/2" G3 x 1500# RTJ
  Outlet size & Rating : 3" x 300RF
  Model No : JLT-JBS-E-65-J-SPL

- 2 No Elbows in the off gas line of HP Scrubber (3" NB x Sch 160) were replaced in view of thickness reduction. Radiography of the root & final pass welding was carried out and found O.K
- Steam jacketed pipe of urea melt pump (P-1408) discharge line at floor No. 2 & 3 was having leakage. Therefore, it was replaced with a prefabricated pipe of same dimensions kept ready beforehand.
- Two nos. Globe valve 1" x 150 # of NC ratio meter line were replaced by new ones.
- 4 nos. of flanged Gate valve, size 4" x150 #, MOC- SS316L were replaced in P-1401 A/B discharge line , P-1201 Suction line and V-1409 A/B inlet & outlet line.
- BEL valve body replacement :-

  HP Scrubber drain valve 1-1/2" NB BEL.
  Autoclave first isolation seal valve 2" NB BEL.
  Rectifying column sample point
  Ammonia to HPF 1st isolation valve of V-1201

Fabrication job carried out through Contractor (M/S. J&J Engineers, Shertha)

- **Replacement of the old corroded structures at Scrubber (H-1203) area**

  The platform on top of HP Scrubber towards Ammonia plant was badly corroded. The replacement job was planned and necessary structural steel was procured departmentally. The job contract was awarded to M/s J&J Engineer vide WO No. 9917126 dated 24/03/2005.

  Safe scaffolding was erected below the old platform towards Ammonia plant side. All corroded M.S. structural members like plates, angles, channels, beams and gratings of the scrubber platform were carefully cut & removed. New MS structural members were welded in position. The total quantity of job was approx. 4.0 tons.

INSTALLATION OF NEW SURFACE CONDENSATE PUMP (P-1815 B)

As an energy saving measure, a new low capacity, low head surface condensate pump was installed in place of existing "SULZER" make pump (P-1815 B). The new pump was supplied by M/S. Microfinish (B.D.K.) pumps Pvt. Ltd., Vadodara, vide P.O. No. 61/00982/9914957 dated 13.03.2004.

Only one pump was proposed for replacement on trial basis. Further, action on replacement of P-1815 A will be taken after verifying energy saving achieved and operating experience of the pump.

The brief details of the new pump are as below :-

Pump Model : 3 x 1-1/2 -13 , 2K
Type : Semi Open
Speed : 2900 RPM

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The typical comparative data of the actual operating conditions for the original Vs. new surface condensate pump are given below.

Sr. No.	Parameters	Unit	Actual operating data of the original SULZER pump (55 HP motor)	Actual operating data of the new MICROFINISH pump (30 HP motor)
1	Pump discharge pressure	kg/cm2g	12.5	8
2	Pressure d/s level control valve	kg/cm2g	4.5	4.5
3	Level control valve opening	%	15	50
4	Surface condensate flow	m3/h	27	33
5	Absorbed power	kW	38	21
6	**Power saving**	**kWh/h**	**17**	
7	**Annual monetary saving**	**Rs. lakhs**	**7.3**	

Following benefits were reported :

- About **17 kW** power has been saved with installation of smaller capacity and low head surface condensate pump.
- Annual monetary saving works out to Rs. **7.3** lakhs.
- The cost incurred for new pump installation is about Rs. **1.5** lakhs.

COOLING WATER PUMP (P-4401/A) & DRIVE TURBINE Q-4411 (Elliott) :

Both the journal Bearings were checked and found okay.

The clearances were checked & following are the readings:

Sr. No.	Description	Design Value	Actual Value (AM)
1	Total Float of the pump	10 mm	8 mm
2	Radial bearing Clearance coupling end	0.20 mm	0.19- 0.21 mm
3	Radial bearing Clearance free end	0.20 mm	0.18 – 0.20 mm

Total Axial Float of the pump is 8 mm.

Coupling of pump with gear box was cleaned, checked and found O.K. Greased and boxed –up.

Elliott Turbine Preventive Maintenance:

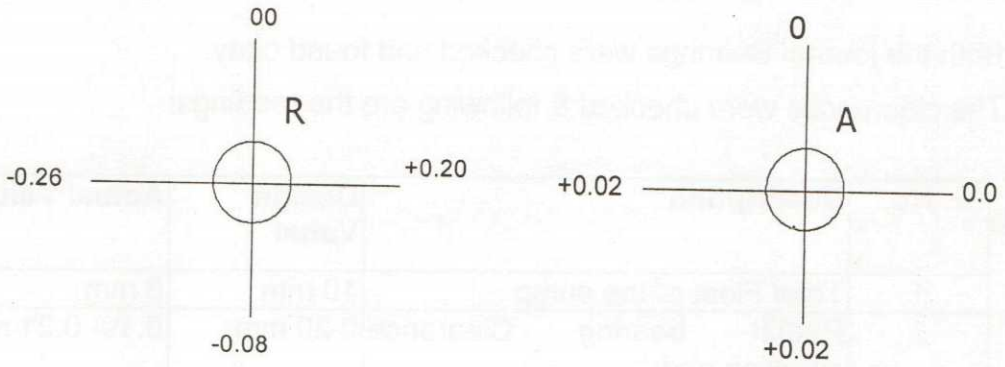
Both the journal Bearings and thrust bearing were DP checked and found okay.

The clearances were checked & following are the readings:

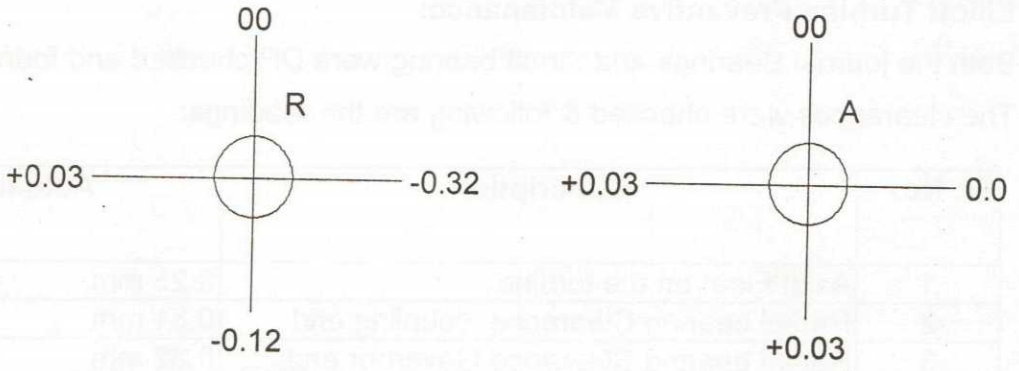
Sr. No.	Description	Actual Value
1	Axial Float on the turbine	0.25 mm
2	Radial bearing Clearance coupling end	0.31 mm
3	Radial bearing Clearance Governor end	0.32 mm
4	Gearwheel front bearing clearance	0.20 – 0.21 mm
5	Gear Wheel rear bearing clearance	0.22 -0.23 mm
6	Pinion gear front bearing clearance	0.30 – 0.31 mm
7	Pinion gear rear bearing clearance	0.30 – 0.32 mm
8	Gear wheel thrust float	0.52 mm

- Oil Cooler tubes were cleaning by Hydro jetting.
- Fresh oil was charged in Governor oil (Servo 32).
- Oil console was drained, cleaned and fresh oil charged.
- Gear box gaskets were replaced.
- Main oil pump and Auxiliary oil pump suction strainer were cleaned & boxed up.
- Gear box to Turbine alignment was checked.

Alignment readings between Gear Box & Cooling Water Pump 102



Turbine to Gear box Alignment readings:

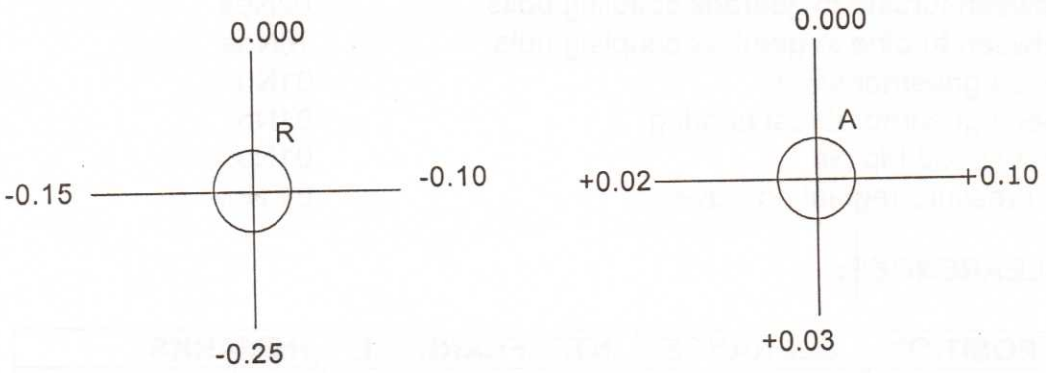


COOLING WATER PUMP (P-4402) :

PREVENTIVE MAINTENANCE OF UREA COOLING WATER PUMP:

- 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 : 0.24 mm Coupling side : 0.18 mm
- Motor was decoupled, coupling checked, new grease filled.
- Both the bearing housing were flushed with oil & fresh oil servo Prime 68 charged.
- The Motor was replaced by Electrical section.
- Radiator cooling water line opened and box-up after cleaning of radiator.
- Coupling oil paper replaced and new grease filled.

Pump with Motor alignment was carried out and following are the readings:



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

The Turbine was taken for complete overhauling. The services of M/s Turbo Engineering Services, Hyderabad was taken for overhauling of turbine and preventive maintenance of pump. The following are the observations and action taken.

- Speed governor, main steam valve hydraulic and steam side, over speed trip governor, low lube oil trip governor were observed in seized condition. The same was overhauled and assembled back.
- Speed governor thrust bearing was in damaged condition, the same was replaced with spare one.
- Rotor run outs were found as 0.35mm on support end bush and 0.08mm on support end shaft.
- Oil seal clearances were at higher side.
- Between turbine and gearbox 2Nos of coupling bolts were damaged. 2nos of coupling bots were replaced and all coupling nuts were replaced with spare one.
- Scoring marks were found on higher side. The same was polished.
- Journal bearing clearances were at higher side. Rear journal bearing was replaced with spare one and front journal bearing old bearing polished and assembled back.
- Speed governor warm wheel was worn-out condition. The same was replaced.
- Lube oil pressure regulating valve was in seized condition. The same was replaced with spare one.
- Over speed trip pin was in rubbed condition. The same was replaced with spare one.
- Two no casing studs were seized in the bottom casing. These were removed by in-situ drilling & tapping.
- After first steam charge, heavy leakage was observed at casing parting plane near carbon seal area. The upper casing was then lapped on Cast iron lapping plate for one day and blue match mark was checked.
- Heavy vibrations to the tune of 21 velocity @ 3700 RPM was observed in the turbine on start-up. To reduce the vibrations, suction line spring supports were checked and found that springs are deformed. Two number new spring supports were replaced & adjusted and vibrations level were reduced.
- Pump bearing clearance were found normal.

SPARES CONSUMED DURING THE OVERHAULING.

- Rear journal bearing 01No
- Front and rear carbon seals 02sets
- Between turbine to gearbox coupling bolts 02Nos
- Between turbine to gearbox coupling nuts 16Nos
- Speed governor shaft 01No
- Speed governor thrust bearing 01No
- Over speed trip pin 01No.
- Oil pressure regulating valve. 01 No.

BEARING CLEARENCES:

SR.NO	POSITION	CLERANCE	INTERFEARENCE	REMARKS
1.	Front	0.20	+0.01	same bearing re used.
2.	Rear	0.12 TO 0.15	+0.02	replaced with spare

Worm gear extension shaft bearing clearance: 0.08 mm by lift.

Rotor thrust float: 0.35mm

Trip lever clearance: 1.60mm (over speed tripping has not done during the commissioning)

Carbon seal clearances:

s.no	Clearance
1.	0.30
2.	0.30
3.	0.28
4.	0.28
5.	0.28
6.	0.28
7.	0.28
8.	0.30
9.	0.30
10.	0.30
11.	0.30
12.	0.30
13.	0.30
14.	0.30

ROTOR REFERENCE DIMENSION:

1. Nozzle segment to C1 2.45mm
2. C1 to turning segment 2.80mm
3. Turning segment to C2 2.50mm

Note while taking of rotor reference dimension rotor was kept in center position.

COOLING WATER PUMP (P-4401 / C) :

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- The Journal bearing clearance checked. Clearance at both end side : 0.22 mm.
- The rotor float was measured as 0.90 mm.
- Cleaned & greasing done after coupling.

COOLING WATER PUMP (P-4401 / D) :

- The Journal bearing clearance checked. Clearance at both end side : 0.21 mm.
- The rotor float was measured as 0.90 mm.
- Cleaned & greasing done after coupling.

COOLING WATER PUMP (P-4404-E) :

PREVENTIVE MAINTENANCE:

- Coupling float was checked after de-coupling and observed : 0.14 mm
- Both bearing top half opened. Both side thrust bearing checked , found in healthy condition.
- Bearing housing cleaned and fresh oil (Servo Prime 68) charged.
- N.R.V. was opened and & pivot pin repaired & Flap centering was done and re-assembled.

Major Overhauling of B F W PUMP TURBINE Q - 5111 :

The Shin Nippon Turbine was taken for complete overhauling due to steam leakage from Carbon Packing rings.

- Removal of coupling spacer - Match marks was checked.
- Alignment & axial play of pump shaft was checked.
- Removal of DE & NDE bearings top halves.
- The Turbine casing was lifted and then rotor was removed.
- Scoring marks was found on turbine journal. The same was polished.
- The following spares were consumed during overhauling of turbine.

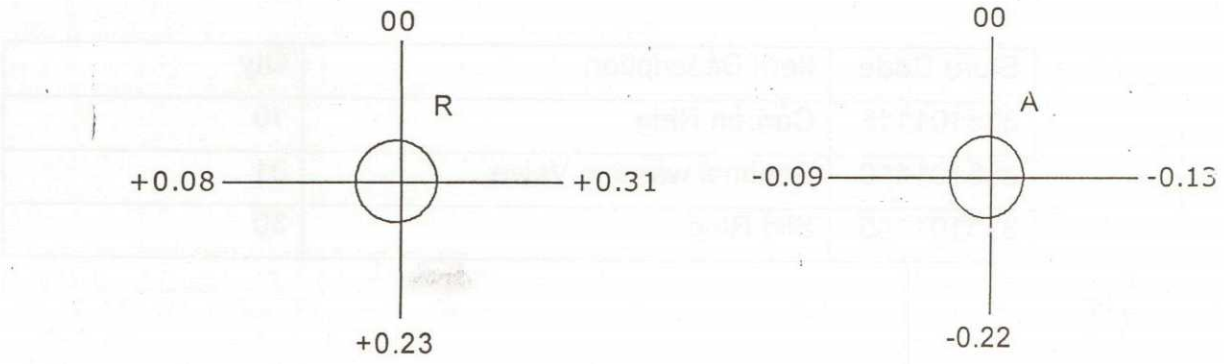
Store Code	Item Description	Qty
335101118	Carbon Ring	10
335101410	Sentinal warning Valve	01
335101185	Slid Ring	30

The carbon ring set was replaced. The following are carbon ring clearances:- 106

Carbon Ring Sr. No from Thrust end	Clearance (MM)
1	0.22
2	0.22
3	0.20
4	0.20
5	0.18
6	0.20
7	0.20
8	0.20
9	0.25
10	0.25

- Cleaning of Radial & Thrust bearings.
- Checking radial clearances of bearings using lead wire.
- Alignment readings were checked and found that alignment is disturbed.
- During re-alignment of turbine, one foundation bolt (governor end side) of turbine was found broken inside casing leg. The bolt was removed by welding of metal piece.
- Same bearings were assembled after polishing and cleaning.
- Install coupling spacer with reference to match marks.
- The oil cooler covers were opened and hydro- jetting was carried out.
- Cleaning / replacing oil filters and oil in the oil console.
- Checking oil line, water line for leaks.
- Suction filter of the MOP was cleaned.

Alignment Readings: Pump To Turbine (Before Preventive maintenance) Clamp on Pump & Dial on Turbine



After Preventive maintenance

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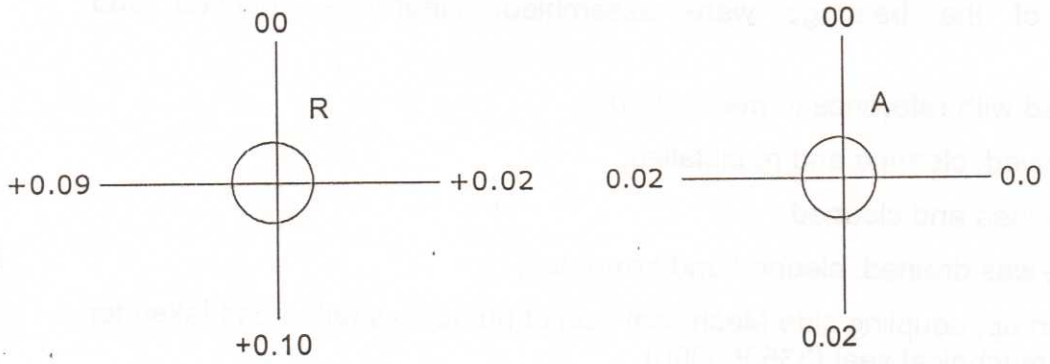


Clearance Details :

Sr. No.	Description	Design Value	Actual Value(AM)
1	Axial Thrust	0.28 - 0.33	0.25 mm
2	Radial bearing Clearance coupling end	0.13 - 0.18	0.12 to 0.15 mm
3	Radial bearing Clearance free end	0.13 - 0.18	0.17 to 0.20 mm
4	Oil Laby clearance CE		0.15 to 0.20 mm
5	Oil Laby clearance TE		015 to 0.20 mm
6	Nozzle block to curties stage 1		1.55 mm
7	Trip lever radial clearance		2.60 mm

B F W PUMP P-5111 :

- Preventive maintenance was carried out on Pump.
- Bearing top halves were removed.
- Coupling end and free end bearing clearances were measured using lead wire and reading are as under:-

Sr. No.	Description	Actual Value(AM)
1	Axial Thrust	0.18 mm
2	Coupling end Bearing Clearance	0.13 mm
3	FE Bearing Clearance	0.12 mm

- Bearing pads were cleaned and polished using green rouge.
- Bottom halves of the bearings were assembled, clearance checked and recorded.
- Coupling is aligned with reference to match mark.
- Oil filter was removed, cleaned and re installed.
- Oil cooler was opened and cleaned.
- Oil in the console was drained, cleaned and boxed up.
- At the time of start up, coupling side Mechnical seal of pump was failed and taken for replaced by new mechnical seal (335050000).

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

PREVENTIVE MAINTENANCE :

- Couplings between the Pump to Gear Box was decoupled after recording the necessary match marks.
- Initial alignment readings and axial float were measured and recorded.
- Bearing top halves were removed.
- Coupling end and free end bearing clearances were measured using lead wire and recorded.
- Bearing halves were cleaned and polished using green rouge.
- DP ckeck of all bearings and coupling hubs and found ok.
- Thrust collar and the bearings assembled, clearance checked and recorded.
- Coupling is aligned with reference to match mark.
- Oil tank & filter was cleaned.
- Oil cooler was opened and cleaned.
- Suction filter of the pump was cleaned.
- Gear Box oil was replenished with new oil cooler cleaned.

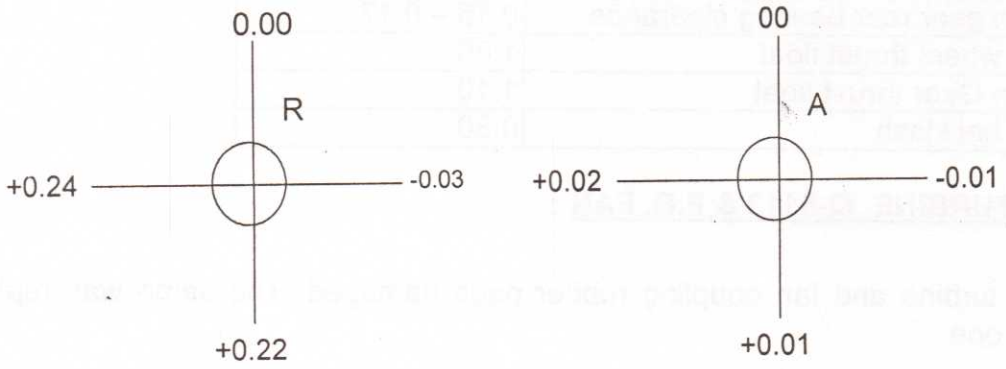
PREVENTIVE MAINTENANCE OF GEAR BOX:

- 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.
- Coupling end and free end bearing clearances were measured using lead wire and recorded.
- 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.

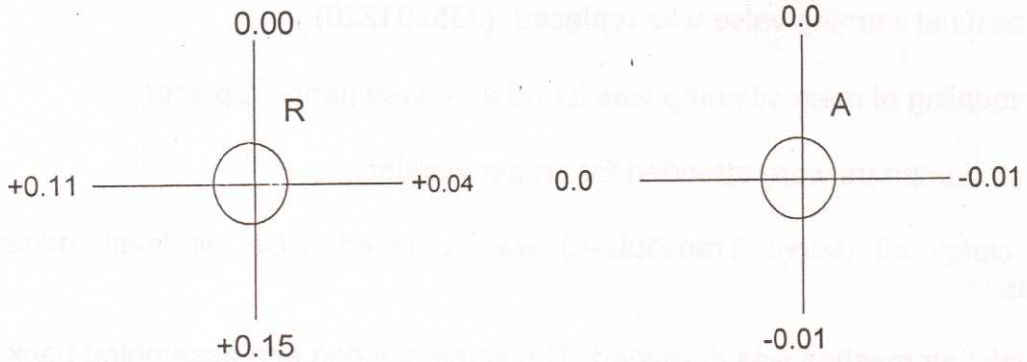
- Bearings were assembled, clearance checked and recorded and boxed up. 109
- Gear Box cover O rings replaced.
- Coupling is aligned with reference to match mark.
- Coupling was fixed.

ALIGNMENT DATA :

Gear Box & Boiler Feed Pump



Alignment reading between Gear Box to Motor



Clearance Details of P-5112

All the values are in mm

Sr.No.	Description	Actual value
1	Radial bearing clearance coupling end	0.14-0.15
2	Radial bearing clearance free end	0.15-0.16
3	Gear wheel front bearing clearance	0.20-0.21
4	Gear wheel rear bearing clearance	0.16
5	Pinion gear front bearing clearance	0.20 mm
6	Pinion gear rear bearing clearance	0.16 – 0.17
7	Gear wheel thrust float	1.60
8	Pinion Gear thrust float	1.10
9	Gear backlash	0.30

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

- Between turbine and fan coupling rubber pads damaged. The same was replaced with new one.
- Oil sludge was found in gearbox journal bearings. The same was cleaned, D.P. test was carried and assembled back.
- Light dust was observed at main oil console. The same was cleaned and refilled with new oil.
- The regulating cum governing valve (335409089) was replaced.
- The sentinel warning valve was replaced. (335401220).
- The coupling of main oil pump was found damaged hence replaced.
- The air dampners were attended for proper working.
- The clutch oil (servo Transfluid-A) was replaced. Also oil level indicator was replaced.
- Fan inlet air meshes was damaged. The same cleaned and assembled back.

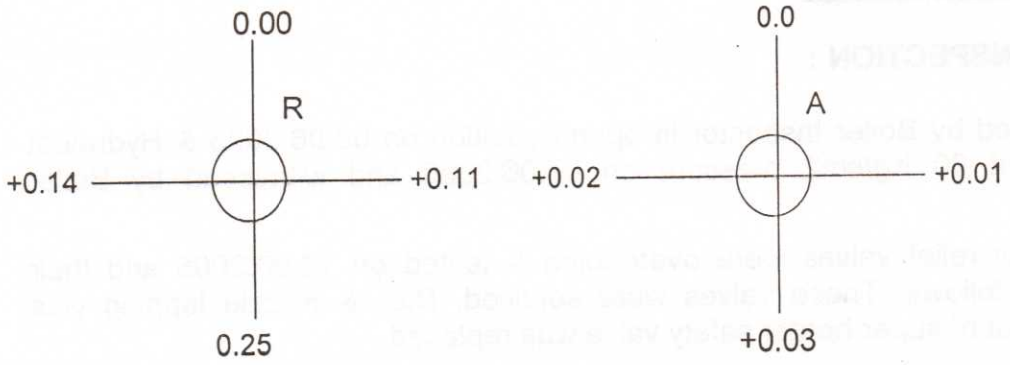
BEARING CLARENCES.

SR.NO	POSITION	CLERANCE	REMARKS
1.	Pinion thrust end journal bearing	0.13	same bearing re used.
2.	Pinion opp thrust end journal bearing	0.13	same bearing re used.
3.	Gear wheel thrust end journal bearing clearance	0.14	same bearing re used.
4.	Gear wheel opp thrust end journal bearing clearance	0.15	same bearing re used.
5.	Fan turbine end roller bearing clearance	0.15	same bearing re used.
6.	Fan motor end roller bearing clearance	0.17	same bearing re used.

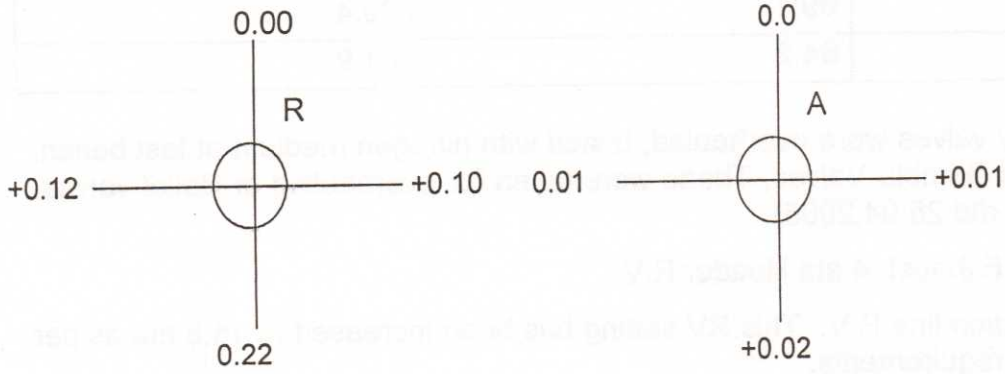
Pinion thrust float : 0.24
Gear wheel thrust float : 0.24

ALIGNMMENT BETWEEN GEARBOX AND FAN:

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



After Preventive Maintenance:



STEAM LEAK JOBS :

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All Steam leak jobs attended as per the Shutdown job list. Five nos ½" x 800 # rating passing valves were replaced on Steam Traps lines on stem header parallel to walk way in Mech(O) area.

M/s EFCO, Hydrabad was engaged vide W.O. No 9916650 dtd 01.02.2005 for in-situ valve seat lapping of passing valves. The following valves were attended:-

- BFW Pump suction and discharge valves of P-5111 & P-5112,
- 60 to 40 ata gate & globe valve at mech shift office.
- Inlet isolation gate valves of Q 4411 & Q-4401/B Cooling water pump turbines.
- Exhaust isolation gate valve of Q4401/B cooling water pump turbine.
- 6" x 250 bar gate valve installed on battery limit steam header
- 8" x 800# gate valve installed at battery limit steam header.
- 14" x 150 # gate valve installed at battery limit steam header.
- 12" x 300# gate valve installed at battery limit steam header.

The threaded valves for PI & TI on cooling water pump discharge lines (04 nos pump) were replaced with welded valves.

All the steam leak jobs as per the list were attended for cooling water pump turbines.

BHEL BOILER JOBS (F-5111) :

BHEL BOILER INSPECTION :

Boiler was inspected by Boiler Inspector in open condition on 03.06.2005 & Hydrotest was carried out at 90 Kg/cm2 pressure on 07.06.2005 and witnessed by Boiler Inspector.

All the three safety relief valves were overhauled & tested on 12.06.2005 and their readings were as follows. These valves were serviced, Disc & Nozzle lapping was carried out. The seat of super heater safety valve was replaced.

Description	Popping Pressure Kg/cm2g	Reset Pressure Kg/cm2g
Drum Rear R.V.	71.90	68.2
Drum Front R.V.	69.1	66.4
Super Heater R.V.	64.2	61.9

The following safety valves were overhauled, tested with nitrogen medium at test bench. The services of M/s Dembla Valves, Thane were taken for overhauling of Relief valves. (Ref W.O. 9917161 dtd 25.04.2005)

- F.D.Fan turbine Exhaust 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.

- Dearator R.V.
- BFW turbine exhaust 4 ata R.V.
- I.SHS supply pump turbine exhaust R.V.
- Steam drum connected all first and second isolation valves gland packing were repacked. The services of Amrutha Engineering , New Panvel were taken for valve gland repacking job. (Ref : WO No 9916071 dtd 04.04.2005)
- The Burners was replaced with 100% MCR Gas fired Burner with provision of 100 % MCR Oil firing by Technical department. For replacement of burner block wall, nine tubes of front wall was cut removed and replace with new tubes to accommodate the higher diameter burners.
- The Flue gas leakage from "D" tubes on the top of furnace, along steam drum was observed in running plant. castable refractory whytheat 'A' was poured to arrest that leak. The refractory was poured on furnace top along steam drum at steam drum to Tube joints in 300 mm width. Also refractory was casted inside the furnace at "D" tube joint.
- "L", inverted "U" shaped Inconel clamps @ 10 x 6 rows were welded on underside of steam drum in super heater coil area. Then inconel wires was tied on these clamps to form a net underside of naked portion of steam drum above superheater coils.. Further castable refractory was casted on this wire net. Old ceramic insulation material & was found loose on opening of furnace.
- Three BHEL make valves was attended by replacing High Pressure sealing ring. (store code : 335816005) on 100% BFW feed water line. The high pressure seal rings were covered by graphite powder before installing. Also valve gland were re-packed with fresh packing material. The location of valves is as under.

  Up stream isolation valve of control valve of 100% BFW feed water line at first floor
  Down stream isolation valve of control valve of 100% BFW feed water line at first floor.
  Up stream isolation valve of regulation valve of 100% BFW feed water line at first floor.
- Remaining Life Assessment of BHEL Boiler was carried out as per Five year action plan approved by CIB, Gujarat. The RLA study was conducted by M/s TBW Ltd, Pune (ref : WO No 9917255 dtd 02.05.05).
- The sample tubes for RLA study was cut and welded by M/s Skywin Erectors, A'bad. (Ref : WO no 9916819 dtd 28.02.05)
- Inside the steam drum, @ 10 - 12 locations, the gap between water demister pads was increased. The same was repaired by welding MS strips using E-6013 welding electrodes.
- The castable refractory lining on furnace floor was found cracked at many locations. Hence complete refractory lining was removed upto tubes. Then ACC make fire bricks AC 70 size = 230x 115 x 75 were laid on floor. The castable refractory whytheat 'A' was used only for leveling of tube floor inside the furnace. M/s M.H. Derrick, Calcutta had executed the civil jobs.
- All inspection window glasses were cleaned and replaced where ever found broken.
- Man hole cover gasket was replaced with asbestos gland packing rope for proper sealing of the flange joint.

- All dampers of air duct were checked and made free by greasing for smooth operation.
- LRB-1 was taken for complete overhauling. The steam injection nozzle at the end of feed pipe of LRB was found worn out. New nozzle was machined from SS 304 material and same was welded with feed pipe by inconel electrodes. The old convergent- divergent nozzles were re-welded in feed pipe.
- The RB-4, RB-5 & RB-6 was removed from the furnace. The damaged face of feed pipe flanges were re-welded & machined to make new seating surface. The feed pipes were found healthy.
- The seal air line NRVs are working healthy.

RE -GENERATIVE AIR PRE-HEATER H-5111 :

- General condition of Cold End baskets was found ok. In few locations some elements were found loose. Metal strips were inserted to lock those loose elements.
- The complete set of 12 nos hot end baskets were replaced. M/s Aneesh Engrs, Kalol was engaged for replacement of Hot end baskets. (Ref : WO No 9917310 dtd 30.04.2005)
- Hot End & Cold End side circumferential seals and radial seals were replaced.
- Cold End side rotor post seal was found worn out. Hence new rotor post seal was welded on same location without removing left over portion of old rotor post seal.
- 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 ltrs) 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 feeler gauge and this is the readings :
  Clearance hot end bearing : 0.012"
  Clearance cold end bearing : 0.008"
- Steam nozzle for swivel type soot blower of RAH unit was cleaned. The coupling bolts of motor of this unit was replaced. Coupling pad (L-95) was also replaced.
- Both side swivel door assembly repaired for smooth operation.

Cooling Tower Jobs:

- The horizontal portion of Urea cooling water return header (both sides) was replaced by M/s J & J Engr, Kalol. (W.O. 9916948 dtd 16.03.2005). The base material for these pipes is SS 304. The entire welding was carrird out using SS 308 filler wires by TIG welding. The lab side header was removed in five pieces with fly jib HM crane. These SS 304 pipes were supplied by M/s J. M. Engineers, A'bad (Ref : PO No 9916850 dtd 12.03.05). The wooden support pieces under the pipe header was replaced.
- The Strainer grills of Urea & Ammonia cooling towers were repaired.

- The basin drain lines of 7-8 cooling tower was observed corroded and same was replaced with SS 304 lines. Reinforcement pads were welded in pipes for arresting leak and better casting of refractory.
- The Urea basin drain valve was replaced.
- The cooling tower distribution valves were attended for smooth operation and isolation. Three valves of Ammonia tower was replaced.
- Interconnection between raw water inlet headers to WTP & HCL fume scrubber line was removed.
- The suction line rubber expansion bellow of P-4402 & P-4401/B was replaced. The size of bellow was 30" and stode code is 452595086.

DM PLANT JOB:

- Cation – 4 inlet isolation valve was replaced with 10" x 150# raising spindle gate valve.
- S 2 & S 3 tank outlet & Drain valve diaphragm were replaced. The S2 tank drain valve body was found corroded.
- The DM water buffer tank was opened for inspection.
- 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 ON :

- Cooling water return header on the top of cooling tower (ammonia old urea and new urea).
- BHEL Boiler stack, all safety valves exhaust cylinders.

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RECLAIM MACHINE M - 2116 :

Thorough inspection and overhauling of complete bucket elevator assembly was carried out for the following :

- Loose / damaged Chain links.
- Broken pins / lock washers / circlips.
- Rubbing buckets.
- Lubrication of pins.
- Overhauling of the take-up unit – cone washer replacement & checking of bearings, shaft & sprockets.
- Bucket elevator top shaft jib head key replaced with a new one.
- Bearing housing with new bearing of Bucket elevator bottom shaft replaced.

Thorough inspection and overhauling of complete scrapper chain assembly was carried out for the following :

- Replacement of damaged scrapper blades.
- Proper tightening and tack welding of nuts to avoid looseness during running.
- Chain tightening.
- Sprocket inspection.
- Through cleaning of accumulated urea inside the scraper boom support, Using small ejector developed in house.

Repairing of take-up unit for scrapper chain : 14 Nos. (7 Pair) of cone washer replaced.

Pivot assembly of link conveyor replaced with new one as old pivot pin and bush were found damaged. Also provided square bar frame at pivot seating portion for strengthening.

Link conveyor Gear Box oil seal replaced & fresh charge of Servo Mesh – 460 oil made.

Guide roller bracket assembly of bottom King-post inside the bunker of reclaim machine overhauled and aligned.

Centering of king post was checked with respect to pivot centre & found within 20 mm.

Thorough cleaning of accumulated Urea inside the supporting structure of Link conveyor belt carried out.

Cleaning and overhauling of carrier rollers and return rollers of Link conveyor carried out. Also sealing system checked and adjusted.

Carried out Overhauling of all gear boxes like long travel, slewing, scrapper and bucket elevator (main gear box) including their alignment with motor.

Thruster oil replaced and brake shoes checked.

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Fluid coupling oil replaced. Servo Prime – 32, Qty. – 13.5 Ltr.
Coupling distance between Gear box and Motor – 338 mm.

F.C.–20 Coupling replaced with new one with new coupling bolts and bushes.

Swing gear box coupling bushes replaced.

Hub and lantern pinion assembly replaced with reconditioned one.

All Slewing rack pins checked and greasing done.

Cardium compound provided on wire rope of hoisting mechanism.

Pedestal bearings of both rear and front axle checked and greasing done.

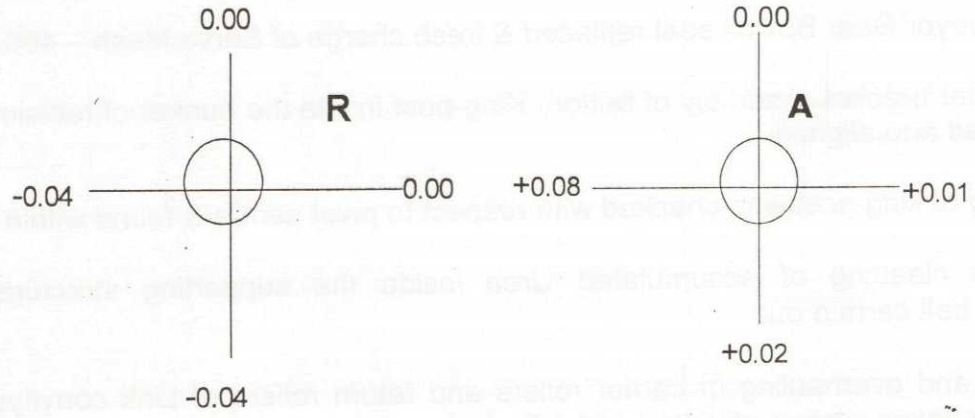
Limit switch set for maximum up/down and swing movements of scrapper arm.

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 on 17/06/05 and 18/06/05 and the machine was found working satisfactorily.

Fluid Coupling Alignment readings: Motor to Gear Box



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 and 8.

Replacement of damaged doors.

Overhauling of coarse and fine feed gate assembly.

Over hauling of bottom flapper assembly.

Servicing of all cylinders.

Overhauling of sack grip assembly.

Alignment of stabilizer plate.

Overhauling of bucket assembly.

Calibration of packer scales.

CONVEYOR M-2110 :

Following jobs were carried out.

M-2110 conveyor Gear Box replaced with reconditioned one. Coupling done after proper alignment.

M--2111 diverter Flapper valve attended for proper sealing and easy operation. Greasing of bearings carried out.

Head pulley brush roller serviced.

Damaged rubber top layer of the belt was removed and patch work was done with cold vulcanizing.

All damaged return rollers were removed, serviced for free rotation and refixed after replacement of rubber disks and sleeves.

All damaged and noisy carrier rollers and guide rollers were replaced.

All pedestal bearings of snub pulley, head pulley, tail pulley and gravity pulley checked and greasing done.

Complete cleaning and painting of structure done.

CONVEYOR M - 2112 :

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Following jobs were carried out :

M-2112 conveyor Gear Box coupling bolts, coupling rubber bushes, both side oil seal and oil replaced with new one. Coupling done after proper alignment.

All noisy and damaged carrier, guide and return rollers replaced with new rollers.

Greasing done in all brgs. of head pulley, tail pulley, snub pulley and gravity pulley.

Gravity take up, rubber lagged pulley replaced with new bearings.

Complete cleaning of conveyor structure done.

M-2112 conveyor Tripper Gear box over hauled and realigned with motor. Checked it's drive chain. Also Tripper Head pulley replaced with rubber lagged pulley with new bearings.

CONVEYOR M-2117 :

Following jobs were carried out

Over hauling of gearbox and replacement of oil seals, oil, coupling bolts and bushes. Coupling done after proper alignment.

All damaged return rollers, carrier rollers and impact rollers replaced with new rollers.

Complete greasing of all bearings of head pulley, tail pulley, snub pulley and gravity pulley.

Tail pulley, Gravity take up pulley and Snub pulley replaced with new rubber lagged pulley and new bearings.

CONVEYOR M-2121 :

Following jobs were carried out

Conveyor Belt replaced with new one, having width of belt 800mm against earlier 750 mm.

Gear box replaced with reconditioned one.

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.

All Return and Carrier rollers replaced 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 :

Gear box of M-2122 belt conveyor attended for replacement of coupling bolts, bushes, oil-seals and oil. Complete cleaning and painting of gear box done. Coupling done after proper alignment. Oil seal Size : 50 x 70 x 8 mm -- 2 Nos.

Diverter plate of 3 and 4 hopper overhauled.

Skirt rubber with inner rubber sheet replaced.

Gear box of tripper of M-2122 conveyor overhauled.

All damaged return rollers and carrier rollers replaced by new rollers.

Complete greasing in all bearings done.

Complete cleaning and painting of conveyor structure done.

CONVEYOR M - 2122 A/B :

Following jobs were carried out :

Both gear boxes overhauled.

All damaged return rollers replaced with new rollers.

Skirt rubber replaced.

Cleaning and painting of complete structure.

DUST CONVEYOR :

Following jobs were carried out

Replacement of oil, oil-seals, coupling bolts and bushes.

All damaged return rollers overhauled.

All carrier rollers attended for free operation.

New skirt rubber with inner rubber sheet provided.

Complete greasing of all bearings done.

SLAT CONVEYOR M-2124 (1 - 6) :

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Following jobs were carried out on all six slat conveyors

Slat conveyor chain of slat conveyor No. 1,2,3 & 7 replaced with new one.

All wooden slats of slat conveyor No. 1,2,3 & 7 replaced by new UHMW-PE (Ultra High Molecular Weight Poly Ethylene) material slats with S.S. 304 Nut bolt.

Preventive maintenance of Gear box done.

MPG and MHT-60 bearing servicing and greasing.

Conveyor adjusting mechanism servicing.

Cleaning and painting of all slat conveyors.

PAY LOADER CONVEYOR M-2113 :

Following jobs were carried out.

Overhauling of carrying and return rollers.

Replacement of gearbox oil, coupling bushes and checking of alignment.

VIBRATING SCREEN-84" (PENWALT) M-2136/ A-B-C-D :

Dust outlet pipes replaced with S.S. 304 material.

Wire mesh screens cleaned.

INSPECTION

AMMONIA PLANT

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The following major inspection activities were performed in Ammonia Plant.

1. Inspection of reformer, catalyst tubes and risers with various NDT Techniques. Details are given at **Annexure-1 to 5**

2. Radiography of 'C' weld joint of all the 336 catalyst tubes and 8 riser tubes.

3. Radiography and D.P. test of newly fabricated weld joints during replacement of 'A' & 'C' coil of Auxiliary Boiler.

4. Automatic ultrasonic scanning of all the Catalyst and Riser tubes Details are given at **Annexure-2**

5. Inspection of 103 D from inside after removal of catalyst.

6. Ultrasonic flaw detection on selected weld joints of critical pipelines and equipments. Details are given at **Annexure-6**

7. Thickness measurement of various equipment was carried out. Details are attached at **Annexure-7**

8. Thickness measurement of various pipelines was carried out. Details are attached at Annexure-8

9. Measurement of residual magnetism of parts of equipments and demagnetization of the same wherever required. Details are given at **Annexure-9**

10. Insitu metallography of selected equipment and pipelines. Summary of observations and microstructure analysis is given at **Annexure - 10**

11. Inspection of newly fabricated pipelines for energy saving project and fabrication jobs carried out departmentally by maintenance department.

12. Qualification tests of welders employed by contractors.

13. Visual inspection of equipments.

14 Inspection of steam drum (GT-1632) and it's related pipelines and equipment based on RLA study was carried out. No abnormality was observed. A separate report was made for same.

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 based on the observations made.

PRIMARY REFORMER 101-B:

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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:

- Automatic ultrasonic scanning of all the 336 Catalyst tubes and 8 Risers tubes was carried out during Shutdown by PDIL. Amongst all 336 tubes, 27 tubes placed in B grade, 297 tubes placed in C grade & 12 tubes placed in D grade . Amongst 8 risers, 3 riser placed in B grade & 5 risers were placed in C grade. Details are attached at **Annexure-2.**

- Radiography of C weld of all 336 catalyst tubes and 8 risers was carried out after removal of catalyst upto below 8" of C weld joints to assess the development of any weld cracks. Total 18 tubes & 2 risers were observed to have crack initiation in weld. Out of 18 nos. Tube nos. 225, 306, 407, 432, 708, 714, 811, 829 tubes were replaced which had crack initiated. Balance 10 tubes had minor crack initiations which were left as it is. Tube nos. 811 & 708 have transverse crack initiation in the weld only. Tube nos. 225, 306, 407, 432, 714, 829 were have circumferntial crack initiation. Riser no. 3 & 8 were observed to have minor crack initiation and same were left as it is.

- The weld joints of reclaimed tubes were found quite satisfactory after one/two year service in the furnace.

- Replaced tubes were checked by DP test and radiography at root run and final run at E weld

- Outlet manifold field weld joints (16 nos.) were radiographed for all the eight rows. No service defects were observed in any joint.

- DP test of 16 nos. of outlet manifold field weld joints, riser tube to weldolet and weldolet to header weld-joints was carried out for all the risers. Also DP test of weld joints of 5 catalyst tube in each row of tube to weldolet and weldolet to outlet header joints was carried out randomly. The tubes numbers selected were 112, 113,133,141,142,201,202,212,213,226,302,320,321,338, 340, 404, 409, 416, 426, 427,504,510,524,525,526,601,615,616,636,640,703,704,723,740,742,807,810, 823, 824,831.NO service defect were revealed

- Creep measurement of all the catalyst tubes was carried out using GO-NOGO Gauge at tunnel slab level. No recordable Creep was found in 322 nos. of tubes, creep was upto 0.73 % in 13 nos. of tubes & tube no 731 have recorded creep in the range of 1.3 to 2.5 %,this was observed since last revamp. The detailed report is enclosed at **Annexure-3.**

- Clearance measurement of outlet headers from the bottom floor was carried out. The report is attached at **Annexure-4.**

- Spring hanger readings of catalyst tubes in cold condition were taken. The report is attached at **Annexure-5**.

CONVECTION ZONE:

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

H.T.Convection Section:

- Just below Mixed feed coil, SS Sheet covering fiber blanket got buckled and burnt, which has exposed the fiber blankets at scattered locations along the length & width of the coil, The height of these sheet is approximately 400mm. The remaining sheets below this area are found in satisfactory condition.

- All the tubes of mixed feed coil were found covered with fine paper like refractory coating, proper cleaning is recommended.

- Intermediate tube supports of mixed feed coil & tunnel thermo well were found in satisfactory condition.

L.T.Convection Section :

- Tube supports of Boiler BFW coil & NG feed preheater coil were found in satisfactory condition as seen from the bottom.

- Lot of refractory debris found between BFW coil and north wall of LT section, due to this passage between coil & wall is chocked and also some portion of the fins is also covered with this.

- Fins of south side two tubes of the bottom most row of NG feed preheater coil found covered with hard refractory debris on its bottom half. Also few tubes of the same row found covered with refractory debris at scattered locations in small length.

- Refractory debris found accumulated inside ID fan casing.

- Bottom floor refractory found damaged at scattered locations.

AUXILIARY BOILER :

FURNACE AREA :

- Insitu replacement of all the tubes of coil 'A' has been done. Following NDT was carried out.

- DP test of bevel edge of all the new tubes.

- DP test of bevel edge of stub ends of all the old tubes.

- Radiography of all the butt weld joints.

- DP test & Radiography of down comer and riser header of coil 'A' & 'C'.

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- Coil 'C' was replaced with new pre febricated coil. The thickness of the tube was found in the range of 7.2 to 7.5 mm.

- In-situ metallography was also carried out and observations are
- mentioned at **Annexure-10**

- Thickness measurement of old existing tubes of coil 'B', inlet header and header caps was carried out. Thickness of tubes,headers and caps was found in the range of 7.11 to 7.69mm, 30.9 to 33.4 and 26.1 to 28.56 mm against the nominal thickness of 7.01mm, 33.82 mm and 25.4 mm respectively.

- Hydro testing of pre fabricated 'C' coil was carried out at 175 kg/cm2 (g) before installation of the same.

- DPT and Radiography of header to Cap weld joints was carried out.

VESSELS AND OTHER EQUIPMENT:

103-D, SECONDARY REFORMER:

Catalyst was removed during this shutdown. Inspection of the complete vessel was carried out .

TOP AIR AND GAS ENTRY:

- Zig - Zag superficial scattered cracks were observed on the refractory lining all over dome and shell.
- At few scattered locations i.e approx. 3mm width observed. No repairing work was carried out.
- Top layer refractory lining has got peeled off at upper most portion of shell i.e. junction between dome and shell.
- Thermo well pipe found bent/inclined upwards approx. 45 deg. from horizontal axis.
- Shift liner observed slightly buckled particularly more on 3rd segment from top.
- Gap of 1" app. Observed between shift liners of top shell to transfer line liner location 5 deg. Clock to 9 deg. Clock position.
- Target hexagonal bricks and alumina balls found in satisfactory condition.

BOTTOM DOME :

- Erosion of refractory and scattered cracks were observed at few locations and same were found more around both the gas inlet nozzles.
- Skirt liner found slightly buckled inward (away from shell) at scattered locations.
- Some of refractory brick slots found chocked with alumina balls

- Upper layer of refractory found slightly damaged near the inner two circles. 127
- Bottom floor refractory found to have loosened and wet in nature.

101-CA/CB GAS INLET NOZZLE:

- Inward bulging of approx. 20 - 40mm was observed at the ID of liner segment in scattered length but upto approx. 250mm length was maximum at the different liner segments.
- Scattered circumferential cracks were observed at the second liner plate from 103-D side at previously made repair weld.
- Catalyst dust found accumulated at both the gas inlet nozzle liner towards 103-D end and one or two alumina balls were also found inside the nozzle.
- Liner around thermocouple of 101-CA found buckled inward by approx. 50mm and gap was observed at bottom of patch plate.
- Minor outward buckling was observed at the top half of both the inlet nozzle end and at 103-D end.
- Gas inlet nozzle liner inside surface bottom half covered with moist catalyst dust layer and also some pieces of refractory .

SHELL:

All the three thermo well were bent by 30 degree approx. inside the shell.

In general, superficial tight cracks were observed on the top cone and shell refractory.

Approx. 4" x 8" area of the top cone castable had spallen and resulted in exposure of metallic element.

Few holes of the bottom dome were still blocked. The dome circumference at shell had a few pores.

Minor bulging was observed on the transfer line liner at first row riser location.

102 - C, WASTE HEAT EXCHANGER:

Tube leakage was observed in 12 nos. of tubes and same were plugged. For further assessment of condition of tubes RFET was carried out. Based upon the result of RFET further 17 nos. of tubes were plugged to enhance the reliability of the equipment. During Hydro test further 5 nos. of tubes were found leaky and same were plugged. Total 34 nos. of tubes were plugged as detailed below.

Tubes are counted from South to North and Row nos. counted from West to East

Row. No.	Tube nos. plugged initially due to leak	Tubes plugged based upon RFET	Tube nos. plugged due to leak in Hydro test
1			
2			
3			
4			
5			
6			
7	9		
8		8	15
9		7,8,9,18	
10	11,21	16	
11		15,20	
12	7,12	20	9
13	15,21	18,19	20
14		13,23	
15		18	
16			
17	15,16,19,23	8	
18		16	14
19	16		
20		14	
21			
22			17
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
Total	12	17	5

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WPS for repairing of tube to tube sheet seal weld and plug weld is attached at **Annexure-11.**

Dehydrogenation of tube sheet was carried out at 350 deg C for 36 hours.

107 - D, TRANSFER LINE:

- Visual inspection of transfer line internals was carried out from outside through manhole.The following observations were made:

- Minor buckling of the liner was observed at scattered locations throughout the length of the transfer line.

- Minor damage of the refractory was observed at flange (entry) of the transfer line.

102-EB, CO2 STRIPPER:

- Visual inspection of vessel top and bottom from inside was carried out the detailed observations are given below.

- Demister pad on top found intact in position

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- Inlet liquid distributor header flange bolts found in sheared Condition.
- Liquid distributor header support welding found cracked at various locations and marked for repair.
- U clamp holding nuts found missing / loose condition.
- Stiffener pipe welding of distributor header support found cracked / broken which is marked for repair.
- Fastening bolts of some trays found missing.
- Lot of foreign particles and debris were found laying on the bottom most trays.
- Tray no. 17 from top found in upward bent condition.

101-F, STEAM DRUM:

Visual inspection of steam drum was carried out.The following observations were made.

- 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.
- Eight nos. of fastening clamps below the West side separator plate were found loose.
- One fastening bolt with clamp of East side separator plate was found sheared off.
- Two nos.of fastening clamps below the east side separator plate were found missing
- One bolt of clamp of 6" distribution pipe was found corroded. (2nd no counting from south side.Holes of this header found enlarged in haphazard shape and same was replaced with new.

102-F , RAW GAS SEPARATOR:

- Internal, Epoxy paint condition was found satisfactory, at 2-3 spots it was found peeled off.
- One segment (East side) of Demister pad found completely displaced from its position, Other Demister pads were found intact in position.
- Corrosion attack was observed on the repaired weld at the inside face of manhole nozzle. Suitable protective coating may be applied at this location.

- Circumferential weld joint of manhole nozzle found porous at 5-6 spots.

- Gas inlet nozzle located at East side was found to have corrosion cavity (approx . 5mm wide x 2-3 mm depth) in its 70% circumference at its East End.

103-F, REFLUX DRUM :

Visual inspection of the drum was carried out. The following observations were made.

- A gap of approx. 100-150 mm was observed between the central segment of demister pad at its North end. Rest of the segments were found intact.The same was observed in the past.

- 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.

- Entire bottom end found oily / slippery.

101 – U, Dearator:

Top drum:-

- Coloration of shell was observed brownish

- Cover plate of the tray enclosure was closed so internal tray etc. could not be inspected.

- Two numbers bolts missing and two numbers found loose of the cover plate of tray encloser.

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.

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

- The coloration of vessel was brownish black from inside.

- Condition of demister pad was found satisfactory, however, one no of fastener of demister pad holding ring was found missing.

- Scattered minor pittings were observed throughout the shell surface, the same was observed in past also.

- Entire internal surface was found oily.

- The Overall condition of the vessel was found satisfactory.

107-F, PRIMARY AMMONIA SEPARATOR:

- Colouration of vessel internals was found blackish brown
- Scattered thin scales were observed on the shell and dished end
- Entire internal surface was found oily
- The overall condition of the vessel was found to be satisfactory.

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 to be satisfactory.
- Thin scales were observed on both the dished ends.
- Minor scattered pittings / scales ware observed in a width of approx. 250mm throughout the length of vessel at its bottom most portion.
- Entire internal surface was found oily.
- Overall condition of the vessel was found to be satisfactory.

110-F, FIRST STAGE REFRIGERANT FLASH DRUM:

Visual inspection of the drum was carried out.The following observations were made.

- Brownish black colouration was observed inside the drum.
- Oil layer was found on the surface of shell and sludge was found at the bottom of vessel .
- 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.

111-F, SECOND STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

- The shell inside surface had assumed blackish gray coloration.
- Thin layer of oil was observed on the complete inside surface.
- The demister pads were found intact in position.

- Scattered scales were observed on both the dished ends.

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- Two bolts of the cover plate of 12" make up line from 109 F, were found missing.

112-F, THIRD STAGE REFRIGERANT FLASH DRUM:

The following observations were made during visual examination.

- 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.
- All nozzles condition was found satisfactory.

R-111, SULPHUR ABSORBER:

The following observations were made during visual examination.

BOTTOM COMPARTMENT:

- Top half of the vessel was found covered with some debris/dust/ loose scale and dust was also found collected at the top grating supports.
- Sample point nozzle and thermocouple were found intact and in good condition.
- Bottom wire mesh was found loose and twisted upward near shell of the vessel. This requires proper fixing as alumna balls were found dropped at the bottom of the vessel through the wire mesh opening.
- Top half of the vessel was assumed to be shining silver in colour whereas bottom half as grayish black.
- Overall condition of the vessel was found satisfactory.

TOP COMPARTMENT:

- Silver shining was found at scattered locations, which were loosely adhered to the shell.(can be removed easily)
- Brownish colouration was observed behind the scales wherever no scales were there.
- The condition of the wire mesh on the grating was found same as was observed at the bottom compartment of the vessel.

NOTE: Alumina balls can be loaded with due care of pressing the wire mesh with shell to avoid falling of the alumna balls from the side of wire mesh.

MISCELLANEOUS JOBS:

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WELDER QUALIFICATION TESTS:

- Performance qualification test of 12 Nos. welders offered by M/s General Engg. Baroda, was carried out. 6 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 13 Nos. welders offered by M/s Ganesh Engg. Was carried out. 11 nos. of welders were qualified during the test.

- Welder qualification test of 4 Nos. welders of M/S. Skywin Engrs.,was carried out. 3 welders were qualified. These welders were qualified for performing welding jobs of auxiliary boiler Tubs.

- Performance qualification test of 9 Nos. welders offered by M/s Aneesh Engg , was carried out. 4 nos. of welders were qualified during the test.

- Performance qualification test of 12 Nos. welders offered by M/s Garcem Engg., was carried out. 7 nos. of welders were qualified during the test.

- Performance qualification test of 3 Nos. welders offered by M/s J & J Engg., was carried out. All 3 welders were qualified during the test.

- Performance qualification test of 6 Nos. welders offered by M/s Mahavir Engg., was carried out. Only 1 welder was qualified during the test.

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, catalyst tubes site 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 . Radiography was carried out on all "C" welds of catalyst tubes and riser tube.Also radiography of weld joints of all the pipelines fabricated by contractors/ departmentally was carried out after root run welding and after final welding, as per requirement.

INSITU METALLOGRAPHY EXAMINATION:

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In order to evaluate the condition of certain critical plant equipment and pipelines operating at more than 300 deg. C temperatures, 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-10.**

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-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-7** (for equipment) and **Annexure-8** (for pipelines).

GAUSS MEASUREMENT:

During this shutdown 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-9**

INSTALLATION OF NEW PIPELINES:

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

OVER SPEED TRIP TEST:

Before startup, during over speed trip test, speed measurement and vibration measurement of BFW pump turbine 104-JAT, Air Compressor drive turbine 101-JT, drive turbine of LO/SO pump of 101 J/105 J , drive turbine of 103-J LOSO pump & drive turbine of aMDEA pump 107JT,116JT,115JAT & 115JBT were carried out.

CHANGE-OVER OF ID FAN TURBINE FROM BACK PRESSURE TO CONDENSING TYPE:

Vibration measurement was carried out full time during change over of ID fan turbine from back pressure to condensing type to monitor any abnormality during changeover.

ANNEXURE-1

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VISUAL INSPECTION REPORT OF PRIMARY REFORMER RADIANT ZONE.

BURNER BLOCKS:

Burner blocks found badly damaged:
201,206,401,809

BOTTOM HEADER INSULATION:

Row No.	Location of header insulation damage/ partial layer damage
1	Below/Between/Above tube no 12,13,25,26,32,33
2	Below/Between/Above tube no 1,20,21,30,31,32
3	Below/Between/Above tube no 20,21
4	Below/Between/Above tube no 10,26,27
5	Below/Between/Above tube no 24,25,26,34
6	Below/Between/Above tube no 15,16,,36-42
7	Below/Between/Above tube no 39,40

ROOF INSULATION:

In general, the condition of the roof insulation is found to be satisfactory. However, at few locations small segments of the fiber insulation blocks have got detached causing exposure of roof plate to the flame/flue gases. In rest of the areas, the ceramic fiber modules had got loosened which needed corrective action.

TUBE ROW NO.	LOCATION OF DAMAGE
1	Near tube no. 112, burner no.114
2	Between tube no. 20-21,22-23
3	Near burner no.302,307
4	Near burner no.401, Between tube no. 9-10,27-28,41-42
5	Between tube no. 24-25
6	Both side of burner no.704, Near tube no. 631
7	Near tube no. 13,14
8	Between tube no. 2-3 Near burner no.910, Between burner no.901-902

Canister base rings of risers found distorted/damaged of row nos.3 &4

REFRACTORY WALLS:

Cerafelt was filled up wherever gap has increased between panel of bricks.

- Gap observed between two segments of Cerafelt blanket at tunnel slab level on south wall at its west end in approximately one mtr.length.

- In general ,condition of refractory walls found in satisfactory condition.

Annexure - 2 (1/5)

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

13.6

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

NOTE: # = BORDER LINE OF C & D GRADE

*** = BORDER LINE OF B & C GRADE**

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GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

NOTE: # = BORDER LINE OF C & D GRADE

* = BORDER LINE OF B & C GRADE

Annexure – 2 (3/5)

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GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

NOTE: # = BORDER LINE OF C & D GRADE

* = BORDER LINE OF B & C GRADE

Annexure – 2 (4/5)

139

GRADATION OF TUBES BY AUS CARRIED OUT BY PDIL

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

NOTE: # = BORDER LINE OF C & D GRADE
* = BORDER LINE OF B & C GRADE

Annexure – 2 (5/5)

GRADATION OF RISER TUBES BY AUS CARRIED OUT BY PDIL

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

Annexure – 3 (1/4)

140

CREEP MEASUREMENT OF PRIMARY REFORMER

CATALYST TUBES AT SLAB LEVEL

TUBE NO	CREEP IN PERCENTAGE				TUBE NO.	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
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	0			TOTAL	41	1		

Annexure – 3 (2/4)

141

CREEP MEASUREMENT OF PRIMARY REFORMER

CATALYST TUBES AT SLAB LEVEL

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
301	X				401		X		
302	X				402	X			
303	X				403	X			
304	X				404	X			
305	X				405	X			
306	X				406	X			
307	X				407	X			
308	X				408	X			
309	X				409	X			
310	X				410	X			
311	X				411	X			
312	X				412	X			
313	X				413	X			
314	X				414	X			
315	X				415	X			
316	X				416	X			
317	X				417	X			
318	X				418	X			
319	X				419	X			
320	X				420	X			
321	X				421	X			
322	X				422	X			
323	X				423	X			
324	X				424	X			
325	X				425	X			
326	X				426	X			
327	X				427	X			
328	X				428	X			
329	X				429	X			
330	X				430	X			
331	X				431	X			
332	X				432	X			
333	X				433	X			
334	X				434	X			
335	X				435	X			
336	X				436	X			
337	X				437	X			
338	X				438	X			
339	X				439	X			
340	X				440	X			
341	X				441	X			
342	X				442	X			
TOTAL	42				TOTAL	41	1		

Annexure – 3 (3/4)

142

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL

TUBE NO	CREEP IN PERCENTAGE				TUBE NO	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
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	42				TOTAL	42			

Annexure – 3 (4/4)

1143

CREEP MEASUREMENT OF PRIMARY REFORMER CATALYST TUBES AT SLAB LEVEL

TUBE NO	CREEP IN PERCENTAGE				TUBE NO.	CREEP IN PERCENTAGE			
	0	0-0.73	0.73-1.3	1.3-2.5		0	0-0.73	0.73-1.3	1.3-2.5
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	39	2		1	TOTAL	33	9		

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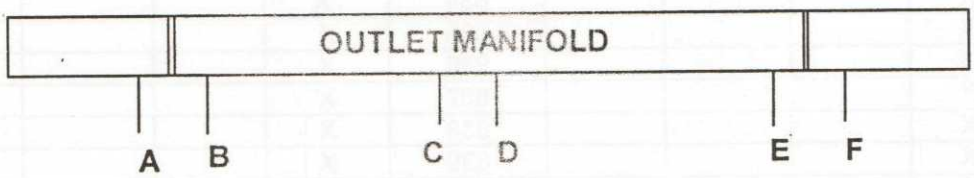
ANNEXURE- 4

CLEARANCE OF OUTLET MANIFOLD FROM GROUND FLOOR IN COLD CONDITION

HEADER NO.	LOCATION OF MEASUREMENT					
	A	B	C	D	E	F
1	320	340	338	340	340	340
2	320	330	335	325	340	305
3	325	292	315	310	305	310
4	325	320	317	315	325	315
5	305	310	315	337	315	320
6	315	295	290	295	300	305
7	330	335	335	330	335	340
8	335	335	310	310	340	340

NOTE : (1) All readings are in MM

(2) Readings are taken without insulation.



Annexure - 5

145

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
1	5	15	15	10	8	5	3	3	20	22	21
2	12	10	7	2	-10	-3	-5	-2	0	-4	-4
3	6	13	8	0	-12	-4	-3	-2	-2	-5	-1
4	0	-10	-1	0	-4	-5	-10	-8	-10	-5	-3
5	0	5	6	7	4	3	2	0	24	20	19
6	16	0	-5	-8	-12	-20	-25	-22	-18	-14	-5
7	0	6	6	-2	-2	-5	-18	-9	-18	-16	-10
8	-7	0	-2	0	-18	-15	-14	-15	-17	-15	0

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

Annexure - 6

UFD OF WELD JOINTS OF FOLLOWING PIPELINES WAS CARRIED OUT:

SR. NO	LINE NO	SIZE	SCHEDULE	FROM	TO	NO. OF JOINTS
1	A-21	10	120	101B	103D	2
2	NG-9	12	100	101B	NG11ATO H	2
3	SG-62A	4	XXS	102B	SG-32	1
4	SG-62B	4	XXS	102B	SG-32	1
5	SG-34	14	100	123-C	121-C	2
6	SG-76A/B	4	120	SG-29	102-B	11
7	NG-8	12	30	NG-7	101-B	2
8	HS-2	12	100	HS-2H	101-B	3
9	PG-1102.01-G36	14	80	H-111	R-112	1
10	R 112 TO NG9	14	80	R-112	NG-9	3
11	6"-NV-1103.01-F34	6	40	R-111	H-111	1
12	6"-NL-1107.01-D24	4	80/XS	E-110A	H-110	1
13	6"-NV-110.01-F34	6	40	H-110	R-110	1
14	HS-3H	12	100	HT SUPER HEATER COIL OUTLET	HS-4	1
15	LT SUPER HEATER COIL TO HT SUPER HEATER COIL	16	160	LT SUPER HEATER COIL	HT SUPER HEATER COIL	1
TOTAL WELD JOINTS						33

Annexure - 7
THICKNESS MEASUREMENT OF EQUIPMENT DURING S/D-2005

Sr. No	Equipment No.	Equipment Description	Shell			Dish End			Channel		
			Nom./ Design	Min./ Measured	% Red.	Nom./ Design	Min./ Measured	% Red	Nom./ Design	Min./ Measured	% Red.
1	101-CB	Primary waste heat exchanger	60.33	61.70							
2	101-JCA	Surface condenser	NA	13.00					NA	12.60	
3	101-JCB	Surface condenser	NA	13.80							
4	101-JLC 1	Lube & seal oil cooler or 101J & 105-J	NA	7.80					NA	7.70	
5	101-JCL2	Lube & seal oil cooler or 101J & 105-J	NA	7.90					NA	8.00	
6	103-D	Secondary Reformer				34.93	37.10		6.35 (Jacket)	6.50	
7	104--E	Condensate Stripper	12.50	11.90	4.80	11.10	14.00				
8	105-CA	Co2 Stripper process gas exchanger	28.58	29.50		26.99	29.20				
9	105-CB	Co2 Stripper process gas exchanger	28.58	29.00		26.99	29.20				
10	106-D	Methanator	44.50	46.30		43.70	47.90				
11	110-CA	Co2 Stripper Condenser	12.70	15.90		12.70			12.70		
12	110-CB	Co2 Stripper Condenser	12.70	11.60	8.66	12.70			12.70		
13	123-C	NH3 Converter Feed water Exchanger	82.55			NA	48.00				
14	130-JC	Air compressor interstage cooler no 2	NA	11.20							
15	171-C	Condensate Stripper Exchanger	9.52	8.50	10.71	9.52			9.52	9.00	5.46
16	2002-F	Demineralised Water Storage Tank	4.80	4.70	2.00	4.80	5.0 (top)				
17	2002-LF	Phosphate Mix Tank	NA	3.80		NA	3.7 (bot.)				
18	2006-UF-1	Salt Storage Tank	NA	5.20		NA	8.1 (bot.)				
19	2007-U	Resin Trap	8.00	7.90	1.25	10.00	9.30	7			
20	F-2005	Moisture Separator for instrument air drier	8.00	8.60		8.00	8.30				
21	R-112	Pre Reformer	85.00	86.50		43.00	47.50				

ANNEXURE – 8

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AMMONIA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY

Sr No	Line No	Nom Bore (inch)	Nom thick (mm)	Line Description		Min Thk observed	% Red.
				From	To		
1	6"-PG-205-2A	6	7.11	102J DISCHARG	102J SUCTION (FICV-200)	5.80	18.42
2	6"-PG-205-2A-4	4	6.02	102J DISCHARG	102J SUCTION (FICV-200)	5.50	8.64
3	6"-PV-1107.01	6	7.11	R112	VENT STACK (PICV-1027)	10.60	NIL
4	6"PV-1107.01-12	12	6.35	R112	VENT STACK (PICV-1027)	6.30	0.79
5	AMDEA-06A	10	9.27	109-C1A	AMDEA-61	7.90	14.78
6	AMDEA-06B	10	9.27	109-C1B	AMDEA-61	8.40	9.39
7	AMDEA-61	14	9.53	MEA-CA/CB	MEA-7	9.20	3.46
8	BF-09	2	8.71	BF-7	101-U	8.60	1.26
9	BF-15-8"	8	15.06	123-C	BF-1H	14.60	3.05
10	BF-1H	6	10.97	BF-15	101-B	14.50	NIL
11	BW-03H	12	21.44	102-C	101-F	19.00	11.38
12	BW-07H	10	18.26	BW-8H	101-F	16.90	7.45
13	BW-08H	12	21.44	HEADER	103-C	21.40	0.19
14	BW-26H	8	15.06	101-F	BW-14H	14.90	1.06
15	BW-30H	12	21.44	101-F	COIL-E 101 B	20.30	5.32
16	BW-31H	10	18.26	101-F	COIL-D 101 B	18.60	NIL
17	BW-35H	14	23.83	101-CA	BW-41 HA, HB	23.10	3.06
18	BW-36H	14	23.83	101-CB	BW-45 HA, HB	28.20	NIL
19	BW-43HA	12	21.44	BW-5H	101-F	21	2.05
20	BW-43HB	12	21.44	BW-5H	101-F	21.20	1.12
21	BW-45HA	12	21.44	BW-36H	101-F	20	6.72
22	BW-45HB	12	21.44	BW-36H	101-F	21.30	0.65
23	CO-15	24	15.88	103-F	UREA PLANT	16.00	NIL
24	CO-07	24	6.35	HEADER	103-F	5.70	10.24
25	LS-28	4	6.02	2004-JA	LS-20	5.90	1.99

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Sr No	Line No	Nom Bore (inch)	Nom thick (mm)	Line Description		Min Thk observed	% Red.
				From	To		
26	LS-31	4	6.02	156-F	LS-3	6.00	0.33
27	MS-16	2	5.54	MS-40	112-JAT	4.60	16.96
28	MS-37	3	5.49	MS-28	104-D	5.20	5.28
29	MS-49	2	5.54	MS-29	NG-6	5.20	6.14
30	NG-804-10"	10	6.35	800-J DISCHARGE	800-J SUCTION	5.50	13.39
31	NG-805-12"	12	6.35	800-J DISCHARGE	800-J SUCTION	5.50	13.39
32	NH-88A	8	8.18	NH-88	121-JA	8.00	2.20
33	NH-89	6	7.11	121-J	CONTROL VALVE	6.10	14.21
34	NH-89-3"	3	5.49	121-J	CONTROL VALVE	7.90	NIL
35	PG-14	16	12.7	106-C	102-F	12.10	4.72
36	PG-16	14	7.92	101-E	136-C	7.0	11.61
37	PG-24	10	6.35	PG-17	PG-18	6.6	NIL
38	PG-33A	4	6.02	105-CA	PG-34	6.20	NIL
39	PW-03-2	2	2.77	PW-3	LC-3	2.70	2.53
40	PW-02-2	2	3.91	PW-3	LC-3	3.10	20.72
41	PW-03	2	3.91	PW-04	PW-12	3.5	10.48
42	PW-04	2.5	5.16	PW-1	106-J	4.70	8.91
43	PW-20	6	10.97	104-E	170-J	10.9	NIL
44	PW-26	2	8.71	PW-24	SPEC.BRK	8.00	8.15
45	PW-27	6	10.97	PW-20	PW-28	10.2	7.00
46	RV-005	4	6.02	A-20	RV-101J	5.90	1.99
47	RV-024	3	7.62	SG-42	RV-103J	6.90	9.45
48	RV-028	6	7.11	RV-SG31	V-16	6.90	2.95
49	RV-034	6	7.11	NH-23	RV-109F	7.10	0.14
50	RV-036	3	5.49	NH-57	RV-110F	6.10	NIL

Sr No	Line No	Nom Bore (inch)	Nom thick (mm)	Line Description		Min Thk observed	% Red.
				From	To		
51	RV-038	4	6.02	NH-19	RV-111F	9.30	NIL
52	RV-043	4	6.02	NH-7	RV112F	6.30	NIL
53	RV-103	4	6.02	MS-11	RV-103JAT	5.90	1.99
54	RV-113	6	7.11	LS-24	RV-101AJ	6.60	7.17
55	RV-125	1.5	5.08	LS-15	RV-112	4.40	13.39
56	S-8	6	7.11	S-5	LS-10 (PIC-17)	7.10	0.14
57	S-8-8"	8	6.35	S-5	LS-10 (PIC-17)	7.80	NIL
58	SC-07	2.5	7.01	SC-42	101-JC	4.70	32.95
59	SC-08	8	6.35	SC-3	101-U	4.80	24.41
60	SC-47	10	9.27	101-JC	112-J	6	35.28
61	SC-47A	10	9.27	101-JC	112-JA	6	35.28
62	SC-47B	10	9.27	101-JC	112-JB	7.60	18.02
63	SG-27	6	14.27	SG-23	105-D	12.80	10.30
64	SG-45	6	7.11	SG-44	SG-6 (FIC-7)	7.10	0.14
65	V-6	6	7.11	PG-18	V-7 (PIC-5)	6.20	12.80
66	V-6-12"	12	9.53	PG-18	V-7 (PIC-5)	8.40	11.86
67	V-92-2"	2	5.54	101D/102D INLET	VENT (SP-73) (PRC-1)	6.90	NIL
68	V-92-6"	6	7.11	101D/102D INLET	VENT (SP-73) (PRC-1)	5.50	22.64

Annexure-9

GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

Sr. No.	Component Description	Max. gauss reading	
		Before	After
101-J AIR COMPRESSOR			
1.0	**Turbine South Bearing**		
1.1	Journal bearing shaft	15.0	4.3
1.2	Journal bearing pads	1.5	
1.3	Journal bearing base ring	1.9	
1.4	Thrust collar	20.0	4.7
1.5	Thrust pads	1.3	
2.0	**Turbine North Bearing**		
2.1	Journal bearing shaft	1.3	
2.2	Journal bearing pads	1.5	
2.3	Journal bearing base ring	1.3	
2.4	Journal Bearing Housing	3.5	
3.0	**H P Case South Bearing**		
3.1	Journal Bearing Housing	2.5	
3.2	Journal Bearing Shaft	3.9	
	Journal bearing pads	1.2	
4.0	**H P Case North Bearing**		
4.1	Journal Bearing Shaft	2.1	
4.2	Journal Thrust Collar	1.1	
4.3	Journal Bearing Pads	1.6	
5.0	**L P Case Comp. Thrust End**		
5.1	Journal Bearing Shaft	2.8	
5.2	Journal Bearing Pads	1.8	
5.3	Thrust Collar	3.0	
6.0	**L P Case Turbine Side**		
6.1	Journal Bearing Shaft	3.5	
6.2	Journal Bearing Pads	1.9	
7.0	**Gear Box**		
7.2	Journal Area	2.4	
7.3	Journal Bearing	2.0	

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Sr. No.	Component Description	Max. gauss reading	
		Before	After
103-J SYN GAS COMPRESSOR			
1.0	**JAT Thrust Bearing**		
	Journal Bearing Shaft	0.6	
1.1	Base Ring	1.2	
	Thrust Plate	2.3	
1.2	Pads	1.5	
2.0	**JAT Opposite Thrust End Radial Bearing**		
2.1	Journal Bearing Shaft	3.8	
2.2	Pads	2.1	
2.3	Thrust Collar	2.5	
2.4	Thrust Side Coupling End	3.5	
2.5	Thrust Side Journal Area	3.2	
2.6	Thrust Side Shaft End	2.5	
3.0	**JBT Non Drive (Thrust End) Radial Bearing**		
3.1	Thrust Bearing	1.5	
3.2	Thrust Bearing Shaft	0.5	
3.3	Thrust Collar	2.5	
3.4	Thrust Pads	1.1	
4.0	**JBT Opposite Thrust End Radial Bearing**		
4.1	Base Ring	1.5	
4.2	Pads	0.5	
4.3	Thrust Collar	0.9	
4.4	Journal Bearing Shaft	2.2	
5.0	**HP Thrust End**		
5.1	Pads	1.5	
5.2	Thrust Shaft Area	2.0	
5.3	Opposite Thrust End Shaft Area	0.9	
5.4	Thrust Collar	2.1	
5.5	Bearing Housing	2.6	
6.0	**HP Journal Bearing**		
6.1	Journal Bearing Shaft	1.9	
6.2	Base Ring	3.0	
6.3	Pads	1.1	
7.0	**LP Thrust End**		
7.1	Thrust Shaft Area	0.8	
7.2	Opposite Thrust End Shaft Area	1.1	
	Pads	1.8	
8 .0	**LP Journal Bearing (Point No. 7)**		
8.1	Base Ring	1.1	
8.2	Pads	1.8	

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Sr. No.	Component Description	Max. gauss reading	
		Before	After
105-J, REF. GAS COMPRESSOR:			
1.0	**Turbine Free End Journal Bearing**		
1.1	Base Ring	1.1	
1.2	Pads	1.0	
2.0	**Turbine Coupling End Journal Bearing**		
2.1	Rotor Journal Portion	2.3	
2.2	Thrust Journal Portion	4.0	0.7
2.3	Thrust Collar	7.2	2.0
2.4	Base Ring	5.1	1.1
2.5	Pads	3.2	0.8
3.0	**HP Case Coupling End Journal Bearing**		
3.1	Thrust Bearing Shaft	17.2	2.3
3.2	Thrust Bearing Pads	2.3	
3.3	Thrust Bearing Base Ring	7.1	0.8
4.0	**HP Case Free End Thrust Bearing**		
4.1	Thrust Bearing Shaft	10.1	1.3
4.2	Thrust Bearing Pads	1.7	
4.3	Thrust Bearing Base Ring	7.2	0.9
5.0	**LP Case Free End Thrust Bearing**		
5.1	Thrust Bearing Shaft	16.2	1.9
5.2	Thrust Bearing Pads	0.8	
5.3	Thrust Bearing Base Ring	2.1	
5.4	Thrust Collar	2.3	
6.0	**Gear Box**	2.9	
107-JAB, aMDEA PUMP:			
1.0	**Turbine West Bearing**		
1.1	Bearing Shaft	0.8	
1.2	Thrust Bearing Pads	0.9	
1.3	Bearing Cage	0.8	
1.4	Bearing Housing	3.4	
1.5	Thrust Collar	1.3	
2.0	**Turbine East Bearing**		
2.1	Bearing Shaft	0.9	
2.2	Bearing Cage	0.7	
2.3	Bearing Housing	1.8	

ANNEXURE- 10

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DETAILS OF INSITU-METALLOGRAPHIC INSPECTION

SR. NO	LOCATION	MOC	MICROSTRUCTURE OBSERVATION	REMARK
1	**AUXILIARY BOILER TUBES-A COIL EAST SIDE** (Weld / HAZ) On weld bet^{n} 1st New & Old Tubes of A-Coil towards East	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows relatively uniformly distributed ferrite & pearlite structure. Initial stage of spheroidization of pearlite is observed.	Normal structure . Base line structure for future reference.
2	**AUXILIARY BOILER TUBES-A COIL EAST SIDE** (Weld / HAZ) On weld bet^{n} 1st Old Tube of coil –A & Header towards East	CS – A-106 Gr.B	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure Microstructure at Parent metal shows ferrite & pearlite structure with few widmanstaten ferrite.	No significant degradation. Monitor after 2 years of service.
3	**AUXILIARY BOILER TUBES-A COIL WEST SIDE** (Weld/HAZ) on weld bet^{n} 2nd new & old Tubes Of A-Coil towards west	CS – A-106 Gr.B	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows relatively uniformly distributed ferrite & pearlite structure.	Normal structure. Base line structure for future reference.
4	**AUXILIARY BOILER TUBES-A COIL WEST SIDE** (Weld / HAZ) On weld bet^{n} 1st Old Tube & Header towards west	CS – A-106 Gr.B	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite/ bainite structure. Microstructure at Parent metal shows ferrite & pearlite structure with widmanstaten ferrite.	As such operation degradation is not significant. The presence of widmanstaten ferrite indicates inferior heat treatment quality (manufacture stage)
5	**NG-9-12"(101B-MIXED FEED COIL TO NG-11)** (Parent Metal) On face of bend	P-11	Micro structure shows coarse & fine-grained essentially ferritic structure. carbide observed at grain boundaries. Presence of creep cavities is observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year of service.
6	**NG-9-12"(101B-MIXED FEED COIL TO NG-11)** (Weld/HAZ) on weld bet^{n} .Bend & pipe	P-11	Microstructure at Weld shows ferrito-bainitic structure in dendritic form whereas HAZ microstructure shows ferrite & bainite .Degradation of bainite is observed. Microstructure at Parent metal shows essentially ferrite structure.Carbide observed at grain boundaries.Indication of creep cavities are observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year of service.
7	**NG-9-12"(101B-MIXED FEED COIL TO NG-11)** (Weld/HAZ) on weld bet^{n} .Bend & pipe	P-11	Microstructure at Weld shows ferrito-bainitic structure in dendritic form whereas HAZ microstructure shows ferrite & bainite .Degradation of bainite is observed. Microstructure at Parent metal shows essentially ferrite structure.Carbide observed at grain boundaries.Indication of creep cavities are observed at grain boundaries	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year of service.
8	**MIXED FEED COIL OUTLET TO NG-9-12"-DISSMILAR JOINT** (Weld/HAZ) On dissimilar weld bet^{n}. Pipe & Nozzle of Header.	P11 to SS 304H	Microstructure at HAZ shows ferrite & bainite. Microstructure at Parent metal shows ferrito-bainitic structure. Degradation of bainite is observed. Indications of creep cavities are observed. Fusion is normal and intact between dissimilar metal.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year of service.

9	**MIXED FEED COIL OUTLET TO NG-9-12"-DISSMILAR JOINT** (Weld/HAZ) On dissimilar weld bet^{n}. Pipe & Nozzle of Header.	SS 304H to P11	Microstructure at Weld metal shows ferrite pools in austenite matrix. Heavy carbide precipitation is observed. Microstructure shows austenitic structure with twins. . Heavy carbide precipitation is observed at grain boundaries.	Carbide precipitation is expected in such service. Care may be taken not to expose any sulfur related deposition during shutdown on external surface.
10	**A-21-10"(FROM 101-B AIR PREHEAT TO 103D)** (Weld/HAZ) On weld bet^{n}. Pipe & Nozzle of Coil.	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite/ bainite structure. Microstructure at Parent metal shows non-uniformly distributed ferrite & pearlite structure .	No significant degradation observed. Monitor after 2 years of service.
11	**A-21-10"(FROM 101-B AIR PREHEAT TO 103D)** (Weld/HAZ) On weld bet^{n}. Pipe & Nozzle of Coil.	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite/ bainite structure. Microstructure shows fine grained essentially ferrite structure. Carbide observed at grain boundries.	No significant degradation. Monitor after 2 years of service.
12	**PRIMARY WASTE HEAT EXCHANGER 101-CA** (Weld/HAZ) On weld bet^{n} shell & steam outlet Nozzle BW -1H-14	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite/ bainite structure. Microstructure at Parent metal shows non-uniformly distributed ferrite & pearlite structure .Initial stage of spheroidization of pearlite is observed.	Monitor after 2 years of service
13	**PRIMARY WASTE HEAT EXCHANGER 101-CA** (Parent Metal) On surface of steam outlet Nozzle BW-1H-14	CS	Microstructure shows ferrite & pearlite structure. .Initial stage of spheroidization of pearlite is observed	Monitor after 2 years of service
14	**PRIMARY WASTE HEAT EXCHANGER 101-CA** (Weld/HAZ) On weld bet^{n}. Shell & steam Outlet Nozzle. BW-35H-14	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows non-uniformly distributed ferrite & pearlite structure .Initial stage of spheroidization of pearlite is observed	Monitor after 2 years of service
15	**PRIMARY WASTE HEAT EXCHANGER 101-CA** (Parent Metal) On surface of steam outlet Nozzle. BW-35H-14	CS	Microstructure shows relatively uniformly distributed ferrite & pearlite structure.	Monitor after 2 years of service
16	**PRIMARY WASTE HEAT EXCHANGER 101-CB** (Weld/HAZ) On weld bet^{n}. Shell & steam Outlet Nozzle. BW-5H-14	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrito-pearlite structure.	Monitor after 2 years of service
17	**PRIMARY WASTE HEAT EXCHANGER 101-CB** (Parent Metal) On surface of steam outlet Nozzle. BW-5H-14	CS	Microstructure shows non-uniformly distributed ferrite & pearlite structure.	Monitor after 2 years of service
18	**PRIMARY WASTE HEAT EXCHANGER 101-CB** (Weld/HAZ) On weld bet^{n}. Shell & Outlet Nozzle. BW-36H-14	CS	Microstructure at Weld metal shows ferrite/ bainite & carbide in dendritic form where as HAZ shows fine grained ferrite & bainite structure. Microstructure at Parent metal shows ferrito-bainitic structure. Presences of creep cavities are observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year of service.
19	**PRIMARY WASTE HEAT EXCHANGER 101-CB** (Parent Metal) On surface of outlet Nozzle. BW-36H-14	CS	Microstructure shows non-uniformly distributed ferrite & pearlite structure. Initial stage of spheroidization of pearlite is observed.	Monitor after two years of service.

20	**LINE BETWEEN 101-CA TO 102C PRIMARY WASTE HEAT EXCHANGER TO SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld bet^{n}. Nozzle & Pipe towards 101-CA	A 387 Gr.C	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure.	Monitor after two year of service.
21	**LINE BETWEEN 101-CA TO 102C PRIMARY WASTE HEAT EXCHANGER TO SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld bet^{n}. Nozzle & Pipe towards 102-C	A 387 Gr.C	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows non-uniformly distributed ferrite & pearlite structure . Initial stage of spheroidization of pearlite is observed.	Monitor after two year of service.
22	**LINE BETWEEN 101-CB TO 102C PRIMARY WASTE HEAT EXCHANGER TO SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld bet^{n}. Nozzle & Pipe towards 101-CB	A 387 Gr.C	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure.	Monitor after 2 year of service.
23	**LINE BETWEEN 101-CB TO 102C PRIMARY WASTE HEAT EXCHANGER TO SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld Betn. Nozzle & Pipe towards 102-C	A 387 Gr.C	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows non-uniformly distributed ferrite & pearlite structure	Monitor after 2 year of service.
24	**102C SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld bet^{n} 26thTube of 12th Row from East side Tube sheet	P11	Microstructure at Weld metal shows ferrite; bainite & carbide in dendritic form where as HAZ shows fine grained ferrite & bainitic structure. Microstructure at Parent metal shows ferrito – bainitic structure with presence of coarse widmanstatten ferrite.	Monitor after 2 year of service
25	**102C SECONDARY WASTE HEAT EXCHANGER** (Parent Metal) On Channel from inside at about 1' below Tube sheet Level.	P 11	Microstructure shows coarse & fine grained essentially ferrite structure. Sub-grain formation is observed. Indication of creep cavities is observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after one year Of service.
26	**102C SECONDARY WASTE HEAT EXCHANGER** (Weld/HAZ) On weld Betn .Pipe & steam outlet nozzle; BW-3H-12		Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure. Initial stage of spheroidization of pearlite is observed	Monitor after 2 year of service
27	**PG-2-18", 102C SECONDARY WASTE HEAT EXCHANGER GAS OUTLET** (Weld/HAZ) On Tee-joint Betn.Gas outlet Nozzle:PG-2-18 & PG-5-14	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure. Initial stage of spheroidization of pearlite is observed	Monitor after 2 year of service
28	**PG-5-14", 102C SECONDARY WASTE HEAT EXCHANGER GAS OUTLET** (Parent Metal) On Pipe of Gas Outlet nozzle: PG-5-14	P11	Microstructure shows non-uniformly distributed ferrite/pearlite structure. . Initial stage of spheroidization of pearlite is observed.	Monitor after 2 year of service
29	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Parent Metal) On shell at Bottom near BFW outlet nozzle; BW-12H-8 towards west	CS	Microstructure shows ferrite & pearlite structure.	Monitor after 2 year of service

30	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Weld/HAZ) On weld between BFW outlet Nozzle:BW -12H-8 & Shell at Bottom towards west side	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as at HAZ shows fine grained ferrite & pearlite structure Microstructure at Parent metal shows widmanstaten ferrite & pearlite structure.	Monitor after 2 year of service
31	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Weld/HAZ) On weld between BFW outlet Nozzle:BW -11H-8 & Shell at Bottom toward side	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows widmanstaten ferrite & pearlite structure.	As forged structure. Indicates normalizing heat treatment is not done. This structure has poor impact strength.
32	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Weld/HAZ) On weld between BFW outlet Nozzle:BW -9H -8 & Shell at top towards East side	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows widmanstaten ferrite & pearlite structure	As forged structure. Indicates normalizing heat treatment is not done. This structure has poor impact strength
33	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Weld/HAZ) On weld between BFW outlet Nozzle:BW -10 H-8 & Shell at top towards west side	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows widmanstaten ferrite & pearllite structure	As forged structure.Indicates normalizing heat treatment is not done. This structure has poor impact strength
34	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** (Weld/HAZ) On weld between flange & Bend of gas outlet Nozzle:PG-5H- 18 towards East side	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows coarse & fine grained essentially ferritic structure. Microstructure shows fine-grained essentially ferritic structure. Indications of creep cavities are observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after 1 year of service
35	**103C PRIMARY SHIFT EFFLUENT WASTE HEAT EXCHANGER** Weld/HAZ) On weld between Pipe & bend of Gas outlet Nozzle: PG-7H-10 towards West side	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows grained ferrite & & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure Initial stage of spheroidization of pearlite is observed	Monitor after two year of service.
36	**METHANATOR-106D** (Weld/HAZ) on circumferential weld between. Shell & Bottom Dish	P1	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure. Initial stage of spheroidization of pearlite	Monitor after 2 years of service.
37	**METHANATOR-106D** (Parent Metal) On Knuckle portion of Bottom Dish	P1	Microstructure shows non- uniformly distributed ferritie & pearlite structure	Monitor after 2 years of service.
38	**STEAM DRUM-101-F** (Weld/HAZ) On circumferential weld between Dish & Shell towards south side	SA 515 Gr.70	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferritie & pearlite/bainite structure. Microstructure at Parent metal shows non- uniformly distributed ferrite & pearlite structure.Carbide observed at grain boundaries	Monitor after 1 years of service; by gold sputterning & SEM
39	**STEAM DRUM-101-F** (Weld/HAZ) On circumferential weld between Dish & Shell towards north side	SA 515 Gr.70	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure. Microstructure at Parent metal shows ferrite with few pearlite structure.	Monitor after 2 year of service

40	**LT STEAM SUPER-HEATER HEADER** (Parent Metal) On Bottom Header near 2h Tube from North side	T11	Microstructure shows non-uniformly distributed fine-grained ferrite/pearlite structure.Carbide observed at grain boundaries. Indications of creep cavities are observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after 1 year of service
41	**LT STEAM SUPER-HEATER HEADER** (Parent Metal) On Top Header near 2nd Tube from North side	T11	Microstructure shows non-uniformly distributed fine-grained ferrite/pearlite structure.Carbide observed at grain boundaries. Presences of creep cavities are observed.	2nd stage of creep damage. Recommended to confirm the creep cavities by Gold sputtering & SEM .Monitor after 1 year of service
42	**LT STEAM SUPER-HEATER - COIL** (Parent Metal) On Bend of 5th coil tube from north side	T11	Microstructure shows non-uniformly distributed fine-grained ferrite/pearlite structure. Carbide observed at grain boundaries.	Monitor after 2 year of service
43	**LT STEAM SUPER-HEATER COIL** (Weld/HAZ) On weld between Pipe & Bend of 5th coil from north side	T11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure	Monitor after 2 year of service
44	**HT STEAM SUPER-HEATER HEADER** Parent Metal) On top Header near 1st Tube from north side .	T22	Microstructure shows fine-grained essentially ferritic structure. Sub-grain formation is observed	Monitor after one year of service
45	**HT STEAM SUPER-HEATER COIL** Parent Metal) On Bend of 5th coil Tube from south side	T22	Microstructure shows fine-grained essentially ferritic structure. Indications of creep cavities are observed.	Monitor after one year of service; by gold sputtering & SEM
46	**HT STEAM SUPER-HEATER COIL** (Weld/HAZ) On weld between Pipe & Bend of 5th coil from south side	T22	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure of parent metal shows non-uniformly distributed ferrite/ pearlite structure	Monitor after 2 year of service
47	**SG-1-12" (106D TO 114C)** (Parent Metal) On face of bottom end near 114C	P11	Microstructure shows relatively uniformly distributed ferrite & pearlite structure .	Monitor after 2 year of service
48	**SG-1-12" (106D TO 114C)** (Weld/HAZ) On weld between Bottom & Top Bend near 114C	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows non uniformly distributed ferrite & pearlite structure. Initial stage of spheroidization of pearlite.	Monitor after 2 year of service
49	**SG-1-12" (106D TO 114C)** (Parent Metal) On face of Top Bend near 114C	P11	Microstructure shows fine-grained essentially ferritic & structure	When compared to 2004 structure at same region it showed disintegration of pearlite. Rounded region in the microstructure are artifacts due to pitting. It need to be monitored during during next opportunity.
50	**PG-6-18" (104D TO 103C)** (Parent Metal) On face of Bend near 104D	P11	Microstructure shows fine-grained essentially ferritic structure. Presence of deformation bands is observed in ferrite grains.	Monitor for restriction in expansion (Stress analysis is recommended) 2nd stage of creep damage Monitor after 1 year of service.

51	**PG-6-18" (104D TO 103C)** (Weld/HAZ) On weld between pipe & Bend near 104-D	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure. Initial stage of spheroidization of pearlite.	Monitor after 2 years of service.
52	**SG-33-14" (122C TO 123C)** (Weld/HAZ) On weld between. Top outlet Bend & flange	P22	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows non- uniformly distributed ferrite & pearlite structure. Initial stage of spheroidization of pearlite observed	Monitor after 1 years of service.
53	**SG-33-14" (122C TO 123C)** (Parent metal) on Top outlet Bend	P54	Microstructure shows ferrite-bainitic structure.	Monitor after 2 years of service.
54	**SG-33-14" (122C TO 123C)** (Weld/HAZ) On weld between Top outlet Bend	P22	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure Microstructure at parent metal shows ferrite-bainitic structure.	Monitor after 2 years of service.
55	**PG-1101-01-F34 (H-110 TO R-110)** (Weld/HAZ) On weld between. Pipe & Bend. Near H -110	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite & pearlite structure Microstructure at parent metal shows ferrite & pearlite structure	Monitor after 2 years of service.
56	**PG-1101-01-F34 (H-110 TO R-110)** (Parent Metal) On face of bend near H-110	P11	Microstructure shows essentially ferrite structure. Accumulation of creep damage in the form of thickening of grain boundaries are observed .	SEM analysis is recommended. Monitor after 1 year of service .
57	**6" NV-1102.01-F34 (R-111 TO H-111** (Weld/HAZ) On weld between Pipe & flange near R-111	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure.	Monitor after 2 years of service.
58	**PG-1103-01-G36 (R-112 TO 101-B)** (Weld/HAZ) On weld between bend & horzontal pipe.	P22	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferrite pearlite structure. Microstructure at Parent metal shows coarse-grained ferrite & bainitic structure.	Monitor after 2 years of service.
59	**HS-2H-12" (FROM 101F TO HS-2)** (Parent Metal) on valve near Steam Drum.	CS	Microstructure shows coarse & fine-grained essentially ferritic structure.Presence of deformation bands is observed in ferrite grains.	Monitor after 1 years of service.
60	**HS-3H TO HS-4 (HIGH PRESSURE STEAM PIPELINE)** (Weld/HAZ) On weld between HS-3H & HS-4 Steam Pipeline towards HS-3H	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as at HAZ shows fine -grained ferritie & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure.	Monitor after 2 years of service
61	**HS-3H TO HS-4 (HIGH PRESSURE STEAM PIPELINE)** (Weld/HAZ) On weld between HS-3H & HS-4 H Steam Pipelines towards HS-4H	P11	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as at HAZ shows fine -grained ferritie & pearlite structure. Microstructure at Parent metal shows ferrite & pearlite structure.	Monitor after 2 years of service

62	**1013-6325-6" FLANGE TO ELBOW JOINT** (Weld/HAZ) On weld bet^{n} 6^{n} Fiange & bend near 115JA	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferritie pearlite structure. Microstructure at Parent metal shows non- uniformly distributed ferrite & pearllite structure with widmanstatten ferrite.	As forged structure.Indicates normalizing heat treatment is not done. This structure has poor impact strength
63	**1013-6325-6" FLANGE TO ELBOW JOINT** (Weld/HAZ) On weld bet^{n} 6^{n} Fiange & Bend near 115JA	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferritie & pearlite structure. Microstructure at Parent metal shows fine grained essentially ferritic structure.	Monitor after 2 years of service.
64	**COMPONENT (ESP PH.1)** (Parent Metal) On 14^{n} Elbow	CS	Microstructure shows fine grained essentially ferritic structure.	Microstructure shows decarburization at surface .
65	**COMPONENT (ESP PH.1)** (Parent Metal) On 18 X 14" Tee No –K52046386 (SCH 40)	CS	Microstructure shows fine grained essentially ferritic structure with few pearlites.	
66	**REPLACED COMPONENT (ESP PH.1)** (Parent Metal) On failed Elbow near punctured region at 112C	CS	Microstructure shows non- uniformly distributed ferrite & pearllite structure with few widmanstatten ferrites.	
67	**AUTOCLAVE- V1201** Weld/HAZ) On circumferential weld between Shell plates at 1st plateform form Top towards externally	CS	Microstructure at Weld metal shows ferrite & carbide in dendritic form where as HAZ shows fine grained ferritie & bainite structure. Microstructure at Parent metal shows fine grained essentially ferritic structure.	Monitor after 2 years of service.

Annexure - 11

1160

WELDING PROCEDURE SPECIFICATIONS (SEE QW -201.1 SECTION IX,ASME BPVC)

WPS NO.: 102-C T/TS

Welding Process	:	GTAW
Type	:	Manual

1. JOINT DESIGN (QW - 402)

Groove design	:	As per Tube bundle drawing
Backing	:	N.A.
Others	:	N.A.

2. BASE METALS (QW - 403)

P.No. 4 to P. No. 4	
Specification	: SA 182 Gr.- F11 to SA 213 Gr.-T11
Thickness Range	: Tube Sheet 165mm (6 ½"), Tube :- 4.191 mm (8BWG) Tube projection 4.76 - 6.35 mm Fillet of 4.76 mm

3. FILLER METALS (QW - 404)

Weld metal analysis	: A No. 3
Filler Metal F No.	: 6
AWS No. (Class)	: Filler: SFA 5.28 (ER 80SG)
Size of Filler wire	: 2.4 mm

4. POSITION (QW - 405)

Position of Groove	:	ALL
Welding Progression	:	
Other	:	

5. PREHEAT (QW - 406)

Preheat Temperature min.	:	125 to 150 degree C
Interpass Temperature max.	:	300 degree C
Preheat Maintenance	:	200 degree C

6. DEHYDROGENATION

Soaking Temperature	:	350 degree C
Soaking time	:	24 hours
Heating Rate	:	35 degree C/hr
Cooling Rate	:	35 degree C/hr
Loading/Unloading Temperature:		150 degree C

7. GAS (QW - 408)

Shielding gas	:	Argon
Gas consumption	:	99.995 %
Flow rate	:	10 to 12 litters / min
Purging gas	:	NA
Gas consumption	:	NA
Flow rate	:	NA

8. ELECTRICAL CHARACTERISTICS (QW - 409)

Current	:	DC
Polarity	:	EP for GTAW
Ampere (Range)	:	80 to 130
Other	:	

9. TECHNIQUE (QW - 410)

String or weave bead	:	String and weave
Initial & Interpass cleaning	:	Grinding & brushing
Oscillation	:	N.A.
Method of back gouging	:	N.A.
Contact tube to work distance:		N.A.
Single or multiple pass	:	Multiple
Travel Speed (Range)	:	4 to 6 cm/min for GTAW

10. WELD INSPECTION

Root weld	:	DP Test
Final weld	:	DP Test

11. STRESS RELIEVING PROCEEDURE

Soaking Temperature	:	675 degree C
Soaking time	:	1 hour
Heating Rate	:	35 degree C/hr (Max.)
Cooling Rate	:	35 degree C/hr (Max.)
Loading Temperature	:	350 degree C
Unloading Temperature	:	300 degree C

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- Internal inspection of High-pressure vessels. Viz Autoclave (V-1201),H. P. Stripper (H-1201) and H.P. Condenser (H-1202).

- Internal inspection of other vessels in the Plant.

- Ultrasonic thickness measurement of various pipelines including HP lines in the Plant. Detailed report is attached at **Annexure-1.** Two nos. of elbows were replaced for pipeline PR–1231– 3" (From PRCV 1201 To H-1203) as 22.51% reduction in thickness was observed in Shutdown-2003 and were recommended for replacement.

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

- Qualification tests of welders employed by contractors.

- Insitu Metallography of V-1201 (Autoclave) carbon steel shell was carried out and no abnormality was observed.

- 7. Residual magnetism measurement of Hitachi compressor rotor (Q-1801), various parts of Old Co2 compressor (K-1101/1) and PB compressor (K-1101/2) was carried out. Detailed report is attached at **Annexure-2**

- Radiography of butt weld of weldolets of HP Lines was carried out. Details are given in **Annexure-3**

- Inspection of entire carbon steel shell of Autoclave (V-1201) after removal of its insulation was carried out.

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

HIGH PRESSURE VESSELS:

AUTOCLAVE (V-1201):

VISUAL INSPECTION:

Thorough visual inspection of the liner, its welds, trays and internals was carried out. Observations made on each compartments are mentioned below.

- Compartment No.1 (Top Compartment):

  Minor Roughening /corrosion of dome liner was observed and also grayish oxide layer was observed on dome and man way surface.

3 Nos. Spot-welds observed to have corroded in North-West direction just below the circumferential seam and 1 no. Undercut was observed on long seam in North East direction. All these spots were marked for repair.

- Compartment No.2:

Minor roughening of tray holding clits and brownish oxide layer was observed on bottom side of trays.

- Compartment No.3:

Very minor roughening was observed on insert liner.

2 nos. of spot welds observed to have corroded which were marked for repair.

Few 'J' bolts were found loose which were marked.

- Compartment No.4:

Slight roughening of insert liner plate and tray holding clits was observed.

Approx. 30 mm below circumferential weld a depression of approx. 100 mm dia. and 3 mm depth observed at west side liner. Same was observed during last inspection also.

Convex bulging of liner plate observed just above circumferential weld by approx. Less than 4 mm height from North to West side.

- Compartment No.5:

Convex bulging of liner plate was observed just above the circumferential weld joint by approx. 3 to 9 mm height starting from north to south direction. The same was observed during last inspection also.

Concave depression of max. 4 to 5 mm was observed at approx. 500 mm below circumferential length. The same was observed during last inspection also.

One crevice cavity of 1.5 feet long was observed on North West long seam and one no. Spot-weld cavity observed on shell liner. These were marked for repair.

- Compartment No.6:

Convex bulging of liner plate was observed above the circumferential weld joint by approx. 3 to 10 mm height, which starts from north-west to south-east direction in approx. Length of 4500 mm. The same was observed during last inspection also.

Concave depression of less than 5 mm depth was observed at approx. One meter below circumferential weld in area of approx. 750 X 70 mm at East side of shell. The same was observed during last inspection also.

- Compartment No.7:

  Convex bulging of liner plate was observed above the circumferential weld joint by approx. less than 6 mm height in approx. 2 mtr. Circumference from South-East to West side. The same was observed during last inspection also.

- Compartment No.8:

  2 nos. cavities were observed and same were marked for repair.

- Compartment No.9:

  One no. Cavity was observed which was marked for repair.

- Compartment No.10:

  4 nos. Old clit welding marks were found corroded which were marked for repair.

- Compartment No.11:

  Just below circumferential weld concave depression of approx. 4 to 6 inch drain North-West direction was observed. The same was observed during last inspection also.

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

  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).

  2 nos. of undercuts were marked for repair in long seam in north direction.

- 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. 11 nos. of defect indications were marked for repair.

- All marked defects were repaired, DP tested followed by ferrite content checking and found nil.

THICKNESS MEASUREMENT:

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Ultrasonic thickness measurement was carried out on liner. The readings are summarized as below:

- MAIN LINER THICKNESS:

	Min.Thk. (mm)	Max.Thk (mm)	Remarks
Man way	6.69	6.86	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Dome area	6.34	6.64	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Compartment 1 (New liner)	6.72	6.92	Replaced with 2 RE69 in April-02, with 6.5 mm thick liner plate.
Compartment 1 (Old liner)	4.33	4.68	Installed thickness 5 mm.
Compartment 2	4.2	5.0	Installed thickness 5 mm.
Compartment 3	4.16	4.46	Installed thickness 5 mm.
Compartment 4 Below cirseam north side	4.0	4.64	Installed thickness 5 mm.
Compartment 5	4.84	4.81	Installed thickness 5 mm.
Compartment 6	4.46	4.81	Installed thickness 5 mm.
Compartment 7	4.63	4.67	Installed thickness 5 mm.
Compartment 8	4.63	4.9	Installed thickness 5 mm.
Compartment 9	4.61	4.76	Installed thickness 5 mm.
Compartment 10	4.88	5.24	Installed thickness 5 mm
Compartment 11 old liner	4.67	4.78	Installed thickness 5 mm
Compartment 11 New (Partial)	6.55	6.67	Replaced with 2 RE69 in April-02 with 6.7 mm thick liner plate.
Compartment 12 Shell liner	4.76	4.8	Installed thickness 5 mm
Compartment 12 Dome liner	6.57	6.59	Fabricated from 7 mm thick 2RE69 plate.

- INSERT LINER:

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Minimum thickness of insert liner of different compartments are as under:

Compartment nos.	Minimum Thickness observed(MM)
3	6.75
4	6.32
8	6.57
9	6.68
10	6.48

- DOWN COMER AND TRAYS:

Compartment No.	Down comer thickness (mm)		Tray thickness (mm)	
	Design thk.	Min.	Design thk.	Min.
1	10.0	--	8.0	6.31
2	10.0	8.66	8.0	6.31
3	10.0	8.72	8.0	6.39
4	10.0	8.75	8.0	6.40
5	10.0	8.64	8.0	6.71
6	10.0	8.94	8.0	6.80
7	10.0	8.94	8.0	6.71
8	10.0	9.11	8.0	7.10
9	10.0	9.54	8.0	7.39
10	10.0	9.78	8.0	7.74
11	10.0	9.70	8.0	8.12
12(10"NB) on Down comer pipe	10.0	9.89	8.0	8.16
12(10"NB) on Reducer	10.0	10.0		
12(8" NB) on Reducer	10.0	8.63		
12(8"NB) on Distance pipe	6.00	4.63		

- **EXTERNAL INSPECTION ON CS SHELL:**

The following inspection activities were carried out.

100% MPI of all circumferential and longitudinal butt weld joints.
100% DPT of all fillet welds / branch welds of connected nozzles.
UFD of all T-Joints.

Thickness measurement of shell.Minimum thickness were observed as under:

Description	Design Thickness(mm)	Min.measured Thk. (mm)
Shell	103	100
Top dish end	55	58
Bottom dish end	55	57

Insitu metallography on selected spots.

Hardness measurement was carried out at randomly selected location ranging from 160 to 170 BHN.

Paint coating thickness measurement of Reactor.

External condition of vessel was found satisfactory with respect to all the above-mentioned activities.

HP STRIPPER (H-1201):

- **BOTTOM DOME:**

The following inspection activities were performed.

Visual Inspection
Thickness measurement

The observations on above inspections are as under. :

- VISUAL INSPECTION:

Two nos. nuts and one bolt of flange of urea solution outlet line were observed blackish compared to other bolts.

Tube to tube sheet seal welds as well as shell to tube sheet overlay welds were found in satisfactory condition and observed to be covered with the oxide layer.

2 nos. Cavities of approx. 2 mm depth x 2mm width x 4 mm length & 2 mm depth x 2 mm width x 25 mm length respectively observed on man way overlay weld. Marked for repair.

Two nos. Liner plates, which had one horizontal weld seam as observed in Short S/D-August 2002 were found to be in satisfactory condition however minor roughening of weld seam has initiated.
Ferrite was measured and no ferrite was observed.

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- Overlay weld and Liner thickness measurement was carried out and details are as under:

DESCRIPTION	Minimum Thickness mm	Maximum Thickness mm	Design Thickness mm (Minimum)
Man way (Overlay)	19.32	24.35	8.0
Dome area (Overlay)	12.08	14.12	8.0
Cylindrical area (Liner)	8.22	10.75	8.0
Tube sheet-Overlay weld	20.15	24.2	8.0
Bottom Cover (Overlay)	15.23	19.2	8.0

- **TOP DOME:**

The following inspection activities were performed.

Visual Inspection
Thickness measurement

The observations on above inspections are as under. :

- VISUAL INSPECTION:

Condition of weld joints was found satisfactory.

Thin oxide layer was observed on top half portion where as shiny surface was observed on bottom area of shell.

Ferrite was measured and no ferrite was observed.

Overall condition was found satisfactory.

- Overlay weld and Liner thickness measurement was carried out and details are as under:

DESCRIPTION	Minimum Thickness mm	Maximum Thickness mm	(Minimum) Design Thickness, mm
Man way (Overlay)	19.4	23.7	8.0
Dome area (Overlay)	11.56	13.85	8.0
Cylindrical area (Liner)	8.04	8.4	8.0
Tube sheet-Overlay weld	13.55	18.5	8.0
Top Cover (Overlay)	11.39	11.88	8.0

- **H.P. CONDENSER H-1202:**

The following inspection activities were performed.

Visual Inspection
Thickness measurement

The observations on above inspections are as under. :

VISUAL INSPECTION:

Top Cover & Bottom Cover:

Sealing face was found satisfactory. Liner & welds were found smooth, except, 08 nos. spots on liner plate of top cover, which have got roughened. These were polished and passivated with 5% HNO3 and finally cleaned with DM water.

Top Channel Head:

The internal surface found to be silver shiny with light brownish band of approx. 75-80 mm width at approx. 300 mm above the tube sheet. Grayish passivation layer was found at very few scattered locations.

Minor roughening of dome and cylindrical area liner was observed where as man way liner was found smooth.

Minor roughening of all the circumferential and longitudinal welds was observed which were found more predominant on the fillet welds of patch plate.

Tube to tube sheet weld had shown no sign of corrosion/ roughening and were found smooth.

Ferrite content was checked on randomly selected spots at welds and parent metal. No ferrite was found.

Thickness measurement of liner segments was carried out.

Bottom Channel Head:

No sign of corrosion/ roughening observed on entire bottom dome area. All welding joints and liner surface found smooth.

At two locations, 2mm deep x 3mm wide cavity was observed on the circumferential weld seam of man way to dome. The same was got repaired and DP tested. Ferrite was also checked and found nil.

Tube to tube sheet seal weld shows no sign of corrosion.

Thickness measurement of liner segments was carried out.

Ferrite content was checked on randomly selected spots at welds and parent metal. No ferrite was found.

DP test of longitudinal weld seam of manway was carried out. One no pinhole detected in heat affected zone of weld. The same was got repaired and DP tested. Ferrite was also checked and found nil.

- **Overlay weld and Liner thickness measurement:**

Top Section:

	Minimum Thickness, mm	Maximum Thickness, mm
Cover (Liner)	18.9	19.67
Man way (Liner)	6.34	7.4
Dome area (Liner)	6.7	7.7
Cylindrical area (Liner)	6.4	6.9
Tube sheet-Overlay weld	10.3	14.6

Bottom Section:

	Minimum Thickness, mm	Maximum Thickness, mm
Cover (Liner)	18.88	19.22
Man way (Liner)	4.46*	8.1
Dome area (Liner)	6.75	6.92
Cylindrical area (Liner)	6.46	7.19
Tube sheet-Overlay weld	10.28	18.76

- Observed at bottom of right hand side of longitudinal weld at west side.
- Gap measurement between liner and shell was carried out for manway area and the same was found in the range of 0.6 to 1.48 mm, which confirms that no corrosion of CS portion beneath SS liner has taken place.
  Refer Photo-1 attached herewith.

- **INSPECTION OF OTHER VESSELS:** 171

H-1113 A/B (Main L.O.Cooler for K-1101/1):

Tube and Tube sheet observed in satisfactory condition.

Epoxy coating was seen to be in satisfactory condition at North end channel center but has been peeled off at inside of South end channel at few locations resulting in corrosion attack.

H-1204 (Recirculation Heater):

Tube to tube sheet weld found in good condition.

Orifice plugs at bottom of tube sheet found intact in position however, urea/water was observed accumulated around O.D. of few orifice plugs.

Brownish deposits observed inside some of the tube holes.

H-1207 (Circulation System-II Cooler):

Heavy corrosion/pittings were observed on the tube sheet area.

Scaling were observed at the inside of approximately 50 % of the tubes. This was found predominant at the upper half of the exchanger.

Epoxy paint found peeled off from the many locations at the inside of the end cover, also partition plate found deformed.

H-1209 (L P Absorber Cooler) :

LP absorber cooler was offered for visual inspection after removal of its tube bundle. The observations made are as under. :

Exchanger Shell:

Scattered scaling/rusting and corrosion cavities up to a depth of 1-2 mm were observed at the inside of shell.

Shell drain nozzle located at South end found to have its weld joint porous at the inside of shell, which was got repaired.

Tube Bundle :

Tube to tube sheet weld joints were found satisfactory.

External surface of almost all the tubes found covered with thin & hard Scales / coating. Cleaning was recommended.

Minor corrosion attack was observed on all the baffle where as moderate corrosion attack was observed on all the tie rods.

H-1301 A/B/C (Desorber heat exchanger): 172

Tube to tube sheet seal welding was found satisfactory, however on H-1301/B west side tube-to-tube sheet weld joints found to have grinding marks at few locations (This seems to be from beginning).

H-1303 (Desorber Bottom Heat Exchanger) :

Minor scales and rusting was observed at the both sides of tube sheet.

Rusting and fine debris were observed at the inside of almost all the tubes, proper cleaning is recommended.

Tube to tube sheet welding was found satisfactory.

H-1351/C (Hydrolyser feed preheater) :

Tube to tube sheet seal welding was found satisfactory.

Minor damages of few tube ends were observed.

H-1352 (Reflux Condenser):

TOP TUBE SHEET:

Tube to tube sheet welding was found satisfactory.

Minor scaling were observed on the inside surface of all the tubes looking from the top end.

BOTTOM TUBE SHEET:

Tube to tube sheet welding was found satisfactory.

On cooling water outlet side, scaling was observed inside almost all the tubes , proper cleaning is recommended.

Complete tube sheet found wet on cooling water outlet side.

Entire inside surface of cooling water outlet line found covered with approx. 2 mm thick gray colour scales.

Epoxy coating found peeled off at scattered locations from the C.W. Inlet & Outlet channel.

H-1419 (Pre-evaporator Condenser) : 173

BOTTOM TUBESHEET:

Tube to tube sheet weld found satisfactory.

Seal welding on 3" nozzle to bottom channel cover has not been carried out. Recommended to get it welded.

1 ½ ' nozzle pipe observed completely choked.

TOP TUBESHEET:

Tube to tube sheet weld found satisfactory.

Overall condition of vessel found satisfactory.

H-1420 (FINAL CONDENSER) :

Tube to tube sheet welding found satisfactory of both the tube sheets.

Epoxy paint found peeled off from the many locations at the inside of the end cover, also partition plate found deformed.

H-1421 (Flash Tank Condenser):

Tube to tube sheet welding was found satisfactory.

Minor scales was observed inside the few tubes.

All tubes were found filled with water.

H-1422 (1st Stage Evaporator) :

The shell and Dish ends have assumed brownish black in colouration.

Tube to tube sheet weld found satisfactory. Scales and deposits were observed inside the tubes.

Some urea lumps were found accumulated on the inside surface of distributor at the top dished end.

Impingement cone to support welding found in broken condition.

Condensate distributor was found satisfactory.

H-1423 (First Stage Evaporator Condenser):

Tube to tube sheet welding was found satisfactory.

Minor scales were observed inside the few tubes.

All tubes were found filled with water.

H-1424 (2 nd Stage Evaporator) :

Vessel inside was found grayish black in colouration just above the dished end welding.

Tube to tube sheet weld joints were found satisfactory.

One no. Urea lumps were found adhered at top dished end.

Impingement cone found intact however it's drain found chocked with urea lumps.

H-1425 (Second Evaporator First Condenser):

Tube to tube sheet welding was found satisfactory.

Minor scales was observed at the inside of many tubes below the distance of approx. 50 mm from top of the tube.

H-1426 (Second Evaporator Second Condenser):

Tube to tube sheet welding was found satisfactory.

All tubes were found filled with water.

H-1814-A (L.O. Cooler of Hitachi Compressor):

Tubes and tube sheet were found satisfactory.

Epoxy coating has got peeled off at various locations on channel cover inside both east and west cover particularly predominant on west side. Recoating is recommended at such locations to prevent any corrosion.

Blind channel cover flange also observed to have epoxy peeled off causing pits on the inside surface.

H-1814-B (L.O. Cooler of Hitachi Compressor):

Tubes and tube sheet were found satisfactory.

Epoxy coating has got peeled off at various locations on channel cover inside both east and west cover particularly predominant on west side. Recoating is recommended at such locations to prevent any corrosion.

Blind channel cover flange also observed to have epoxy peeled off causing pits on the inside surface.

H-1815 (Surface Condenser for Hitachi Compressor): 175

SOUTH SIDE HALF (West side channel)

Bottom half: Found satisfactory.

Top half: Scales were observed inside almost all the tubes of bottom half. Proper cleaning is recommended.

Epoxy coating found damaged at scattered locations on top half and on end cover surfaces which has resulted in corrosion at such locations, recoating is recommended.

SOUTH SIDE HALF (East side channel)

Bottom half: Found satisfactory except few tubes were found to have scales inside.

Top half: Found satisfactory except few tubes were found to have scales inside.

Epoxy coating found damaged at scattered locations on top half and on end cover surfaces which has resulted in corrosion at such locations, recoating is recommended.

North side partition (East side cover)

Tubes and tube sheet surface condition was found satisfactory.

Epoxy coating was found peeled off at seven locations from seating surface, edge of partition plate and adjacent area near tube sheet, channel cover, recoating was recommended.

North side partition (West side cover)

Scaling was observed at the inside surface of the tubes.

Tubes and tube sheet surface condition found satisfactory.

Epoxy coating found peeled off at many locations at the top half of channel shell, this was marked for proper cleaning and application of epoxy paint.

Epoxy coating was found peeled off at four locations from channel cover.

T-1301 (Ammonia Water Tank):

Brownish colouration on bottom plate and bottom half of shell and silver bright colouration on top half of shell was observed.

Bottom plate was found bulged up side at different locations. Same has been observed in past.

Weld joints and nozzle condition was found to be satisfactory. 176

Water and fine debris found accumulated at the south east corner of the tank.

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

Brown colouration on bottom plate and bottom half of shell and silver bright colouration on top half of the shell was observed.

All weld joints and nozzle condition was found satisfactory.

T-1401 (Urea Solution Tank):

Bottom plate is having bulging upward as has been observed in the past, the central two plates are getting pushed downward. The 70% of the outer most circumference of bottom plate was found bulged upward in a width of approx. 300 mm

Weld joints condition was found satisfactory.

Dark brown colouration was observed inside the tank.

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

Brownish gray colouration was observed on bottom half and bright silver colouration was observed on top half.

Nozzles and weld joint condition was satisfactory.

T-1501 (Condensate Tank):

Brownish black colouration was observed inside the tank.

Weld joint condition was satisfactory.

All nozzle condition was found satisfactory.

In general, condition of the tank found satisfactory.

V-1101 (CO_2 Knock Out Drum):

Epoxy paint was found peeled off from few locations. Also blisters of epoxy paint were observed at few locations.

Demister pads were found intact in position. At few locations it was found chocked (covered) with yellow colour debris.

Brownish colour patches were observed at scattered locations on shell surface.

V-1102 (NH3 SUCTION FILTER) :

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Visual inspection of the vessel was carried out from inside. The observations were as below.

Oily surface was observed inside the vessel.

Overall condition of the equipment was found satisfactory.

Colouration of vessel was brownish from inside.

Condition of SS filter was found satisfactory.

V-1103 (NH3 Suction Vessel):

Visual inspection of the vessel internals was carried out. The observations were as follows.

Colouration of vessel inside was blackish.

The condition of longitudinal and circumferential weld joints was satisfactory.

Oil layer was found on the bottom-dished end.

In general condition of the vessel was found satisfactory.

V-1202 (Rectifying Column):

From Bottom manhole:

Colouration of top cone was silver with black patches where as brownish colouration was found on bottom-dished end.

Lot of debris found at the bottom and at the I.D. Of manhole, proper cleaning is recommended.

V-1203 (L. P. ABSORBER):

From Top End:

Colouration of shell was observed greyish black.

Perforated support grid just below top hand hole found intact in position but its circumferential plate was found distorted at two locations which has resulted in almost complete covering of two out most segment of perforated holes.

From Bottom End:
Colouration of shell was observed grayish black.

Weld joints condition found satisfactory.
Debris were found collected at the bottom dished end.

Packing supporting grid was found intact in position.

V-1206 (Atmospheric Vent Scrubber): 178

Demister pads were found intact in position and condition of the same was found satisfactory.

All fasteners were found intact.

Silver gray colouration was observed inside the vessel with brownish patch at East side.

Overall condition was found satisfactory.

V-1207 (L. P. Scrubber):

The observations of visual inspection from top were as follows.

Colouration of shell portion was observed blackish grey.

In general condition of vessel found satisfactory.

V-1301 (2ND Desorber):

Visual inspection of vessel was carried out from bottom and top manhole. The observations were as follows.

Bottom Compartment:

Brownish colouration was observed inside the vessel.

Nozzle condition was found satisfactory.

Top Compartment:

Brownish colouration was observed inside the vessel.

3 nos. fasteners and its clamp of the tray found in loose condition.

Top nozzle was found satisfactory

V-1351 (HYDROLYSER) :

Visual inspection of vessel top and bottom compartment only was carried out.

Top Compartment:

Top dish end and shell of top section has assumed brownish black colouration and brownish matter was found sticking on the edge of trays.

Trays had brownish colouration.

Fasteners were found intact in position.

Condition of top tray was found satisfactory. 179

Bottom Compartment:

Brownish colouration was observed.

Fasteners of trays were found intact in position

Oil layer was observed all around.

One no. of bolt of steam inlet flange was found loose.

Clamping bolt of steam inlet pipe to shell was also found missing.

V-1352 (First Desorber):

Visual inspection was carried out from top and bottom manhole.

Top Manhole:

Brownish colouration was observed inside the vessel.

All fasteners were found intact

Weld joint condition was found satisfactory.

Brownish colouration was observed inside the vessel.

Thickness measurement was carried out. Minimum thickness of shell was 8.1mm and D.E. was 9.01mm.

V-1418 (Pre Evaporator Separator):

Condition of the cone and weld joints was found satisfactory.

Minor scaling was observed inside the tubes.

Tube to tube sheet weld found in good condition.

Impingement cone found in intact condition.

Vessel inside was found brownish black in colouration.

V-1421 (Flash Drum Scrubber):

Shell inside was found brownish in colour.

Demister pads condition was found satisfactory and were found intact in condition.

Weld joint condition was found satisfactory.

Previously repaired welding near manhole was found satisfactory.

V-1423 (1 ST Stage Evaporator Scrubber): 1 SP

Visual inspection was carried out from top manhole.

Shell inside was observed brownish in colouration.

Demister pads were found intact in position and condition of the same was found satisfactory.

Solidified urea solution particles were found adhered at demister pads at few locations.

Overall condition of the vessel was found satisfactory.

V-1501 (4 ATA STEAM DRUM):

Colouration of shell and Dish ends found brownish black.

3 nos. bolts found loose and 1 missing of baffle plate located on west side near south hole. It is recommended to check the bolts and nuts of all the baffle plates for its tightness.

Distribution sparger found intact in position.

Wire wound to hold the demister pads found unwound of several locations.

Weld joint condition found satisfactory.

V-1502 (23 ATA Steam Drum):

Brownish black colouration was observed inside the vessel.

All the internal fittings were found in good condition.

Weld joints condition was found satisfactory

Overall condition was found satisfactory.

V-1503 (9 ATA Steam Drum):

Colouration of Shell and dished end was observed grayish black for the bottom half where as brownish gray for top half.

Complete internal surface of vessel was found covered with fine dust particles.

Scattered scales were observed on both the dished ends.

BFW inlet line supports welding was found cracked, the same was observed in past also.

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V-1811 (Ist Stage Separator):

Demister pads found intact in position.

Vortex breaker found intact in position.

Colouration of shell had assumed shiny.

1"NB pipe(condensate drain) at the inside of vessel found cracked at a distance from approx. 450 mm from its bottom end.

Overall condition of the vessel found satisfactory.

V-1812 (IInd STAGE SEPARATOR):

Demister pads found intact in position.
Vortex breaker found intact in position.
Colouration of shell had assumed shiny.

Bad odor was found at the inside of vessel.

Overall condition of the vessel found satisfactory.

V-1813 (IIIrd STAGE SEPARATOR);

As seen from the manhole no abnormality observed.

H-1814-A (L.O. Cooler of Hitachi Compressor) :

Tubes and tube sheet were found satisfactory.

Epoxy coating has got peeled off at various locations on channel cover inside both east and west cover particularly predominant on west side. Recoating is recommended at such locations to prevent any corrosion.

Blind channel cover flange also observed to have epoxy peeled off causing pits on the inside surface.

P-1201-A/B (L.O Cooler):

CHANNEL COVER END:

Rusting and corrosion observed on inside surface of channel cover.
Minor pitting and cavities were observed on tube sheet face.

HEAD END:
Minor pitting and corrosion cavities were observed.

P-1102-C (L.O Cooler):

Tube sheet found satisfactory at both sides.

Gasket at C.W inlet found covering approx. 50% holes of one row at bottom half.

ANNEXURE-1

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UREA PLANT PIPELINE THICKNESS MEASUREMENT SUMMARY

Sr No	Line No	Nom Bore (inch)	Nom thick (mm)	Line Description		Min Thk observed	% Red.
				From	To		
1	CO-E10-2122	6	10.97	H-1813	V-1813	9.9	9.75
2	CO-F10-2119	8	23.01	K-1801	H-1813	22.4	2.65
3	CO-F10-2124	8	23.01	K-1801	GA-1112	23.00	0.04
4	CO-F10-2140	4	13.49	CO-F10-2119-8"	TV-1808	11.50	14.75
5	CO-F10-2140-SS	4	8.56	CO-F10-2119	TV-1808	7.20	15.89
6	GA-1101	30	6.25	BL	H-1104	6.30	NIL
7	GA-1112	6	14.27	K-1101-2	GA-1201	12.00	15.91
8	GA-1201	6	13.33	GA-1112	H-1201	13.50	NIL
9	GA-1202	1	6.35	GA-1112	GA-1203	5.00	21.26
10	GA-1202-SS	1	4.55	GA-1112	GA-1203	4.10	9.89
11	MA-1106	4	8.56	MA-1605-6"	MA-1203-4"	7.00	18.22
12	MA-1106-4"	4	8.56	P-1102-A	MA-1605-6"	7.00	18.22
13	MA-1117	4	6.02	RV-1103	MA-1116	5.60	6.98
14	MA-1125	4	6.02	RV-1112	MA-1122	5.90	1.99
15	MA-1128	4	8.56	P-1102/B	MA-1605	7.30	14.72
16	MA-1202	3	7.62	MA-1201	V-1201	7.00	8.14
17	MA-1603-4"	4	6.02	MA-1122-6"	MA-1603-4"	4.90	18.60
18	MA-1603-6"	6	7.11	MA-1122-6"	MA-1603-4"	6.30	11.39
19	MA-1604-3"	3	7.62	1102-C	MA-1604-4"	6.4	16.01
20	MA-1604-4"	4	8.56	MA-1604-3"	MA-1605-6"	8.00	6.54
21	MA-1605	6	14.27	MA-1106	MA-1203	13.3	6.79
22	MA-1605-4"	4	8.56	P-1102 A/B/C	MA-1106-4"	7.90	7.71
23	MA-1607-4"	4	6.02	MA-1605	MA-1116	5.6	6.97
24	MA-1609-4"	4	6.02	P-1102 A/B/C	V-1103	7.0	NIL
25	PR-1201	8	19.58	V-1201	H-1201	18.0	8.06
26	PR-1202	10	24.33	H-1201	HP CONDENSER	21.80	10.40

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Sr No	Line No	Nom Bore (inch)	Nom thick (mm)	Line Description		Min Thk observed	% Red.
				From	To		
27	PR-1203	8	19.58	H-1202	V-1201	13.20	32.58
28	PR-1204	8	19.58	HP-CONDENSER	V-1201	18.6	5.05
29	PR-1205-6"	6	15.24	PR-1205-8"	V-1202	13.10	14.04
30	PR-1205-8"	8	19.58	STRIPPER BOTTOM	V-1202	20.2	-
31	PR-1207	6	3.4	PR-1206	V-1406	3.00	11.76
32	PR-1208	4	10.4	AUTOCLAVE TOP	SCRUBBER	9.8	5.76
33	PR-1212	4	10.4	SCRUBBER	AUTOCLAVE BOTTAM	9.10	12.5
34	PR-1224	3	7.62	P-1201/B	PR-1638-4"	6.00	21.26
35	PR-1225	3	7.62	P-1201 A/B	H-1203	6.30	17.32
36	PR-1230	6	15.24	MA-1203-4"	H-1202	13.20	13.39
37	PR-1231	3	8.12	H-1203	PRCV-1201	7.1	12.56
38	PR-1234-3"	3	7.62	H-1203	V-1203	3.00	60.63
39	PR-1234-4"	4	8.12	PRCV-1201	V-1203	7.40	8.87
40	PR-1253	3	3.05	V-1203	V-1207	2.80	8.20
41	PR-1373	4	3.05	P-1351/B DISCHARGE	PR-1361	2.30	24.59
42	PR-1404	4	3.05	P-1401	V-1409	2.3	24.59
43	PR-1637	4	9.14	P-1201 C	PR-1638-4"	9.2	-
44	PR-1638-4"	4	13.49	P-1201 A/B/C	MA-1230-6"	13.00	3.63
45	SC-1101	14	9.52	H-1102	H-1206	9.20	3.36
46	SC-1102	6	9.52	SC-1228	SC-1101	8.80	7.56
47	ST-1119	2	3.91	ST-1101	Q-1113	3.50	10.49
48	ST-1125-10	10	9.27	ST-1116	PICV-1129	8.10	12.62
49	ST-1205	6	7.11	V-1502	H-1201	5.50	22.64

Annexure-2

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GAUSS MEASUREMENT & DEMAGNETIZATION REPORT

Sr. No.	Component Description	Max. gauss reading	
		Before	After
K-1801,CO2 COMPRESSOR			
1.0	**Turbine South Bearing**		
1.1	Journal bearing shaft	10	4.0
1.2	Journal bearing pads	1.7	
1.3	Journal bearing base ring	1.2	
1.4	Thrust bearing base ring	1.8	
1.5	Thrust collar	27	1.2
1.6	Thrust pads	1.5	
2.0	**Turbine North Bearing**		
2.1	Journal bearing shaft	1.5	
2.2	Journal bearing pads	2.3	
2.3	Journal bearing base ring	2.4	
3.0	**H P Case South Bearing**		
3.1	Journal Bearing Shaft	2.9	
3.2	Bearing Pads	1.2	
3.3	Bearing base ring	2.7	
4.0	**H P Case North Bearing**		
4.1	Journal Bearing Shaft	1.2	
4.2	Journal Thrust Collar	2.5	
4.3	Thrust Pads	1.6	
4.4	Journal Bearing Pads	1.6	
4.5	Journal Bearing Base Ring	1.2	
5.0	**L P Case South Bearing**		
5.1	Journal Shaft Portion	2.3	
5.2	Journal Bearing Pads	1.8	
5.3	Journal Bearing Base Ring	2.9	
6.0	**LP Case North Bearing**		
6.1	Journal shaft Portion	2.2	
6.2	Journal Bearing Pads	2.2	
6.3	Journal Bearing Base Ring	2.7	
6.4	Thrust Collar	1.5	
6.5	Thrust Pads	0.6	

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Sr. No.	Component Description	Max. gauss reading	
		Before	After
7.0	**Gear Box**		
7.1	HP Pinion Shaft	0.8	
7.2	HP Bearing	1.4	
7.3	LP Pinion Shaft	1.2	
7.4	LP Bearing	1.5	
K-1101/1,CO2 COMPRESSOR			
1.0	**TURBINE FRONT BEARING**		
1.1	Journal Bearing	1.9	
1.2	Thrust Bearing	2.6	
2.0	**TURBINE COUPLING END**		
2.1	Turbine Journal	2.6	
2.2	Turbine coupling Shaft Journal Bearing	3.6	
3.0	**COMPRESSOR COUPLING END**		
3.2	Compressor Coupling end Journal Bearing Shaft	3.6	
4.0	**COMPRESSOR THRUST END**		
4.1	Thrust Pads	1.6	
4.2	Thrust Journal Bearing	0.5	
4.3	Thrust end Journal Bearing Shaft	1.5	
	K-1101/2,CO2 COMPRESSOR		
1.0	**TURBINE FRONT BEARING**		
1.1	Thrust end Journal Shaft	0.7	
1.2	Thrust Collar	2.6	
2.0	**TURBINE COUPLING END**		
2.1	Coupling end Radial Bearing	0.7	
2.2	Coupling end Journal Shaft	2.2	

Annexure:3

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Radiography of butt weld joints of the weldolets of the following H.P. line tappings was carried out to check soundness of the same including its parent metal on heat affected area.

Sr. No.	Fitting Identification	Line Where Installed	Observation	Remark
1	TR-1201	V-1201 to H-1201 liquid line	Found satisfactory	
2	TR-1202	HPCC liquid outlet to V-1201	Found satisfactory	
3	TR-1203	Ammonia + Carbamate to HPCC	Found satisfactory	
4	TR-1205	Ammonia to Autoclave	Found satisfactory	
5	TR-1206	Autoclave off gas to H-1203	Found satisfactory	
6	TR-1207	CO2 to HP Stripper	Found satisfactory	
7	TR-1209	Stripper off gas to HPCC	Found satisfactory	
8	TR-1210	Stripper liquid outlet line	Found satisfactory	
9	TI-1214	H-1203 to V-1201 Carbamate line	Found satisfactory	
10	TI-1209	Carbamate pump discharge line to HPCC	Found satisfactory	
11	HPF to PRCV-1201	H-1203 off gas to V-1203	Found satisfactory	
12	HPF to HICV-1202	V-1201 off gas to H-1203	Found satisfactory	
13	HPF to FICV-1204	Carbamate pump discharge to HP scrubber	Found satisfactory	
14	HPF to Seal isolation valve	Liquid outlet from V-1201	Found satisfactory	
15	HPF to Carbamate line to HPCC	Carbamate pump discharge line to HPCC	Found satisfactory	
16	HPF to Ammonia line to HPCC	Ammonia pump discharge line to HPCC	Found satisfactory	

- Condition Assessment and Remaining Life analysis of 80 TPH, BHEL make (GT-2068) boiler was carried out by M/S Thermax Babcock & Wilcox Ltd.,Pune. Detailed report of this is attached at **Annexure-1.**

- Inspection of Deaerator, D.M.water buffer tank, Degasser sump tank and Underground cooling water line of 52" NB from Sump of P-4401 C/D to sump of P-4401 E.

- Replacement of cooling water return header (West Side) Dye penetrate examination & Radiography of welds joints of newly fabricated cooling tower return header.

- DP test & Radiography of weld joints of rerouted piping and tubes of front wall for replacement of new burner.

- OST of Q 4401 B was carried out.

The detailed observations on individual equipment are given below.

DEAERATOR:

Inspection of the deaerator head and the storage shell was carried out. Observations are as under.

DEAERATOR HEAD:

- Middle and West side segment of 5th tray (Bottom most) found dislocated from its position.

- East side tray segment of the 5th tray found slightly damaged i.e. cracked near the angle support.

- Angle supports provided in between i.e. below the trays observed to have sagging downwards.

DEAERATOR STORAGE SHELL:

- Brownish colouration was observed inside the shell.

- Condition of the weld joints was found satisfactory.

U/G COOLING WATER LINE 52"NB FROM SUMP OF P-4401 C/D TO SUMP OF P-4401/E:-

- Underground cooling water line of 52" NB from Sump of P-4401 C/D to sump of P-4401 E was offered from inspection from inside. Inspection was carried out and observations are as under.

- Minor corrosion signs were observed and paint was found peeled off on top portion of the pipe at scattered locations.

- Weld joint condition was found satisfactory.

- Thickness was measured at random from inside. Minimum reading of 10.8 mm and max. reading of 13.1 mm was found.

- Overall condition was found satisfactory.

DM WATER BUFFER TANK

- Inspection of the DM water Buffer Tank was carried out. Observations are as under.

- Cut mark was observed on rubber lining at one location i.e. bottom portion. Marked for repair

- Shore 'A' hardness measurement was carried out at randomly selected spots and found to be ranging from 62 to 70 Shore 'A'.

- In general, condition of rubber lining of complete tank found to be satisfactory.

DEGASSER SUMP TANK

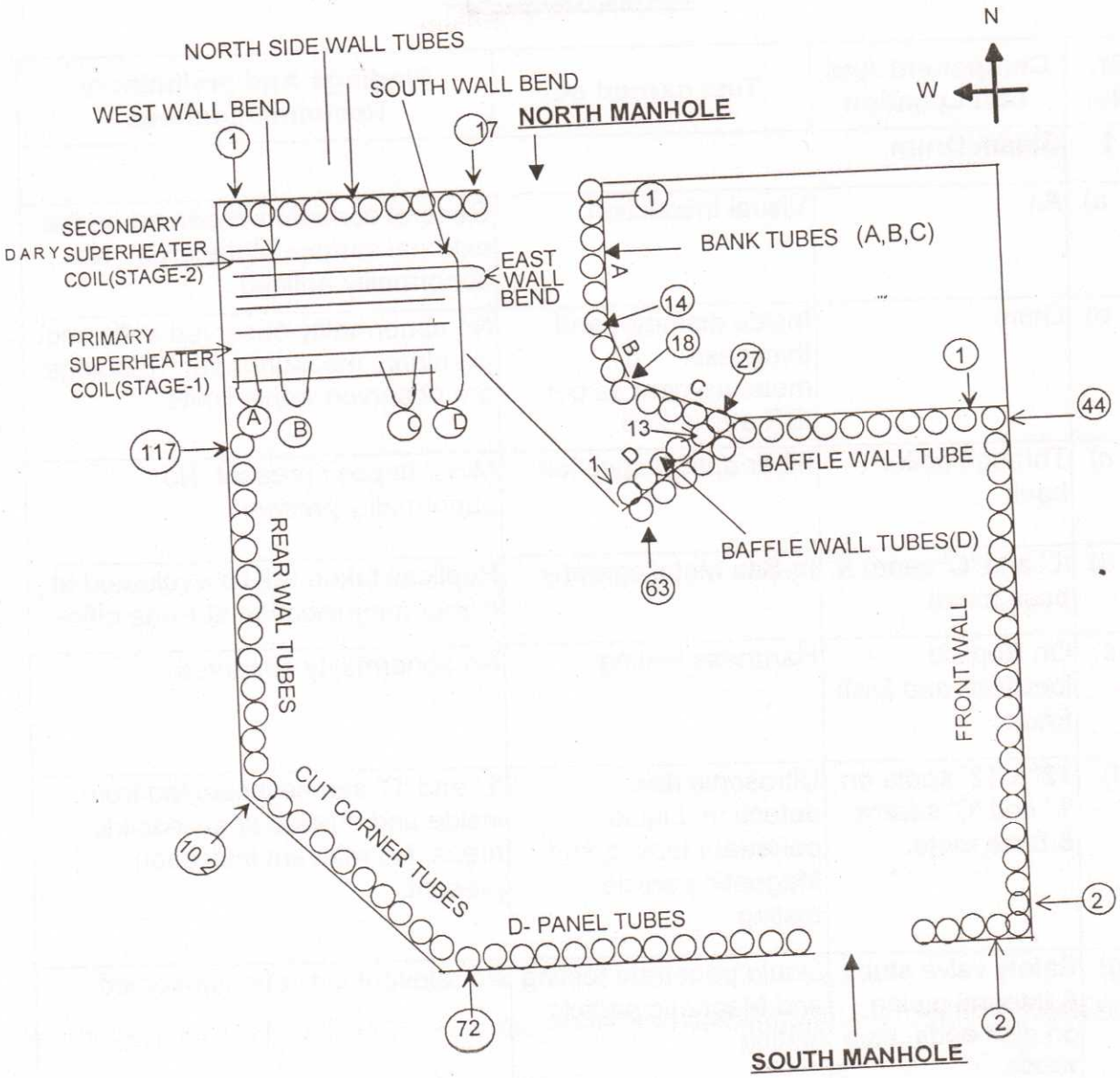
- Inspection of the Degasser Sump Tank was carried out. Observations are as under.

- Shore 'A' hardness measurement was carried out at randomly selected spots and found to be ranging from 62 to 70 Shore 'A'.

- In general, condition of rubber lining of complete tank found to be satisfactory.

COOLING TOWER AREA:

Cooling water return header (West side) of Urea Plant near cooling tower was replaced with SS by M/s Smitha Engineers. Its weld joints were D.P. tested at the various stages of fabrication and defects observed were got rectified.



BHEL BOILER FURNACE LAYOUT
(GT-2068)

ANNEXURE - I

Sr. No.	Component And Test Location	Test carried out	Findings And preliminary Recommendations
1	**Steam Drum**		
a)	All	Visual Inspection	General corrosion observed on the external surface of the drum. No abnormality noticed.
b)	Drum	Inside diameter and thickness. ID measurement as per IBR article 256.	No abnormality observed in ID and circularity measurement. Readings are observed within limits.
c)	Through boiler bank	Fiber optic inspection	Minor deposit present. No abnormality present.
d)	'L' and 'C' seam & base metal	In-Situ Metallography	Replicas taken will be evaluated at higher magnification at Pune office.
e)	On Replica locations and Dish Ends	Hardness testing.	No abnormality observed.
f)	12" x 12" spots on 'L' and 'C' seams & base metal	Ultrasonic flaw detection, Liquid penetrant testing and Magnetic particle testing	'L' and 'C' seams inspected from inside and outside at accessible areas. No relevant indication present.
g)	Safety valve stubs & integral piping on dish ends, stub welds.	Liquid penetrant testing and Magnetic particle testing	No relevant indication observed.
h)	Drum inside deposits	Deposit analysis	Test results will be incorporated in the final report.

'L' seam – Longitudinal seam.
'C' seam – Circumferential seam.

Sr. No.	Component And Test Location	Test carried out	Findings And preliminary Recommendations
2	**Water Drum**		
a)	All	Visual Inspection	Internal and external surface drum found in good condition. Minor corrosion observed on internal surfaces.
b)	Drum	Inside diameter and thickness. ID measurement as per IBR article 256.	No abnormality observed in ID and circularity measurement. Readings are observed within limits.
c)	Through boiler bank	Fiber optic inspection.	Minor deposit present. No major abnormality present.
d)	'L' and 'C' seam & base metal	In-Situ Metallography, Liquid penetrant testing (LPT) and Magnetic particle testing (MPT).	Replicas taken will be evaluated at higher magnification at Pune office. No relevant indication observed in LPT & MPT.
e)	On Replica locations and Dish Ends	Hardness testing.	No abnormality observed.
f)	12" x 12" spots on 'L' and 'C' seams & base metal	Ultrasonic flaw detection	Total 'L' and 'C' seams inspected from inside and outside. No relevant indication present.
g)	Drum inside deposits	Deposit analysis	Test results will be incorporated in the final report.
3	**Superheater coils (Primary & Secondary Inlet & Outlet Coils)**		
a)	All	Visual Inspection	Thick deposits were present on the external surface.
b)	At 2 levels on every alternate tube.	Outside diameter and thickness measurement.	No abnormality observed in diameter or thickness measurement.
		NOTIS (Non Destructive Internal Oxide Thickness measurement)	Remaining life of tube will be given in final report.
		Hardness testing in accessible areas.	Hardness found within limits.
c)	8 Nos. total tube samples 700 mm length each from primary & Secondary Inlet & Outlet.	Tube sampling for laboratory metallurgical analysis.	8 tube samples collected. Refer Annexure – II.

4	**Primary and Secondary Inlet & Outlet Superheater headers, De-super heater header And Furnace front & Rear top and bottom header**		
a)	All	Visual Inspection	No abnormality present.
		Outside diameter & thickness measurement	No abnormality present.
b)	Through cut tubes and drain connections. **Fiber optic inspection**	Primary and Secondary Inlet & Outlet headers internal surfaces found in good condition. Primary SH Inlet tube (1st from top) indicated heavy internal yellow deposits for 1.5- m length near inlet header. Primary SH outlet tube internal surface showed white deposit layer for 4-inch length near outlet header. De-super heater header – SS Sleeve internal surface showed yellow and white deposits. Spray element found in good condition.	
c)	Stub weld joints	Liquid penetrant testing (LPT) and Magnetic particle testing (MPT).	No relevant indication observed.
d)	Weld & Base Metal (Header 'C' seam and piping)	In-Situ Metallography & Hardness testing.	Replicas will be evaluated at higher magnification at Pune office. Hardness found within limits.
		Ultrasonic flaw detection.	No relevant indication observed.
5	**Main Steam Line**		
a)	All	Visual Inspection	No abnormality present.
		Outside diameter & thickness measurement	No abnormality observed.
b)	Through safety valve nozzle opening.	Fiber optic inspection	Minor whitish deposits present at the bottom of the main steam line pipe near main steam stop valve.
c)	Stub weld joints, supports, attachment welding, safety valve stubs, drain stubs.	Liquid penetrant testing (LPT) and Magnetic particle testing (MPT).	No relevant indication observed.
d)	Weld & Base Metal	In-Situ Metallography & Hardness testing.	Replicas will be evaluated at higher magnification at Pune office. Hardness found within limits. No deviation present.
		Ultrasonic flaw detection.	No relevant indication observed.

6	**Boiler bank tubes and down comer tubes**		
a)	All	Visual Inspection	Soot type deposits were present on the external surface of rear tubes. Other locations no abnormality present.
b)	On every alternate tubes at two elevations on	Outside diameter and thickness measurement	No thickness reduction present. Outside diameter measurements did not indicate any reduction.
c)	10% selected tubes through steam and water drum	Fiber optic inspection	Soot type deposits present on internal surfaces.
d)	1 No. tube sample of 700 mm length	Tube sampling for laboratory metallurgical analysis.	A tube sample is collected. Refer Annexure – II.
7	**Furnace tubes (Front, Rear, 'D' wall, Cut corner and Baffle wall.**		
a)	All	Visual Inspection	Thick hard adherent deposits were present on the front, rear, 'D' wall, cut corner and baffle wall tubes. These deposits were removed by IFFCO during the shutdown.
b)	On every alternate tubes at 3 elevations	Outside diameter Thickness measurement Hardness measurement FHyNES (furnace Hydrogen damage inspection)	OD measurement will be taken on cut tube samples. No thickness reduction observed. Hardness found within limits. No hydrogen damage present.
c)	4 No. tube samples of 700 mm length	For metallurgical analysis.	4 tube samples collected. Refer Annexure – II.

ANNEXURE – II

Tube Samples Collected for Laboratory Testing. 194

Sr. No.	Component	No. of tubes collected.
1.	Furnace Front Wall	1 No.
2.	Furnace Rear Wall	1 No.
3.	Furnace Cut Corner Tube	1 No.
4.	Baffle wall tube	1 No.
5.	Boiler Bank tube	1 No.
6.	Primary SH Inlet tube	2 Nos.
7.	Primary SH Outlet tube	2 Nos.
8.	Secondary SH Inlet tube	2 Nos.
9.	Secondary SH Outlet tube	2 Nos.
Total		**13 Nos.**

INSTRUMENTATION

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CONTROL VALVE: MAINTENANCE JOBS

FRCV-3 - C/V was opened from bonnet and from bottom flange. Plug was replaced by new one, diaphragm was opened and checked found to be good, same was refixed. All parts were cleaned and overhauled. Provided new valve positioner and gland packing. Did lapping and C/V assembled . C/V stroke was checked.

FRCV- 1 - C/V was opened from bonnet. Plug and seat was replaced by new one. diaphragm was opened and checked found to be good, same was refixed. Bottom flange was opened , cleaned and refixed it.input S/V and its tubing was changed from ¼" to 3/8". C/V stroke was checked.

PRCV-1A - C/V was opened from line flanges. Inspected the plug/seat.Fine cut & lapping was carried for tight shut off.Checked its hand jack assembly it was found internaly damaged and it was beyond repairable hence removed it from assembly. Checked the stroke.

ARCV-3 - C/V was opened from bonnet. Plug and seat taken out for inspection did machining on plug. All parts were cleaned and overhauled. Provided new gland packings. C/V assembled and stroke was checked.

PICV-28 - C/V was opened from bonnet. Plug and seat taken out for inspection did machining on plug-steam . All parts were cleaned and overhauled. C/V assembled . Provided new gland packings . C/V stroke was checked.

MICV -1 to 10 - C/V opened from line flanges. Diaphragm was opened and checked. Replaced damaged one's and was refixed. Plug and seat were machined and lapped if required . All parts were cleaned and overhauled. C/V assembled & C/V stroke was checked.

LCV-15 - All parts were cleaned and overhauled. C/V assembled & Removed the hand jack assembly and overhauled for smooth operation. Provided new ¼" copper tubing. C/V stroke was checked.

LCV-134 - All parts were cleaned and overhauled. C/V assembled & Replaced the positioner linkage as old one was damaged.C/V stroke was checked.

FRCV-5 - C/V opened from line flanges. Diaphragm was opened and checked. All parts were cleaned and overhauled. Provided new gland packing. C/V assembled & stroke was checked.

FRCV-2 - Actuator diaphragm was opened and checked, found ok. Replaced the gland packings & stroke was checked.

MICV 1A TO 9A – Checked the stroke of new installed control valves.Provided new positioner gauges which were damaged.

MICV-4 – I/P converter found faulty . Replaced it by new one.

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LCV-16 – Opened the control valve from flange. Inspected the plug/seat fine lapping done and re-fixed & checked it for tight shut off. Inspected the diaphragm ,changed valve positioner & finally checked the stroke.

LCV-18- Opened the control valve from flange. Inspected the plug/seat fine lapping done and refixed & checked it for tight shut off. Inspected the diaphragm & finally checked the stroke.

LCV-19 -Opened the control valve from flange. Inspected the plug/seat fine lapping done and refixed & checked it for tight shut off. Inspected the diaphragm , replaced hand jack bearing & finally checked the stroke

MICV 24 TO 32 – All the control valves were removed from bonnet. Inspected plug/seat and taken fine cut on plug and assembled. checked for tight shut off. General cleaning were carried out. Finally checked the stroke.

TRCV - 142 - C/v was opened from bonnet & overhauled the spares & Inspected the plug & seat , provided the new gland packing & stroke was checked.

PICV - 13 A & B - C/V preventive Maintenance was done. Finally C/V stroke was checked.

PICV -005, FICV-002, PRCV-002 – C/V preventive Maintenance was done. Control valve plug seat opened and fixed back after lapping. Finally C/V stroke was checked

PICV-006 – Replaced all gauges of valve positioner after lapping.

FICV -9,10,11 : Preventive maintenance was carried out, replaced all the internal tubing with S.S tubing and configured the all three loops for DCS. Checked the stroke from control room, found ok.

PV-802 : Did complete overhauling of AGBC vent control valve and fixed it back without hand jack . Finally C/V stroke was checked

PV-137 – (PGR plant) Hand jack link found in broken condition. Replaced it by new one. Finally C/V stroke was checked

MICV-32 – Changed I/P converter. Finally C/V stroke was checked

MICV-28 – Provided new air supply regulator. Finally C/V stroke was checked

LCV-22 – Removed from line for all old gland packings , provided new gland packings. Finally C/V stroke was checked

PRCV-18 – General cleaning and stroke checking was performed. 199
In following control valves general /cleaning, greasing & preventive maintenance were carried out . Provided new gland packings. Also v/p cleaned and related air header & regulator also flushed. C/V stroke was checked.

1.	TRCV-142A	2.	PICV-13A	3.	PICV-13B	4.	MICV-61
5.	V-7	6.	V-18	7.	FICV-1016	8.	HICV-186
9.	FICV-7	10.	FRCV-2	11.	FICV -1017	12.	PIC-139
13.	FICV-8	14.	FICV-11	15.	TRCV-10	16.	HICV-1004
17.	FICV-9	18.	PICV-20	19.	V-5	20.	TRCV-11
21.	FICV-10	22.	PV-1007	23.	PIC-1016	24.	PIC-1017

COMPRESSOR HOUSE JOBS :

Air Compressor (101J) :

- Removed all Radial , Axial and key-phasor probes along with relevant junction boxes, speed pick-ups,T/C, pressure gauges and THI's 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.

- **HIC-101J :** General cleaning and overhauling of governor positioner carried out , replaced it's gauges, and air regulator, checked lock out relay, cylinder leakage . Positioner was fixed and stroke checking was performed.

- Did ½" & ¼" ss tubing for lube oil console as per mechanical requirement.

- Provided RTD element in LP case thrust bearing and configured in DCS for indication.

Synthesis Gas Compressor (103J) :

Following jobs were carried out for installation and commissioning of 3500 series vibration monitoring system for Synthesis Gas Compressor :

- Removed all old 7200 series BNC radial vibration , axial displacement, and speed probes and all proximitors along with relevant junction boxes and extension cables.

- 7200 Series monitor Rack in control room was removed and new 3500 series monitor rack was installed . Necessary cabling for powering up the rack and for earthlings was done.

- c) New 3500 series proximitors were mounted in junction boxes and JBs were installed at respective locations. Installation of new compatible probes for axial displacement, radial vibration and speed along with extension cables and proximitors was carried out in field.

- Individual loops were checked for continuity between field and control room.Probe characteristics were verified using TK-3 kit and gap voltages were set for all the installed probes.

- Necessary changes were done in rack configuration ,data acquisition and operator display software for capturing the data for 103J in operator display PC in control room. Rack monitors were configured as per operational requirement. Functional checking of modules was performed.

- One existing TDX-connex was upgraded to TDX-net for interfacing with DM-2K computer. Necessary configuration was done in DM-2K software for capturing static and dynamic data from monitoring rack via TDX-net .

- DCS communication was established for all 101J and 103J radial vibration, axial displacement, trip relay , alarm relay and speed tags of both compressors.One cable from BNC monitor communication gateway module to DCS was laid and values of all points were verified by simulation with the help of TK-3 kit.

- **PRCV-12** general cleaning, overhauling and functional checking was performed. Its piston/cylinder were lubricated. It's air regulator, gauges was replaced. Checked air failure function. Stroke-checking from control room was performed.

- **MIC-23** Governor positioner cleaning/checking was done replaced its all PI's and its stroke checking was performed.

- Provided RTD elements in JAT and JBT case thrust bearing and configured in DCS for indication.

Ammonia Refrigeration Compressor (105J):

- Removed all radial , axial and key-phasor probes alongwith relevant junction boxes, proximeters , speed pick-ups,T/C, pressure gauges and THIs to facilitate mechanical jobs. After completion of jobs the same were fixed back after cleaning/functional checking and gap voltage adjustments for radial and axial probes were carried out.

- **PRC-9** – 105J Governor's pneumatic actuator assembly was checked . Replaced complete actuator assembly.. Checked Its stroke and lock-out relay functional .

- Replaced damaged probe proximeters , radial vibrations probes, axial displacement probes, extension cables and hose for many points and adjusted the gap voltage.

- Provided RTD element in turbine case thrust bearing and configured in DCS for indication.

- **LIC-31,LIC-32,LIC-33, LIC-34 (105J LP/HP case)** : New provision for four control loop's through DCS was made. 4 nos. of level transmitters & control valves were installed & did necessary cabling,tubing etc and taken in line. Checked the operation from DCS .

FIELD INSTRUMENTS JOBS :

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- **SI-101J,SI-103J,SI-105J** : Removed three obsolete Beacon make frequency to current converter and related power and signal cables from control room .
- **FIC-9,FIC-10,FIC-11** : Replaced all three pneumatic transmitter by new smart Fuji make TX .Configured all three in DCS and laid cables from TX to JB and JB to control room.
- Configured RTD for 101JLP,105JT , 103JAT,103JBT bearing temperature in DCS.Installed new RTD JB ,cable trays and laid multicore RTD cables from RTD heads to JB and JB to control room.
- 16 no. Primary reformer bottom header thermocouple taken out and replaced all by new T/Cs.
- MIC-11: MIC-11 tubing removed to facilitate mech. jobs and same was fixed back after completion of mech. Work .
- Mechanical DP measurement machine tubing done. Provided high range pressure gauges for hydro test of vessels and lines
- FRC-2 : Provision of 3 separate tapping through condensing pot were made for all three PLC/DCS transmitters as per the letter from process TM/02/1200 suggestion approval committee .
- Eye- Hye : Checked the electrodes, wiring and flushed the chamber.
- 9.Laid one 12 pair signal cable for JBC-03 in pre-reformer area to replace damaged cable from JB to C/R. Did respective connection with ferruling of each pair of the cable.
- 102C : Hydrogen removing/Trace relieving job was carried out by mech. for that four nos. T/C connected for tube heating assembly and temp. recorder provided for temp indication.
- Removed Old pipe and JB's related to the 7200 series vibration monitoring for 103J compressor area to ammonia control room.
- Rerouting of cables of JBC-33 done due to fouling with ESP pipe also lifted the cable trays to safer distance from ESP hot lines
- Removed PDI-102 TX at stripper top along with cable tray to facilitate mechanical
- jobs and fixed back after completion of job.
- Replaced ¼" tubing of FRCV-3 FICV-9,FICV-10 and FICV-11 solenoid valve by 3/8".
- TX installed at GAIL premises were calibrated
- . Bottom Thermocouple of 110-F,111-F,112-F checked and replaced 110-F T/C with head and T/C of 111-F due to its bad condition. T/C of 112-F found ok.

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- Instrument Air dryer heater opened replaced one faulty coil 1.5Kw of 4.5kw heater and fixed back . Junction box fuses , relay contact changeover checked and found ok.
- Removed old cables , cable gland etc in 107-J area.
- Laid one12 pair cable from battery limit to control room for display / indication LNG parameters given by GSPL .
- Igniters and solenoids valves of start-up heater were cleaned and functionally checked.
- Removed old cables,cable tray,tubings in stripper area.
- Power cable and 12 pair signal cable laid for steam drum to control room for new boiler drum level monitoring system.
- Annunciator-D was checked for group alarm system of 101J,105J, 103J in presence of IIC representative and modified wirings as per the suggestion of its representative. Its functional testing for individual group alarm was performed and found satisfactory.
- Instrument air headers flushing was carried out in different areas.
- FRCV-1 solenoid valve was replaced by new one and for that necessary tubing wiring done.
- 104-J and 107-J solenoid valve opened to facilitate mechanical jobs and fixed back after completion of job.
- DM water tank pneumatic level tubing found punctured same was replaced and make alright.
- PRCV-2 Relocated the TX. & I to P converter/transmitter mounted and necessary tubing/cabling done to facilitate technical jobs.
- 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.
- Trip circuit of the all compressors were checked with production people and adjusted switches as per requirement and design trip value.
- By changing the position of solenoid malfunctioning of VS-203 was rectified .
- PI provided at 101D.
- 114C out let TI-033 taken out from line
- FT-5 (total 3 No. DCS,PLC transmitters) : Range changed from 1140SM3/hr (7500mmH2O) to 600 SM3/hr (2077 mmH2O).
- FT-14 (PLC/DCS TX.) : Range changed from 570 SM3/hr(5000 mmH2O) to 600 SM3/hr(5540 mmH2O).

- Opened O2 analyser, checked furnace, sample filter and electrode and finally checked calibration.
- **Following ISO related quality/Safety affecting instruments were calibrated:-**

1.	PT-7	2.	PT-8	3.	PT-10	4.	PT-28
5.	PT-150	6.	PT-5	7.	PT-4	8.	PT-80
9.	PT-62	10.	PT-9	11.	PT-36	12.	FT-1
13.	FT-2	14.	FT-3	15.	FT-100	16.	TI-104E
17.	AR-1	18.	PT-1027	19.	FT-1006	20.	FT-1005
21.	PIC-1A	22.	TI -0117	23.	TI-0007 (TRC-10)	24.	TI-0011
25.	TI-0026	26.	TI-0039	27.	TI-0036	28.	TIC-1025
29.	PT-501	30.	PT503				

CONTROL ROOM JOBS :

- Pushbutton provided for 112JAT Manual start, 112JBM manual start, 112JAT/112JBM standby ,2004JM manual start and 2004JAT/2004JM stand by as per the EWR logics at auxiliary console and same was configured in PLC.
- I-31,I-32 &I-33 block logic modified and made two new logic I-32A & I-31A as per the requirement of production people against MWO and checked the modified logic in presence of production people.
- 3.Checked all console push button ,indicating ,limit switch lamps and tightened the connection .

Technical dept. Jobs :

- PIC-3 : Configured the loop in DCS and did ferruling at Tx,I/P,JB and control room side. Checked Continuity and stroke of the valve.
- Replaced orifice plate of FIC-002 and change the flow configuration according to the new orifice plate.
- PRC-2: Replaced old valve by new one. Did tubing , cabling wiring, stroke checking etc for the new valve
- checked the T/C loop of H-110 after modification.

Annual Maintenance of UPSS, DCS and PLC :

FUJI make UPSS

- The preventive maintenance of UPSS was carried by M/s IL, Jaipur against the AMC. General cleaning, servicing and configuration of parameter checking were done.
- UPSS to AVR Auto changeover was checked, found OK.

AMCO Battery

2.7

- 5 nos of new Battery cells & 3 Nos of old battery cells were charged externally replaced total 8 nos of charged cells (5 new & 3 old.) in place of weak cells no. 8 ,69 ,99 ,100 ,101 ,102 , 103 & 154.
- Cleaned all battery cells , terminals , inter cell connections. Did Topping of distilled water in cells and tightened all inter cell connections and cables and measured the Sp.Gr and Voltage of each cell . Found total Voltage 247 V .
- Battery bank was charged. After charging , Measured the Voltage of each cell . Total Voltage reading was found to be 288 V .
- 2 cycles of discharging and charging was carried out as mentioned below

  Manual equalize timer setting changed from 8 Hours to 12 hours.
  Equalizing voltage setting was found 278 VDC and changed to 288 VDC as per recommendation of M/s AMCO Engineer.Reading of each battery cell was taken.

- Final check of UPSS & battery operation was carried out and found ok. Details are as under

  Duration : 90 minutes
  AC output voltage : 115 V ac
  AC load current : 103 A
  Battery discharge up to :193 V dc

  Alarm and trip settings for UPS-1 and UPS-2 were found as below :

  UPS-1 : a) Alarm setting - 200 VDC b) Trip setting : 193 VDC

  UPS-2 : a) Alarm setting - 202 VDC b) Trip setting : 195 VDC

  After completion of AMC jobs the Battery bank performance was found satisfactory.

YBL DCS

- The preventive maintenance of DCS was carried by M/s YBL as per the AMC. All EFCD, EOPS, HIS ,EFMS and Engineering stations circuit PCB cards were removed from cabinet/panel and cleaned. Overhauled the fans, cleaned the filter, panels and cabinets.
- All the jobs related with AMC were attended. Checked the redundancy for CPUs, MAC2 cards, power supplies and HF buses. Checked system components healthiness. All system components were found working O.K. Taken the latest backup of complete DCS in magnetic tape .
- 3.System voltage measurement has been carried out. Voltage level was found within specified limit
- M/s YIL has done mapping in CS3000 DCS for ALR121 (Port2) to communicate with Bentley Vibration monitoring system. Connected RS485 cable at ALR121 card of CS3000 and established communication between subsystem and CS3000. Done I/O mapping in I/O builder and generate control drawing for approx 50 analog tags and 13 digital tags.Cross checked and verified the vibration tag's (Analog & Digital) reading of Bentley system with CS3000 system- It was found O.K.

HIMA PLC

- The preventive maintenance of HIMA PLC was carried out. Cleaning of filters, fans, cabinets etc. was carried out for all the four PLC stations.

- Checked the redundancy of all the four PLC at card ,CPU and power supply level. Checked Error code by removing every card and redundant card(If applicable),fuse etc. The whole system was checked in presence of PLC representative for fault diagnostic measure.

- Prepared/modified/defined/wired/tested the condensate pump 112JAT/112JBM AUTO start & TRIP logic and DM water pump 2004JAT /2004JAM AUTO start & TRIP logic as per EWR in ELOP of PLC-2 ,wizcon operator station and sequence event recorder

- Cleaned all the five Power supply units (110VAC to 24VDC). Voltages of individual racks of all the PLCs are measured and found healthy

- Faulty F 3237 card at locations 1309 in PLC 3 was replaced by new F 3237 card.
- Back up copy of all the programs (ELOP and Wizcon) were taken.

GE-Fanuc PLC

- The preventive maintenance of GE-FANUC PLC was carried out. Cleaning of cards, filters, fans, cabinets etc. was carried out .PLC was completely tested for redundancy at CPU and bus level from A to B change over and vise versa.

- 2.Checked and tightened all terminal strip connection in cabinet and replaced one faulty terminal strip.

ABB CO2 and CH4 Analyser(AR-1 & AR-2)

- The preventive maintenance of ABB make CO2 analyser was carried out.

  CO2 Analyzer was checked for malfunctioning. Condition of sample cell was very good. Optical alignment and phase alignment performed and sensor CPU board, detector and cell were checked for malfunctioning. It was observed that sensor CPU board was glowing red LED error and it was faulty.

  The sensor board was replaced by similar board from H2 Analyzer(I.G Plant) and zero/span basic calibration was performed after replacement. The Analyzer was found working satisfactorily.
- Manual Calibration of CH4 analyser was checked & found ok.

CAPITAL JOBS CARRIED OUT IN ANNUAL TURNAROUND

- **LIC-5,LIC-8,LIC-10,LIC-21,LIC-23** - Replaced pneumatic head assembly by electronic head assembly. Laid single pair cables of level troll and I/P for the respective valve to JB's.Configured the level trolls in DCS. Did calibration and checked stroke through DCS.

- Replaced 7200 series vibration system to 3500 series vibration system for Synthesis compressor. 205

- Replaced FIC-9,FIC-10,FIC-11 Pneumatic TX. By new smart electronic transmitter.

PREVENTIVE MAINTENANCE JOBS (As per the ISO 9001:2000 list)

- Preventive maintenance of following control valves, as per the list, were carried out by general cleaning, greasing, positioner & I/P checking, gland replacement / tightening, stroke checking.

  FRCV-1, FRCV-2, FRCV-3, V-18, PRC13A/B, MIC-22, FICV-12, FICV-14, PRCV-25 LCV-13, FICV-7, FICV-8, FICV-9, FICV-10, FICV -11, FICV-15

- HIC-101J for 101JT: Carried out general cleaning and overhauling. Changed air regulator of Governor positioner, stroke checked and overhauled.

- MIC-23 for 103JBT : Carried out general cleaning and overhauling. Changed air regulator of Governor positioner, stroke checked and completely overhauled.

- PRC-12 for 103JAT : Carried out general cleaning and overhauling. Stroke checked and completely overhauled.

- PRC-9 for 105JT : General cleaning, overhauling of governor positioner was carried out and checked stroke.

- The preventive maintenance of UPSS was carried by M/s I/L, Jaipur. The general cleaning, servicing and configuration and parameter checking were done as per AMC. The trip setting noted down using the hand held configurator. Battery back up test carried out. Redundancy test for the UPS1 and 2 checked.

- 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. Overhauled 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.

- The preventive maintenance of HIMA PLC were carried out by M/s Chemtrol 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.

- The preventive maintenance of GE-FANUC PLC were carried out. PLC was completely tested for redundancy at CPU and bus levels and the changeover from A to B and vise versa were checked.

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HITACHI (CO2) COMPRESSOR

- All vibration probes extension cables and Proximeter were removed and checked and installed back to facilitate Mech. Maintenance jobs.
- All RTDs and Thermocouples were removed to facilitate Mech. Maintenance, checked and installed back. In TE-1839 wire damaged so that it was replaced by new one.
- Followings Trip and Alarm Switches were cleaned, checked and calibrated:-
- LSHH-1806. LSHH -1808. LSHH -1804. PSHH-1843A. PSHH-1843B. PSHH-1843C. PSLL-1801A. PSLL-1801B. PSLL-1801C. PSL-1816 ,PSL-1818 A. PSL-1818 B PSL-1818 C. PSHH-1839A. PSHH-1839B. PSHH-1839C. PSLL-1838A. PSLL-1838B. PSLL-1838C. PSL-1812. PSL-1813. PSLL1844. PSLL-1843.
- Local Control Panel and PLC Box were cleaned, all wiring connection were tightened.
- Followings transmitters were cleaned and calibrated:-
- LICT-1805, LICT-1807, LICT-1821, LICT-1803, PI-1802,
- PI-1809, LT-1809, PT-1836
- All junction boxes were cleaned, terminal tightened and terminal details were noted.
- All I/H converters calibrated

OLD CENTRIFUGAL AND PB COMPRESSOR

- Panel was cleaned and all wiring connections were tightened.
- All vibration probes, extension cable of both compressor were removed and checked then installed back to facilitate mech. Maintenance jobs.
- All thermocouple of both compressor were removed to facilitate mech. Maintenance jobs. Checked and installed back.
- LC -1123 Leveltrol calibration carried out.
- Following trip and alarm switches were calibrated:-
- PHCO-1133, PHA-1133, PLCO-1101, PHCO-1127, PLCO-1124, PLCO-1145, PHCO-1126, PHCO-1132, PLCO-1166, LHCO-1123, PLCO-1153, PLCO-1167, PLCO-1160,.

CONTROL/ MARSHALLING ROOM

- DCS, ACDB, PDB, Vibration cabinet, PLC Panel were cleaned, all terminals were tightened.
- 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.
- OMRON PLC Panel cleaning & checking of OMRON PLC also CPU Battery voltage were checked and found alright.
- D C S Printer - Out of five, four printer were repaired by yokogawa engineer and are ready four use. Two nos. took in line with urea DCS.
- Radiac Relay unit for LR- 1201 was calibrated.

- Anti surge controller was replaced by spare one which was repaired at USA.
- Cleaning wood ward Governor console.

OTHER PLANT JOBS

- 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
- All Plant J. B.s terminal were tightened.
- LRC-1201 and LH-1201 detectors were removed to facilitate Mech. Maintenance.
- 8 nos. HP Thermowell removed and hydrotested. And all thermowell were refixed.
- Preventive maintenance of turbine flow meter for cooling water was carried out.
- PT-1481, LRC-1421, LT-1481, LT- 1701 A & 1701 B. LRCV-1201. PT- 1202. LT-1202.. PT -1201C transmitters were calibrated.
- FR -1504 Orifice was replaced by new one.
- Following alarm and trip switches were calibrated-
- PAHH-1194, PAH-1193, PHCO-1363A&B, PLCO-1102A, PLCO-1201A, PALL-1195, PLCO-1102B, PSLL-1101, LSL-1357
- Coordinated with Production/ Maintenance persons for miscellaneous plant Jobs related to instruments.
- FR-1122 Orifice was opened as leakage. Orifice surface finishing work completed. It was refixed in line by mech. Maintenance.
- I/P Convertors of following control valves were replaced by new.
  FICV -1102. FICV -1385. HICV-1422B. PICV-1221. PICV-1129. PICV-1422
- New magnetic flow meter (FIT -1352. FIT -1353 And FIT -1435) were replaced taken in line.
- N/C Ratiometer - Sample line fittings of cooler were leakage. Rectified it.
- Two cable were replaced from marshalling room to MCC.
- LIC- 1235 Leveltrol was removed and installed back to facilitate mech. Maintenance jobs.
- TI -1216 New thermowell was installed in 23 ata steam inlet line . job was completed and taken in line.
- LT -1303A New level Transmitter was installed. And taken in line.
- Instrument air header were flushed at various points.
- PIC- 1424 - Transmitter was shifted to new convinient location.

WEEP HOLE CHECKING OF HP VESSELS:

- Coordinated with production persons for fixed fitting and tubing of weepholes.

CONTROL VALVES :

- HICV-1801 and PICV-1810 Control valve were opened from bonnet and trim parts including plug , seat and carbon seal rings were replaced by spare once. Boxed up the valve and calibration carried out.
- LRCV-1201 – Dropped from line and following jobs carried out. Diaphragm changed with new one. Machining was done on seating portion of plug and seat. c/v body was replaced by spare one. Gland packing replaced by new. Calibration carried out after refixing the valve in line.

- HICV-1201 The valve was dropped from line, over all maintenace was carried out including 1..diaphragm changed with new one, 2..Plug & Seat was replaced by spare one, c/v body was replaced by spare one. gland packings were replaced by new. Fixed back and calibration carried out.
- PICV-1129 – : Control valve dropped from line ,body cavitation at seat coller rectified by machining,provided new gaskets and gland packing and refixed after satisfactory hydro test.
- TICV-1226 – Control valve was dropped from line. Baffle plate mounting was tightened as loose. Then c/v was refixed in line. Calibration carried out.
- LICV -1351 Control valve was replaced by new one.
- LICV- 1352 Control valve was replaced by new one.
- LICV-1420 Control valve was replaced by new one.
- TICV- 1201 Control valve was replaced by spare one as big size.
- FRCV -1421 Control valve was replaced by new one.
- HICV-1423 New control valve was provided.
- TRCV -1422 Control valve was replaced by new one.
- PICV -1128 Control valve was opened from bonnet. Plug and seat repaired by lapping. Gland packing changed by new. c/v was refixed in line.
- LICV -1201 Control valve was opened from bonnet. Lapping was done on plug and seat. Gland packing changed by new. c/v was refixed in line. Calibration carried out.
- FRCV -1201 Control valve was opened from line. Lapping was done on plug and seat. Also new gland packing provided. c/v was refixed in line.
- MICV -1101 Control valve was opened from bonnet. Machining was done on seating portion of plug and seat.then c/v reassable work completed. c/v was fixed in line.
- HICV -1207 Control valve was opened from line. Completely serviced the valve. and c/v refixed in line.
- PRCV -1201 Control valve was opened from line. Machining work was done on seating portion of plug and seat. Gland packing changed by new. c/v was refixed in line.
- LICV -1123 A & 1123 B Both control valve were opened from line. Lapping were done on both c/v plug and seat. Gland packing of both c/v changed by new. Both c/v were refixed in line. Calibration of both c/v carried out.
- HICV-1202 Actuator diaphragm was replaced by new one.
- LICV -1502 A Control valve was opened from bonnet. Machining & lapping work was done on seating portion of plug and seat. New gland packing provided. c/v was refixed in line with new lock nut. Calibration carried out.
- LCV -1501 Control valve was opened from line. Lapping was done on plug and seat. New gland packing provided. Control valve was refixed in line. Calibration carried out.
- PICV-1221 Control valve was dropped from line. Plug and seat repaired by lapping. Gland packing changed by new. Calibration carried out.
- TICV -1701A & TICV-1701B - Both control valve were removed from line. Plug and seat of both c/v repaired by lapping. Gland packing of both c/v changed by new. Calibration of both c/v carried out.
- PRCV -1504 Control valve was opened from bonnet. Plug, seat & cage was repaired / modified. Provided new gland packing. Actuator piston was replaced as old one was having the crack. Boxed up the valve and checked the calibration.
- HICV -1221 A Control valve was opened from line & checked condition of the baffle found it ok. Actuator also overhualed.
- N/C Ratiometer monoblock valve was replaced by spare one.

- Actuator of Prill Divert three-way valve was replaced with spare one as faulty. 210
- TRCV -1421 Control valve was opened from line. Valve & Actuator were completely overhauled. Replaced seal oring. Provided new gland packing. C/V Refixed in line.
- F0llowing control valves overhauled & checked for operation.
- FICV-1352, PICV-1502A, LICV-1353, FICV-1204,FICV-1303, PICV-4801, FICV-1351, HICV-1581, PICV-1481, TRCV-1202, FICV-1302, HICV-1208, LICV-1422, LICV-1301, PICV -1130. PICV -1422. PICV-1385. PRCV-1202. LICV-1203. HICV-1422A. HICV-1422B. PICV-1131. LCV-1502B. PICV-1502. HICV-1802. HICV-1803. HICV-1022
- Painting and stroke-checking of Control valves carried out.
- 32. Replacement 6 cable from MCC to control panel as old
- cable was short.

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BOILER PLANT

TBW Burner modification jobs :

- **Removed following TBW modification related instruments during Annual shutdown.**
  Fuel air damper positioner, damper open / close limit switch, air damper solenoid valve & Oil gun engangement limit switch
  Aux.gun related man.automising steam, oil & scavenging valve's limit switches of both Burners.
  DPC-1and DPT-1(Furnace diff. pressure controller)
  Flame detector of oil & gas for both the Burners.
  Ingnitor gun assembly.and Ingnitor diff. pressure switch of both Burners.
  FT-22(Gas flow, old elect. trans.)
  GHTV, CCV-22, GBTV of burner 1 & 2,
  PSH-25, PSH-26, PSL-27, PSL-29,

- **Following TBW modification related new instruments were installed in field & C/R.**
  PT-25,DPT-29, FT-22,TT-24(Electronic Transmitters.)
  GHTV,GHVV, CCV-22,(Control valves)
  GBTV1-4A,B,C & GBTV2-4A,B,C(On-Off valves)
  PSL-25,PSH-26, PSN-26,PSL-27,DPSLL-29,PSL-30.
  (Pressure and Diff.Pressure Switches)
  DPIC-29,PIC-25(YBL make US-1000 controller) and TI-25.(Temprature.Inicator)
  New Model Flame detector for oil & gas and scanner for both the burners.

- **Carriedout the ckt /wiring modification in BMS panel as suggested by TBW .**

- **DCS Related job :**

  Installed DCS / PLC Operator Consoles, Marshling and system cabinets
  Cables for common power and interconnection laidout between Operator console to DCS/PLC Marshling and system cabinets
  Connections at both the ends of operator console and DCS/PLC Marshling and system cabinets was done.
  110 VAC Power supply from Ammonia plant UPSS was connected to DCS/PLC system.
  3 Nos. of Earth pits were made.Conneted them to individual Marshalling & system cabinet.
  Checked all Analog input/output and Digital input/output.
  Laid Cable trays for field Instruments(I/P Convertors, Transmitters) and From local Junction Box to control room, Operator Consoles to Marshalling & system cabinet.

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Laid signal, power, thermocouple & RTD cables from instrument to field Junction Box and from field Junction Box to control room. Ferruling,lugging and termination with inst., field J.B. & in control room cabinets was done.

40 Nos.of new Electronic transmitters and 17 Nos. of I/P converters were calibrated and installed.

Carriedout air supply and Impulse line S.S. tubing for I/P conv. & air supply regulators.

DCS system was taken in service. Performance of DCS system was observed and found satisfactory.

- **PLC Related job :**
  PLC logic was checked by us and YIL engr. necessory modifications were carried out to suit to Logics for new TBW Burner.
  Connection of DI/DO of PLC to field Instruments is awaited for appropriate clearance.
  PLC system is ready for service after field connection.

Note : All the above mentioned activities were carriedout under guidence & supervision of installation & commissioning engr. from M/S YIL, Bangalore.

- All wiring terminals of BMS Panel & Main Control Panel were cleaned and tightened
- Following Receiver switches behind control panel were checked
- PSL-2,PSL-6,PSL-7,PSL-8,PAL-4,LAL-3,LAH-4,FSL-2,FSL-4,FSL-11,FSL-5111,PSL-41

UPS SYSTEM :

Checked the performance M/s IL make UPS System.
Checked the performance of batteries for M/s IL make UPS System by taking 10 minutes to 2 Hrs. load on batteries. Changed Battery No. 13 of Bank B as it was found weak.

FIELD JOBS :

- Following field switches were checked.
  LSL-1,LSL-2,LSL-3 of steam drum(Replaced micro switch assembly of LSL-2, LSL-3)LLCO-5111, LAL-5111, LAH-5111, LAL-5171 LAH-5171 PSL-1 PSL-11, PSH-12 PSL-24, PSL-25, PSL-26 & PSL-27 oflgnition and fuel gas line. PSL-28 and PSL-29f atomising steam line PSL-21 ,PSL-22 & PSL-23
- Checked set value of following lube oil system switches of motor and turbine driven BFW pump.
- PAL-5114, PLCI-5113, PLCO-5112 for P-5111PAL-5113, PLCI-5112, PLCO-5111 for Q-5111 PAL-5115, PLCI-5114, PLCO-5113 for P-5112 PLCI-5115 M-5112 AOP.

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- **Limit Switches :**

All BTV's limit switches(BTV1-1, 1-2,1-3,BTV 2-1,2-2,2-3)were cleaned and checked.
HOHTV, IGTV, CCV21,CCV22 limit switches were cleaned and checked it's operation.
All Manual Main Gun Oil / Atomising steam Valve limit switch were cleaned and checked the operation.

- **Dampers :** Following dampers were overhauled and checked
F.D. fan inlet damper and F.D. fan outlet damper.
Air heater inlet damper and Air heater outlet damper

- **Steam Drum :**

EYE-HYE Electrodes were checked and all the terminals & wire lugs were replaced by new one.
Checked new O2 Analyzer and calibrated it with air in single point calibration mode.
Press.gauges : PI-2,PI-3,PI-4,&,PI-5 were calibrated as related with Boiler inspection.

- **Control Valves :**

Following control valves & positioner were cleaned and checked .
FCV-1(100% BFW), PCV-2, LCV-4, PCV-1, TCV-1, PCV-50. BTV-1-1, BTV-1-2, BTV-1-3, BTV-2-1, 2-2, 2-3, CCV 22, HORV, HOHTV, GHTV, IGTV
Hooked up new control valve (I/L make) PCV-22 & CCV-22 on fuel gas line.

- All furnace draft impulse lines were flushed with 7.0 kg/cm2 air.

- BFW Turbine and FD Fan turbine governor oil TRIP solenoid valves were cleaned and checked operation.

- Furnace Temp. t/c with t/w was replaced wth new one as it was found burnt.
- Carried out removal / refixing of instrument to facilitate mech.maintenace.

- job of BFW pump(Motor/Turbine driven).

Ammonia and Naphtha Storage:

PIC 3103 Local Controller were cleaned and synchronized.
Controller and control valves of LSHS Tank A ,B and C were overhauled and checked.

214

Cooling Tower :

- Q- 4411 Turbine North and south side radial vib probes , speed pick-up unit was removed & installed as per mech. requirement.
- PICV-5153
- Replaced Plug and Seat of control valve by new one as old plug stem was found broken. Control valve was fixed back in line and checked stroke.
- Checked performance of AIRPAX make speed indicator and set it for over speed trip of Q-4411.
- Overhauled Ammonia side alkaly dossing pH control valve as it was passing during normal running.

I.G. Plant :

- Servicing and calibration of ABB make H_2 analyzer of new I. G. Plant. (Service engineer From M/s ABB has completed this work.)
- Replaced old I.G.Plant hooter(siren).
- Attended all running jobs.

Weigh Bridge (Main Gate) :

Following jobs were carried out.
(Service engr.from M/s Ashbee Systems has attended following job)
Overhauled the load cell mounting assembly and checked the alignment of load cell,cleaned the digital indicator and computer.
Calibrated the weigh Bridge with standard weights. (upto 33 tones)

2215

Bagging & Material Handling Plant :

- Packer Scale Nos. 1,2,3,4 and 8

  Checked wiring terminals in the main panel, local panel, Solenoid boxes and loadcell boxes

  Cleaned and checked RIC Card, DataPond, all relays, fuses, and

  checked all sensor.

  Checked functions of datapond alongwith calibration of all Packer Scales.

- **Computapak Panels :**

  All PCB's inside the computapak panels were removed and cleaned.

  Calibrated the UBM 9A, 9B and 10A,10B.

- **Auto Bag Placers :**

  Cleaned/checked all sensors, local panels of both auto bag placers.

- **Weighing Scales :**

  Cleaned the weighing scales , Digital Indicators etc.

  Cleaned the PCB of digital indicator.

  Calibrated all the weighing scales.

- **Belt Weigher System :**

  Cleaned/Overhauled the techo meter assembly

  Checked the healthiness of loadcell, techometer, digital indicator etc.

  Checked the load cell performance by actually putting weights and checking milli volts,the performance was found satisfactory.

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- Preventive maintenance carried out on transformers: TR-6, TR-21 & TR-22 and the job details are as under:
  Inspection of primary and secondary cable boxes, end termination, checking and tightening of connections.
  Measurement for Insulation resistance, magnetic balance test, Voltage ratio, BDV of transformer oil.
  Alarm & tripping contacts of MOG and Buchholz relay were checked. Defects were observed in Buchholz relay of TR-6 and Tr-22 and these were rectified.
  Condition of silica gel was checked. Discharged silica gel was recharged.
  Oil leakages from the transformers were attended and damaged gaskets were replaced.
- Preventive maintenance 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 :
  Checked the tightness of outgoing terminals.
  Cleaned the feeder compartments.
  Replaced damaged/ worn out contacts, etc.
- Following modification in relay and protection system was carried out in MCC-16.
  Replaced extremely inverse relay CDG34 relay with normal inverse CDG31 relay .
  Replaced Motpro replay with CDG34 relay in feeder for Fire MCC.
- Overhauled the following motors:
  101 BJT, 101J, 103J, 104J,104 JA, 104 JT, 105J, 106J, 108J,108 JA,107 JT, 118JB
- Preventive maintenance of following MOVs were carried out :
  SP1,SP3,SP4,SP5,SP70,SP151,SP152,SP153,SP154,SP155,SP156,SP158 & SP159 .
- Modification carried out in control circuit of MOV SP 159 and its Control Voltage is changed from 110 V to 230 V.
- Modifications carried out in control circuits of 112-J , and112-JB for auto starting of motors in case of high level of surface condenser .
- Modifications carried out in control circuits of 2004–J for auto starting of motor in case of low level of water in deaerator.
- Preventive maintenance of TMG circuit breakers installed in MCC 5 were carried out.

217

ELECTRICAL

- Preventive maintenance carried out on transformers: TR-7A, Tr-7B, TR-17, Tr-18, Tr-20 and the job details are as under:
  Inspection of primary and secondary cable boxes,
  Measurement for Insulation resistance, magnetic balance end termination, checking and tightening of connection. test, Voltage ratio, BDV of transformer oil.
  Alarm & tripping contacts of MOG and Buchholz relay were checked.
  Condition of silica gel was checked. Discharged silica gel was recharged.
  Oil leakages from the transformers were attended and damaged gaskets were replaced. HT bushings in cable terminal box of Tr-17 were replaced.
  Bus Duct of TR-18,Tr-19 & Tr-20 from MCC to transformer were checked and retightened the bolts. Transformer oil of Tr-7B was replaced and filtered.
- Preventive maintenance of all the feeder compartment in MCC 6 and MCC 14, MCC 15 were carried out.:
  Checked the tightness of cable & wiring terminals in the feeders.
  Cleaned the feeder compartments.
  Replaced damaged/ worn out contacts, etc.
- Following modification jobs carried out in Relay & Protection system:
  Earth fault protection was provided in MCC-14 by installing CDG-11 relay.
  Replaced extremely inverse relay CDG34 relay in MCC-15 with normal inverse CDG31 relay.
- Preventive maintenance of TMG circuit breakers installed in MCC-6 were carried out.
- Preventive maintenance of following MOV were carried out: MOV1101, MOV 1102, MOV 1201, MOV 1202, MOV 1203, MOV 1501 & MOV 1801.
- Control Voltage of MOV 1102 is changed from 110 V to 230 V.
- Overhauled the following motors.
  P1814 B, P1815 A, P1815 B, P1408, M1402 /1, M1402/2, P1131A, P1131 B, P1231A, P1231 B, M1403/1, P1817, M1419, M1421, M1403/2, P1351/B, P1401 A, P1401 B, P1204 A, P1204 B, P1401 B.
- Preventive maintenance carried out on all rope switches and replaced defective one with new. Replaced rope of all conveyors.
- Power and control supply of Motors P1351A, P 1352A i.e Hydrolyser feed pump and Reflex pump shifted from MCC-14 to MCC-15.

219

- Preventive maintenance carried out on transformers: TR-2A, TR-2B, TR-3A, TR-3B, TR-8, TR-11, TR-12, TR-13 & TR-14 and the job details are as under:
  Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
  Measurement for Insulation resistance, magnetic balance test, Voltage ratio, BDV of transformer oil were carried out on each transformer.
  Alarm & tripping contacts of MOG and Buchholz relay were checked. MOG of Tr-2A. TR-3A and Tr-3B were replaced with new one.
  Condition of silica gel was checked. Discharged silica gel was recharged.
  Oil leakages from the transformers were attended and damaged gaskets were replaced.
  Transformer oil of Tr-8 and Tr-3B were filtered.
- Preventive maintenance of all the feeder compartment in MCC 1,2, 2A, 2F, were carried out.:
  Checked the tightness of cable & wiring terminals in the feeders.
  Cleaned the feeder compartments.
  Replaced damaged / worn out contacts, etc.

- Preventive maintenance of TMG circuit breakers installed in MCC 1,2, & 2F were carried out.
- Modification carried out in control circuits of motors P4203 A and P4203 B for auto starting in case of low discharge pressure of DM water..

- Overhaued the following motors.
  P4401A, P4401B,P4401C,P5111/A, 5111/B, P5112/A, P5112/B, P5115 A, P5115 B, P5113, K5113
- Preventive maintenance carried out on transformers: TR-1B, TR-1C , TR-4A, TR-4B, TR-15, and job details are as under:
  Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
  Measurement for Insulation resistance, magnetic balance test, Voltage ratio, BDV of transformer oil were carried out on each transformer.
  Alarm & tripping contacts of MOG and Buchholz relay were checked.
  Condition of silica gel was checked. Discharged silica gel was recharged .
  Oil leakages from on the transformers were attended and damaged gaskets were replaced.

- Preventive maintenance of all the feeder compartments in MCC 3, DG MCC were carried out.:

  Checking the tightness of cable & wiring terminals in the feeders..
  Cleaned the feeder compartments.
  Replaced damaged / worn out contacts, etc.
  Tightness of the bolts of bus bars in DG Panel were checked.
- Modification jobs in relay and protection system were carried out as under:

  Earth fault unit CDG-61 relay from DG bus coupler panel , CDG14 from new DG Panel, earth fault unit CDG61 of DG panel were removed. High set feature of CDG61 in DG panel were also by passed.

  Modification in Over-current and earth fault protection were carried out for outgoing feeder of 11 KV panel in 66 KV switchyard to 11 KV MPSS panels.
- Preventive maintenance of TMG circuit breakers installed in MCC 3 were carried out.
- Preventive maintenance of all 11 KV Vacuum Circuit Breakers of Jyoti panel were carried out.
- Preventive maintenance jobs were carried out in 66 KV switchyard.:

  Cleaning of insulators of all the CT & PT units, bus bar support, lightning arrester, breakers , etc.

  Insulation Resistance was measured of all the CTs & PTs.
  All the moving parts of isolators were cleaned and lubricated.
  11 KV VCB panels were cleaned and outgoing cable terminals were checked for its tightness or hot spot.
  Modification carried out in Feeder 52-P by providing double bus bars to suit 1250 A breakers..

- Preventive maintenance carried out on transformer: TR-5A, TR-5B, and the job details are as under:
  Inspection of primary and secondary cable boxes, end termination, checking and tightening of connection.
  Measurement for Insulation resistance, magnetic balance test, Voltage ratio, BDV of transformer oil were carried out on each transformer.
  Alarm & tripping contacts of MOG and Buchholz relay were checked. Servicing of Buchholz Relay of Tr-5B was carried out.
  Condition of silica gel was checked. Discharged silica gel was recharged.
  Oil leakages from on the transformers were attended and damaged gaskets were replaced.
- Preventive maintenance of all the feeder compartments in MCC 4, 4A & 9 were carried out.:
  Checked the tightness of outgoing terminals.
  Cleaned the feeder compartment.
  Replaced damaged /worn out contacts, etc.

- Preventive maintenance of TMG circuit breakers installed in MCC 4 were carried out.
- Overhauled the following motors.
  Dust Conveyor motor, M2110, M2112, M2116/1,M2116/2, M2116/3, M2116/5, M2121, M2122, M2122/A1, M2122/A2, K 2704/3
- Preventive maintenance carried out on all rope switches and replaced defective one with new. Replaced rope of all conveyors .

222

CIVIL

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AUXILIARY BO'LER:

- Replacement of burner block for burners No. 1 and 3
- Replacing of Header and other refectory work in side auxiliary boiler.

PRIMARY REFORMER:

Patch work of insulation brick was carried out after removal of old damaged refractory. Reconstruction of tunnel walls and slabs, where headers are replaced.

SECONDARY REFORMER:

Repairing of cracks developed inside the secondary reformer.

UREA PLANT

224

- Repairing of scrapper floor by flling the joints of existing tiles and vatas by epoxy system.
- Providing and laying IP Net protective painting on outside surface of bucket room of prill tower.
- Epoxy painting of RCC structure of Prill bucket room, Lift cabin room, stair case at Prill tower top level, inside scrapper floor of Prill tower etc.
- Repairing of red mandana stone flooring at urea plant ground floor & prill cooling system area.
- Painting of conveyor gantry from Prill tower prill cooling system to silo.
- Bitumastic flooring repair at prill tower top and 2nd floor of prill cooling system plant.
- Epoxy plaster work for RCC structures of prill cooling system.

224

WATER TREATMENT PLANT:

- Repairing of floor by bitumastic lining for water treatment plant..
- FRV lining work for strong effluent channel and open channel near lagoon phase B area.

BOILER HOUSE :

Repairing of refractory for burners side, floor and superheated zone inside BHEL boiler.

226

- Repairing of Walk way for conveyor belt inside the Silo by epoxy monolithic plaster.
- Epoxy painting of Transfer tower and conveyor gantry from Silo to B & MH.
- Repairing of Hopper floor / Packer scale floor with the use of epoxy monolithic plaster.
- Epoxy painting of RCC columns, ceiling, slab, beams and other RCC structure in Bagging plant at Ground Floor, First Floor and Second Floor.
- IP Net painting for the external surface of conveyor gantry from Silo to B & MH plant and damaged slabs bottom of 2nd floor slab, inside staircase, bottom slab of conveyor gantry from silo to B&MH.
- Epoxy screeding flooring at 1st floor for Robort area (North side) and repair work at south side floor.
- Repair of false ceiling in Shift Engineer room.

227

TECHNICAL

MECHANICAL:

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FOR ESP PHASE - I

The equipment's as given below which were erected in the running plant, were hooked up, commissioned and taken in the line.

- LTS Guard
- Knock out Drum
- BFW Pre heaters 142-CB and 143-C
- New CO2 Absorber 101-EA
- HP-103-E1 / LP-103-E2 Flash Vessels
- Semi lean Solution Pump 115-JA & JB Trains
- Split Stream Pumps 116-JA & JB

The equipment's given below were removed.

- 108-C1A & C1B, 108-C2A & C2B
- 111-CA & CB
- Old Absorber 101-E
- CO2 Stripper 102-EA - Isolated for removal

Layout drawing showing the new equipment's added and the equipment's deleted is enclosed herewith.

OTHERS JOBS :

Replacement of control valves in GAIL station:

Following control valves in GAIL metering station have been replaced to improve the reliability of the system.

- Existing PICV-002(LNG pressure control valve) of 6" NB size has been replaced with new control valve of size 8" NB to let down LNG from 45Kg/Cm2g to 40Kg/Cm2g
- Existing FICV-002(LNG flow control valve) of 6" NB size has been replaced with new control valve of size 8" NB
- Existing PICV-006 of 2" NB size has been replaced with new control valve of size 4" NB to let down LNG from 45Kg/Cm2g to NG header.
- Gate valve & check valve of size 8"x300# has been provided in NG header to avoid back flow of LNG in NG header.

Fuel gas supply to primary reformer for 100% gas firing:

Following jobs has been carried out :

- MICV 1A TO 9A(9nos control valves) has been installed on new headers for each burner row at front side of primary reformer. Size : 3" x300#
- Equalisation line of 100 mm NB header row no. 3,4 &5 has been removed and ends has been capped.

- Common MICV (for MICV 1ATO 9A) installed during turnaround 2004 on new 200 mm NB header at front side of primary reformer has been removed and spool piece has been provided.
- Existing PRCV-2 of 6" NB has been replaced by new 250NB size control valve along with related pipe modification.

Fuel gas supply for auxiliary boiler:

Check valve has been installed in 150mm NB AG to utility header connecting downstream to PICV-004

Provision of isolation to control valve PIC005(EWR A-232,Dated22/08/2005)

Gate valve of size 12"x300# has been provided at down stream of PIC-005 in v-7-12" vent line . This will facilitate in checking and rectify the passing control valve on line during normal plant operation.

Casing drain and sealing steam system of ID fan drive turbine

A 20 mm NB tapping has been taken from bypass line of main isolation valve on LP steam line . Through this tapping sealing stem has been provided in steam end as well as in exhaust end packing case and as motive for newly installed ejector. The ejector exhaust line of size 25mm NB has been connected to new exhaust line to 101-JCA at the top .

ID fan 101BJT exhaust line modification:

- ID fan exhaust line of 10" size which was prefabricated and erected in the running plant was hookup with the ID fan turbine exhaust after reducing 4" size. Necessary platform was provided for operation and maintenance of isolation valves. The exhaust line was also hookedup with surface condenser 101-JCA.
- This modification was carried out to convert ID fan back pressure turbine to condensing type turbine. Internal modification in the turbine will be carried out in the shutdown 2006.

Installation of control valve SP-71:

- New shift converter inlet vent control valve SP-71 has been installed with related piping modification, its pressure transmitter , inter connecting wiring upto nearest junction box for its operation through DCS in Ammonia control room.
- The original motor operated vent valve was replaced with control valves to facilitate for easy operation and control.

INSTRUMENTATION:

FOR ESP – PHASE - I

Installed and commissioned CENTUM-CS 3000 DCS. The main activities involved are :

- Installation and commissioning of CS 3000 control station
- Replacement of 4 Nos of existing EOPS with CS 3000 HIS.
- Networking of new system with existing Centem-XL system.
- Installation & commissioning of CS 3000 Engineering Station
- Installation & Commissioning of MIS system.

230

Expansion of HIMA PLC System was carried out . The main Jobs involved are:

- Installation and wiring of Hardwares for accommodating additional 50 inputs and 25 outputs.
- Engineering and configuration of ESP LOGICS.
- Engineering of Operator station and SER Station
- Configuration and commissioning of PLC to CS 3000 DCS communication.
- Expansion of Push Button Panel

Other ESP Jobs

- Erection and commissioning of all instrumentation related to pumps 115-JA/JB, 116-JA/JB and Recycle gas Compressor 117-J.
- Installation & Commissioning of following Field Instruments:

  45 Nos of Smart Transmitters.

  20 Nos of Control Valves.

  20 Nos of Thermocouples with Well.

  18 Nos of Dial Thermometers

  3 Nos of Woodward Governors

  35 Nos of Pressure gauges

  14 Nos of I/P Converters

  20 Nos of Level gauges

  Installation of 22 Nos of Junction Boxes, Laying and termination of Signal, Power and T/C Extension cables, Instrument Air Piping and Tubing, Impulse tubing and interconnection of Instrument and Electrical systems.

- **Fuel Gas System Jobs**

  Installation and Commissioning of 13 Nos of new control valves.

  Installation & Commissioning of 9 Nos of Smart transmitters.

  Cabling and Tubing work for above Jobs.

- Installation of newly procured shift converter inlet vent control valve SP-71 , its pressure transmitter , inter connecting wiring upto nearest junction box for its operation through DCS in Ammonia control room completed.
- Duplex Thermocouple installation in flue gas stack of H - 110 in Pre Reformer area , ITS wiring upto existing junction box for control room indication & its commissioning. The job is completed.

231

MECHANICAL:

- **Ammonia tapping for Dehydrator column(105-E) :**

  Tapping of size 50 NB x Sch80 has been taken from ammonia pump discharge line (100NB) for supplying ammonia to dehydrator in ammonia plant. Valve of size 2"x1500# has also been provided in the tapping.

- **Installation of butterfly type control valve (HICV-1221B) :**

  New high CV butter fly control valve HICV- 1221 - B for CCS-II cooler by pass control valve has been installed with piping (size 10"xSch40) modification. I/P converter along with its wiring upto existing junction box for its operation through DCS in Urea control room & its commissioning was completed.

  Size & rating of valve: 10"NB X300#

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MECHANICAL:

- **REPLACEMENT OF BHEL BOILER BURNERS WITH 100 % MCR (Maximum Continuous Rating) GAS BURNERS**

To make existing BHEL Boiler capable of operating at 0 to 100 % MCR either with gas or LSHS or in combination of both and 100 % MCR gas burners to utilise NG, both the burners of BHEL Boiler were replaced with New Burners along with tubes in burner front wall, burner box, wind box , ducting, piping and associated instrumentation's.

The burners were designed and supplied by **M/s Thermax Babcock & Wilcox Limited, Pune** (P.O. No. 62/00095/KLL/15539YN/9916604, P.O. Value : 97.5 Lakhs) along with 12 Nos. of bend tubes, wind box, burner box, air ducting, Fuel Gas & other connected piping materials, refractory & insulation materials and all other required control valves & instrumentation's.

Following jobs were carried out :

Removal of existing Gas Line along with instrumentation

Removal of existing burners (02 Nos.) along with connected piping

Removal of refractory

Dismantling of existing wind box, burner box, air ducting along with dampener

Cutting & removal of 14 Nos. of bend tubes from burner front wall to replace with new bend tubes to accommodate new burners.

14 Nos. tubes were replaced with 12 Nos. bend tubes supplied by M/s Thermax Babcock & Wilcox Limited, Pune and 02 Nos. straight tubes procured by IFFCO

Ground Inspection of all the 14 tubes & Final Hydrotest was witness by IBR inspector

Burner Box & Wind Box installation

Installation of both the burners & installation of refractory

Installation / modifications of air ducting

Connection of Fuel gas line (line size increased) with valves & control valves, LSHS lines, Steam Lines, air lines and all other connected lines to burners along with support & structures

All connected instrumentation jobs

All the above mechanical jobs were carried out by **M/s Shree Ganesh Engineering Co., Ahmedabad** (W.O. No. 61/01436/KLL/16699VS/9917382).

Reference Thermax Drawings :

1. P&I Diagram for Firing System (Drg. No. D12-1RT-5083P, R-2)
2. Assembly & Details of Burner Tubes (Drg. No. P4H-1RT-23568, R-1)
3. Round Studding Arrgt. For Burner Tubes (Drg. No. P4H-1RT-23574, R-0)
4. Orientation of Burners, Hoses Fittings (Drg. No. L11-1RT-23849, R-0)
5. 33" Oil & Gas Burner Assly. Circular Type, CW Air Flow (Drg. No. L11-1RT-23122, R-0)
6. Filler Plate & Anchor for Wind Box & Burner Box (Drg. No. R11-2RT-22881, R-0)

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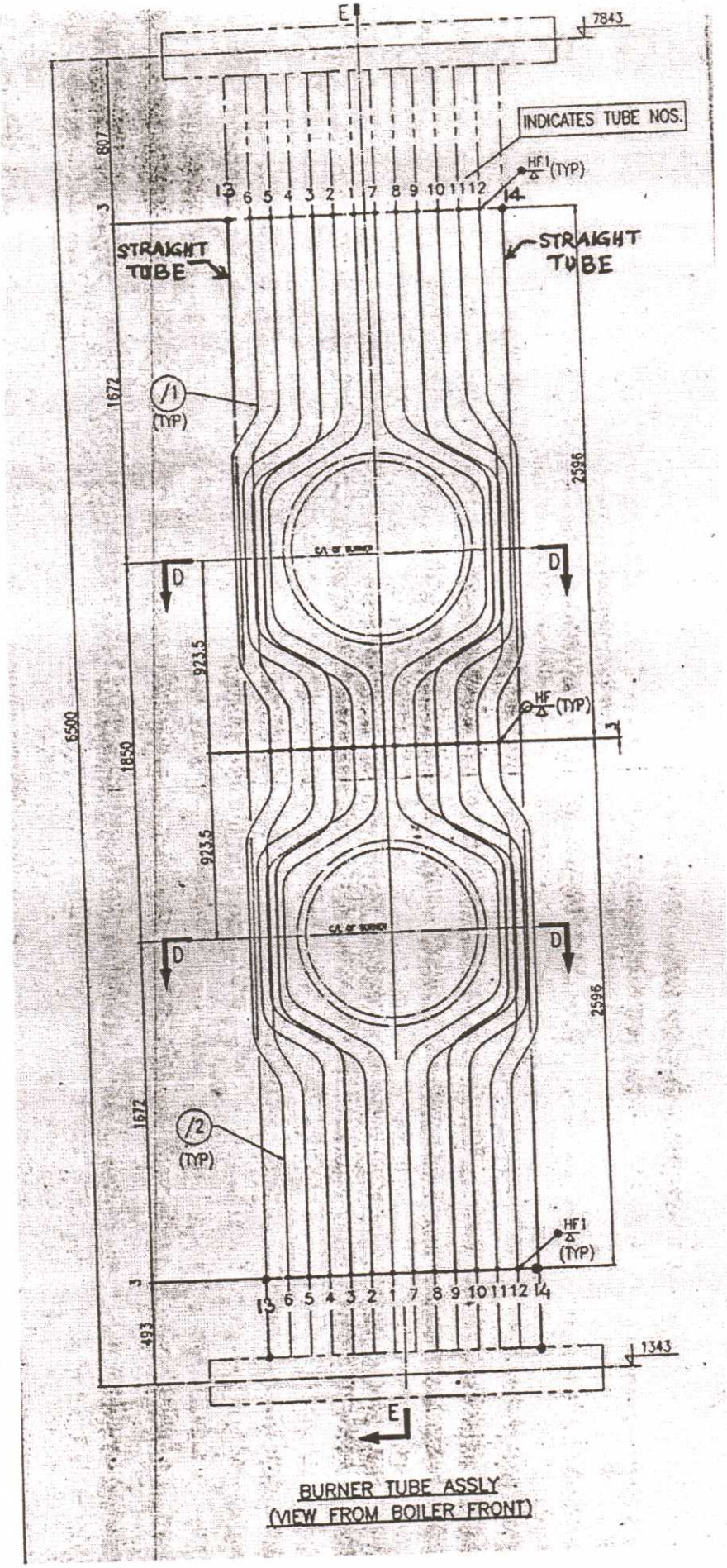
7. Assembly & Details of Wind Box & Burner Box (Drg. No. L12-1RT-23341, R-0)
8. Modified Ducting for Fan to Wind Box (Drg. No. A1B-1RT-23342, R-0)
9. Refractory Detail of Burner Box (Drg. No. R11-2RT-22783, R-0)
10. Natural Gas Piping (Drg. No. L15-1RT-23651, R-0)
11. Atomiser & coupler assembly. (Drg.No. L 11 – 3 RT- 1270 M)

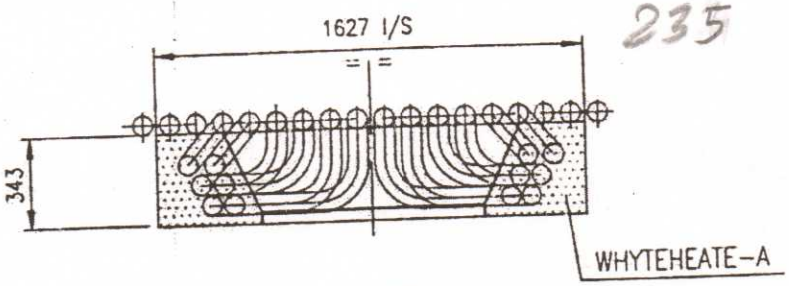
Following drawings are attached for ready reference.

1. Burner tube assembly.
2. Refractory detail & new burner's position.
3. Atomiser & coupler assembly.

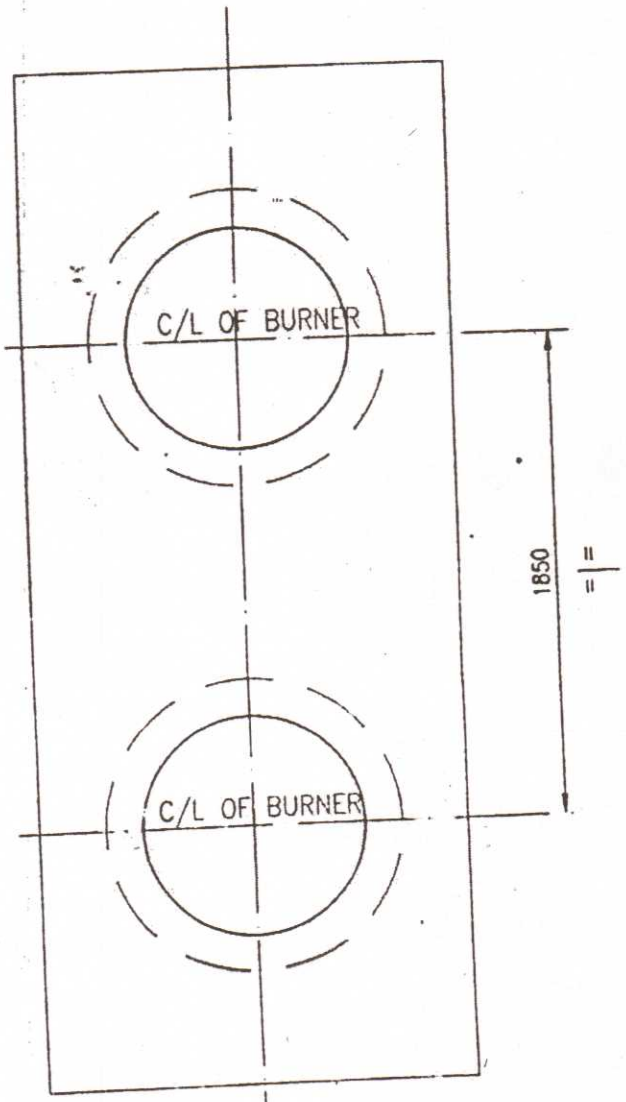


BURNER TUBE ASSLY
(VIEW FROM BOILER FRONT)

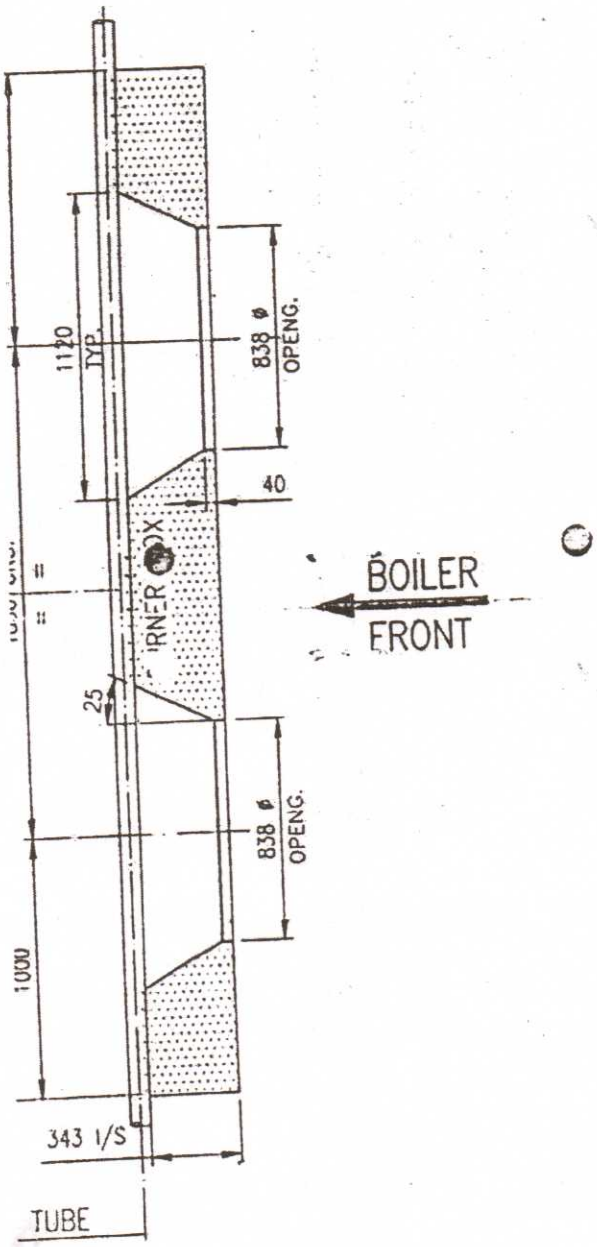
235



PLAN



VIEW FROM BOILER FRONT

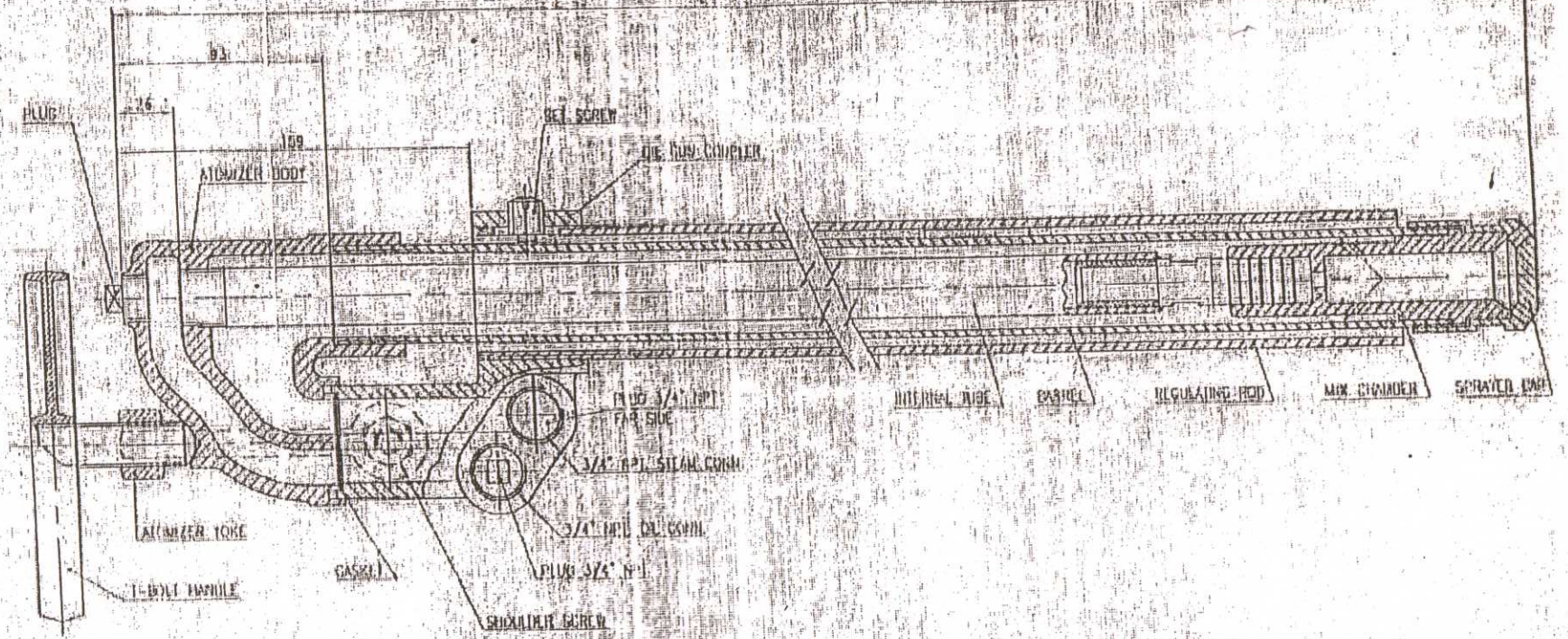


ONAL SIDE VIEW

REF. DRG. NO. R11-2RT-22783, R-0

236

IF IN DOUBT, ASK
DO NOT SCALE



NOTE-
ENTER PUNCHED MODEL NUMBER FOR SPRAYER CAP & MIX CHAMBER

REV. NO.	REVISION	DRAWN BY & DATE	CAD CHK BY & DATE	APPD BY & DATE

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Thermax Babcock & Wilcox Limited, PUNE 411 019

ATOMIZER & COUPLER ASSLY.

PROJECT NO. PT1681

REF NO.

SCALE	DRAWN	SHANK	09/09/
1 : 1	CHECKED	[illegible]	09/09/
	APPROVED	[illegible]	09/09/

DRG.NO. L11-3RT-127DM

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